



Assessing Key Constraints in Cashew Production: Insights from Kerala and Tamil Nadu, India

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: <https://doi.org/10.9734/air/2024/v25i51168>

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/125470>

Original Research Article

Received: 15/08/2024

Accepted: 17/10/2024

Published: 23/10/2024

ABSTRACT

India ranks among the world's top cashew producers, with Kerala and Tamil Nadu serving as key contributors to the country's cashew production. Among the Plantation sector, specifically cashew cultivation plays a pivotal role in boosting farm economy in India. This particular study explores field constraints experienced by cashew growers in Kerala and Tamil Nadu, which significantly impacts cashew cultivation. The key objective is to compare field challenges experienced by cashew growers among major producers in southern regions of India. The methodology involves a

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Cite as: M, Mohamed Aseemudheen, Esakkimuthu M, Manju Prem S, and Anitha G. 2024. "Assessing Key Constraints in Cashew Production: Insights from Kerala and Tamil Nadu, India". *Advances in Research* 25 (5):362-72. <https://doi.org/10.9734/air/2024/v25i51168>.

purposive multi-stage sampling approach to select regions, with an equal proportion of 80 respondents from each state selected through simple random sampling. Totally, 160 cashew growers were investigated for data collection through pre-tested structured interview schedule. The data sets were analysed using SPSS software, with frequency and percentage analysis employed to rank the identified constraints. The significant findings were pest and disease infestations, labour scarcity, unstable market price, lack of technical know-how and inadequate processing facilities. Notably, 100 per cent of growers reported that, Cashew Stem and Root Borer (CSRB) infestation as a most critical issue in both states. This paper highlights, region-specific and timely technical interventions, commodity-specific assured markets, proper pricing system and infrastructure development. The study's interpretation highlights the need to address high-priority and specialized constraints through targeted policy reforms and technical support systems, aiming to enhance the productivity and sustainability of cashew farming in India. These findings also provide valuable insights that can be applied to other cashew-producing regions and contribute to shaping national agricultural policies.

Keywords: Agriculture; pest; labour; markets; infrastructure; farmers; policy; sustainability.

1. INTRODUCTION

Agriculture serves as backbone of India's economy, supporting livelihoods for 52 per cent of the population and contributes 18.1 per cent to the country's Gross Domestic Product (GDP), thus playing a pivotal role in employment generation and overall economic growth [1]. Among the diverse sectors in agriculture, especially plantation crops like cashew, occupies a special place due to significant contributions to rural income, employment and export earnings [2]. India is one among the largest producers of cashews globally, with Kerala and Tamil Nadu contributing significantly to its overall production. Cashew farming plays a vital role in the agricultural economy of these states, providing livelihood and export revenue [3,4]. Cashew (*Anacardium occidentale L.*), which originates from the Portuguese word 'Caju', was first introduced to India from northeastern Brazil between 1563 and 1570 [5]. Over the centuries passed, it has become well adapted to India's climatic conditions and evolved from its initial use for measures like afforestation and soil conservation into a high-value commercial crop. Since, inception of crop, it is often referred as "gold mine" of wasteland and cashew has transformed into a critical source of livelihood for farmers [6]. India holds the largest area under cashew cultivation, covering 21.6% of the global total and rank as the third-largest producer of raw cashew nuts, contributes 17.3% to the world's supply. The trend on export scenario shows, India falls behind Vietnam, makes 34% of the global cashew kernel exports [7]. Also, it has emerged as one of the world's leading producer, consumer and exporter of cashew nuts, with its kernels being highly prized in over 60 countries for their superior quality and taste [8]. However,

despite its dominant global presence, India's cashew productivity trails behind key competitors like Vietnam, Nigeria and Ivory Coast mainly due to several pressing constraints. These include improper harvesting methods, inadequate drying processes, limited storage facilities and poor post-harvest infrastructure, which hinder the country's ability to maximize yields and quality [9].

Among India's leading cashew-producing states, Kerala and Tamil Nadu stand out as significant contributors to the nation's cashew nut production. Tamil Nadu boasts a vast expanse of 167,000 hectares dedicated to cashew cultivation, yields approximately 73.60 thousand tonnes of cashew nuts annually. This large-scale production highlights Tamil Nadu's importance in the national cashew industry. In contrast, Kerala with a considerably smaller cultivation area of 103,200 hectares, produces 73.10 thousand tonnes of cashew nuts per year. Besides, 38% less land under cultivation, Kerala's cashew productivity comes remarkably close to Tamil Nadu cashew production [10]. This noticeable discrepancy in production output relative to land size between states underscores a significant variation in productivity. There are many factors that, could explain this differences such as distinct agricultural practices, levels of technological advancement and varying degrees of infrastructural support. The state of Kerala's higher productivity per unit area may be attributed to more efficient cultivation techniques, superior management of resources, or better adaptation to local environmental conditions. Contradictorily, Tamil Nadu's larger landholdings may face challenges in optimizing productivity due to potential constraints in infrastructure, labour and the management of agricultural

inputs. The critical understanding of these differences is crucial for development of tailored strategies to address productivity gaps and boost overall cashew output in both regions.

The scope of this comparative study encompasses an in-depth analysis of the constraints faced by cashew growers in Kerala and Tamil Nadu, two of India's prominent cashew-producing states. Focusing on the unique challenges and limitations encountered in each region, the study aims to provide a comprehensive understanding of how these factors affect the overall impact on productivity and sustainability of cashew farming. The significance of this research potential is to inform policymakers and stakeholders about the specific needs and issues prevalent in these states, facilitating the development of targeted interventions and the existing support systems. Furthermore, the findings can serve as a valuable reference for other cashew-producing regions, contributing to the enhancement of cashew cultivation practices at a national level.

Though the experienced constraints, ranging from climatic challenges, pest and disease infestations to limited access to modern agrotechnologies and inadequate market facilities, which affect both states in varying degrees. Addressing these issues is critical not only for enhancing productivity, but also for improving the livelihoods of farmers and ensuring the sustainable growth of the cashew industry in both states. Therefore, research problem of this study addresses the various constraints faced by cashew growers in Kerala and Tamil Nadu, which significantly hinder their productivity and sustainability despite the crop's contribution to the horticultural economy. These constraints encompass socio-economic issues, limited access to resources and technological barriers. The objectives of this study is to identify and categorise the major constraints faced by cashew growers in both states, analyse the differences between the two regions, assess the impact of these constraints on productivity and sustainability, and provide recommendations for policy initiatives and technical support systems aimed at enhancing cashew cultivation in India.

2. LITREATURE REVIEW

A range of studies has illuminated the significant challenges encountered by cashew producers, offering valuable insights into the constraints in cashew production. Uwagboe [11] identified inadequate capital and insufficient storage

facilities as critical barriers in Nigeria, with 70% of respondents highlighting difficulties in obtaining loans as a major factor affecting production. Kandeegan and Mahendran [12] similarly reported on the obstacles faced by cashew farmers in Tamil Nadu, including pest and disease management, high labour demands during harvest time, and adverse climatic conditions. They also pointed out that inadequate capital and a lack of knowledge regarding value addition practices contributed to lower productivity than the national average. In their study, Jayasankar et al. [13] further delineated the constraints hindering the adoption of high-density planting among Indian cashew growers, citing concerns such as fear of natural disasters (100%), labour shortages (89.2%), elevated labour costs (71.6%), insufficient credit facilities (70%), and pest and disease incidence (58.3%). Additionally, Pattanayak and Padhy [14] examined India's cashew production, underscoring the country's competitive advantage while proposing strategies to tackle the challenges that impede productivity.

However, significant gaps persist in the literature concerning the comparative analysis of constraints faced by cashew growers across different states, particularly in Kerala and Tamil Nadu. Many previous studies have concentrated on specific regions or challenges without offering a comprehensive overview of the unique issues affecting each state. This study aims to bridge this gap by providing an in-depth comparative analysis of the constraints impacting cashew production in Kerala and Tamil Nadu, thereby enhancing the understanding of the factors that influence cashew farming in India.

3. METHODOLOGY

The multi-stage purposive sampling process implied to identify the study area. Multi-stage purposive sampling is a method that involves selecting samples in multiple stages to capture a diverse and representative perspective of a population. This sampling method was chosen for several reasons. Firstly, it allows for focused representation of the diverse cashew farming landscape, ensures wider range of challenges. Secondly, it is resource-efficient, enabling researchers to collect data from a manageable number of respondents while still being representative of the larger population. Additionally, this method fosters depth of insight by honing on specific characteristics pertinent to cashew growers, leading to richer data on the

constraints affecting productivity and sustainability. Also, its flexibility allows researchers to adapt their strategy based on the study's needs, ensuring relevant and informative data collection. Overall, multi-stage purposive sampling was selected to provide a comprehensive understanding of the constraints faced by cashew growers while optimizing resource use.

In this study on the constraints faced by cashew growers in Kerala and Tamil Nadu, the researcher first identified these two states due to their significant contributions to India's cashew production. This methodology led to the identification of the two districts from the two states with highest cashew production viz., Cuddalore district in Tamil Nadu and Kannur district in Kerala. Further, among the fourteen districts of Kerala, Kannur leads in cashew nut production covers an area of 19,264 hectares and yield potential constitutes 14,475 metric tonnes [15] makes an ideal focus for this study. According to season and crop report of Government of Tamil Nadu 2021-22, Cuddalore produced 10,515 metric tonnes of cashew nut, established as the lead producer among the districts of Tamil Nadu, with a total area of 29,489 hectares [16]. This wholesome selection process relied on secondary data from statistical reports published by both state governments and further validated through expert consultations. Also, insights gained from intense dialogues with field-level Agriculture Officers of Kerala and Horticulture Officers of Tamil Nadu provided valuable context on local cashew production scenario. Additionally, consultations with faculty members from Tamil Nadu Agricultural University (TNAU) and Kerala Agricultural University (KAU), along with scientists from the All India Coordinated Research Project (AICRP) on cashew in Kerala and officials from Regional Research Stations in Tamil Nadu, contributed to a broader perspective on cashew nut production. Furthermore, discussion with officials from State Horticultural Farm in Tamil Nadu enriched the intellect on indigenous system and cashew cultivation practices. Hence, these collective efforts were crucial in identification of best-performing development blocks in cashew cultivation and thereby establishes a solid foundation for this research.

In Kannur district of Kerala, 80 cashew growers were selected for the study, with 40 respondents from Iritty block and 40 respondents from Peravoor block. In Iritty locality, simple random

sampling procedure was followed to select 20 sample from Kacherikadavu and Payam gram panchayat. Likewise, in Peravoor 20 cashew growers were selected from Kelakam and Kottiyoor gram panchayat. This methodological procedure ensured a representative sample from Kannur, paving a way for enabling a comprehensive analysis of regional cashew cultivation practices.

Similarly, in Cuddalore district of Tamil Nadu 80 cashew growers were selected with 40 from Panruti block and 40 from Kammapuram block. From each block two gram panchayat were chosen purposively, viz., Alagappasamuthiram and Arasadikuppam from Panruti block, while in the Kammapuram block, Kotteri and Muthanai gram panchayat were selected, resulting in 20 cashew growers each. In total, cumulative sample size attained 160 through multi-stage sampling, provided a balanced dataset for the study.

Data collection was carried out through structured interviews, which facilitated the systematic gathering of quantitative and qualitative information from respondents. This method ensured consistency in the data collected and allowed for the collection of comprehensive insights regarding the constraints faced by cashew growers. The structured interviews included a series of pre-defined questions designed to capture the respondents' perceptions and experiences related to various constraints in cashew production. By employing this method, the study aimed to achieve a deeper understanding of the specific challenges faced by farmers in the selected regions. The schedule was developed after a pilot study in non-sample area, that identified key challenges through discussions with farmers and experts. It includes a list of constraints, which respondents ranked based on their personal experiences, providing a nuanced understanding of how each issue affected their farm economy and cashew cultivation practices. This ranking system captured the subjective nature of the challenges, essential for targeted interventions. An open-ended question facilitated respondents to mention additional constraints not covered in the pre-defined list, ensuring a comprehensive collection of data. The gathered information was analysed using Statistical Package for Social Sciences (SPSS) to represent the frequency, percentage of each constraint and cumulative frequency to better understand their prioritization. These methods strengthened the research

findings, offering insights into the most critical issues affecting cashew farmers.

4. RESULTS

The findings are presented as constraints in the Table 1, which includes frequency (f) and per cent (%) based on the collected data, along with the assigned rank for each constraint. Below the table, each constraint is discussed in detail to provide a comprehensive understanding of the challenges faced by the respondents. The radar overlay chart illustrating the constraints faced by cashew farmers is presented in Fig. 1.

The analysis of the findings revealed several major challenges faced by cashew growers in both Kerala and Tamil Nadu, with pest infestations, labour scarcity and unstable market prices emerging as critical issues.

In Kerala, pest and disease infestations, particularly the Cashew Stem and Root Borer (CSRB), were identified as the most pressing challenge, reported by 100% of respondents. This underscores the urgent need for effective pest management strategies to protect the yield potential of cashew trees. Limited labour availability emerged as a significant constraint, with 97.50% of farmers indicating difficulties in securing an adequate workforce, highlighting challenges in labour management. Additionally,

low market prices for raw cashew kernels were reported by 93.75% of respondents, exacerbated by a lack of a stable pricing system, contributing to financial vulnerability among growers. Market monopoly was identified as a significant concern by 92.50% of farmers, indicating how middlemen and large traders control pricing, reducing the bargaining power of farmers. High labour costs were reported as a concern by 91.25% of growers, compounding the issue of labour scarcity and increasing production costs. Moreover, market price fluctuations affected 81.25% of respondents, creating unpredictability in income and complicating long-term planning. The quality of inputs provided by government agencies was a concern for 71.25% of the farmers, impacting productivity directly. The absence of group cohesiveness, noted by 72.50% of respondents, limits access to better marketing opportunities and technical guidance. Human-wildlife conflict was a notable issue for 61.25% of farmers, leading to severe crop damage from elephants, wild boars, and leopards. The absence of a minimum support price affected 50% of respondents, further exacerbating financial uncertainty in cashew farming. Inadequate government support during natural calamities was noted by 47.50% of respondents, highlighting the vulnerability of growers to environmental shocks. Heavy winds and landslides were reported by 37.50% of

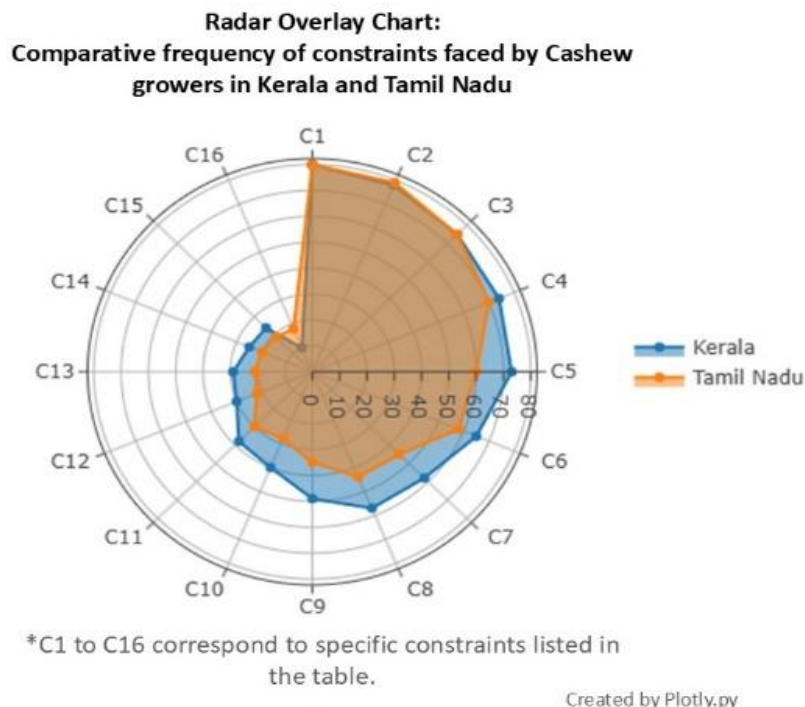


Fig. 1. Radar overlay chart

Table 1. Constraints faced by the cashew growers of Kerala and Tamil Nadu

Sl. No.	KERALA (n=80)			TAMIL NADU (n=80)				
	Constraints	f	%	Rank	Constraints	f	%	Rank
1.	Prevalent pest and disease infestations (CSRB)	80	100.00	I	Prevalent pest and disease infestations (CSRB)	80	100.00	I
2.	Limited labour availability	78	97.50	II	Low market price for the raw cashew kernel during procurement by local merchant / traders	79	98.75	II
3.	Low market price for raw cashew kernel during procurement by local merchant / traders	75	93.75	III	Seasonal changes and climate variability impacts cashew nut yield	75	93.75	III
4.	Monopoly market affecting pricing system	74	92.50	IV	High cost associated with labour and agricultural inputs	70	87.50	IV
5.	High cost in hiring labour and farm machineries	73	91.25	V	Inadequate irrigation facilities	60	75.00	V
6.	Fluctuations in market price	65	81.25	VI	Lack of extension support from the government machineries	58	72.50	VI
7.	Inferior quality of inputs and graft provided by state government	58	72.50	VII	Infestation by wild boar, deer and peacock	45	56.25	VII
8.	Lack of group cohesiveness among growers	57	71.25	VIII	Unsuitability of hybrid varieties in rainfed-cultivation area	44	55.00	VIII
9.	Human-wildlife conflict caused by elephant, wild boar and leopard	49	61.25	IX	Dominance of agro-input dealers in fertiliser and pesticide recommendations	35	43.75	IX
10.	Absence of minimum support price	40	50.00	X	Non-availability of infrastructure facilities for processing, drying and storage	28	35.00	X
11.	Insufficient government support during natural calamities	38	47.50	XI	Absence of crop-specific scheme	30	37.50	XI
12.	Devastating incidences of heavy windfall and landslides	30	37.50	XII	Lack of practically applicable training opportunities	22	27.50	XII
13.	Insufficient technical guidance from government	29	36.25	XIII	Monopoly market affecting pricing system	21	26.25	XIII

Sl. No.	KERALA (n=80)			TAMIL NADU (n=80)				
	Constraints	f	%	Rank	Constraints	f	%	Rank
14.	Adulteration of cashew nuts by mixing inferior quality from different districts by local merchant/traders	25	31.25	XIV	Absence of value addition industries and product diversification mechanism	20	25.00	XIV
15.	Lack of small-scale industries for cashew processing units	24	30.00	XV	Insufficient preference or low price for local cashew yield due to high dependence on imported cashew kernel	19	23.75	XV
16.	Absence of developmental interventions from the Cashew Board	10	12.50	XVI	Wastage of cashew apple due to lack of processing facilities	18	22.50	XVI

farmers as significant threats to crop yield. Insufficient technical guidance from the government, reported by 36.25% of respondents, indicates a gap in disseminating critical information about effective horticultural practices in cashew cultivation. Adulteration of cashew nuts by local merchants was a concern for 31.25% of farmers, raising issues about product quality and farmers' economic security. Limited infrastructure for kernel processing was highlighted by 30% of farmers, restricting their ability to convert raw cashew into higher-value products. Lastly, the perceived lack of support from the Cashew Board was noted by 12.50% of respondents, indicating a need for stronger developmental interventions in the cashew industry.

In Tamil Nadu, the occurrence of pest and disease infestations, particularly CSRB, was similarly reported as a critical issue by 100% of respondents. Low market prices for raw cashew kernels were identified as the most significant constraint by 98.75% of farmers, emphasizing the urgent need for a regulated pricing system to protect farmers from middlemen exploitation. Seasonal changes and climate variability affected approximately 93.75% of farmers, demonstrating the sensitivity of cashew cultivation to climatic fluctuations. High labor and agro-input costs were reported by 87.50% of respondents, representing a serious financial burden that impacts profitability. Inadequate irrigation facilities were a constraint for 75% of farmers, indicating the need for improved water management strategies. Additionally, 72.50% of respondents expressed concerns about the lack of extension support from government agencies, highlighting the need for better technical guidance in scientific cashew cultivation practices. Infestations by wild animals, including wild boars, deer, and peacocks, were noted as significant issues by 56.25% of farmers, resulting in crop damage and economic yield loss. Furthermore, 55% of respondents indicated that hybrids of cashew were unsuitable for rainfed areas due to a lack of water for irrigation, emphasizing the need for the development of adaptable varieties. Additionally, 43.75% of respondents noted the influence of agro-input dealers due to the monopolistic nature of private firms, impacting personal farming decisions. The lack of infrastructure facilities for processing, drying, and storage was reported by 35% of farmers, leading to significant post-harvest losses. The absence of crop-specific schemes was indicated by 37.50% of respondents,

highlighting a gap in targeted government initiatives to support cashew cultivation. A lack of practically applicable training opportunities was cited by 27.50% of farmers, underscoring the need for hands-on technical guidance. A monopoly marketing system affecting pricing was noted by 26.25% of respondents, suggesting challenges in negotiating fair prices. The absence of value-added industries was reported by 25.00%, limiting farmers' ability to enhance profitability through processing. Additionally, 23.75% of respondents expressed concern over insufficient preference or low prices for local cashew yields due to high imports from countries like Ivory Coast, Vietnam, and Ghana, driving down the value of locally produced cashews. Finally, wastage of cashew apples due to a lack of processing facilities was cited as a constraint by 22.50% of respondents, highlighting missed opportunities for utilizing cashew apples for value-added products.

Comparatively, both states face similar pest management challenges; however, Tamil Nadu growers highlighted climate-related issues more prominently. Labor availability emerged as a critical concern in Kerala, while Tamil Nadu growers focused on the broader economic impacts of market prices and climate variability. The identification of these challenges is essential for developing region-specific interventions to enhance productivity and resilience in cashew farming.

5. DISCUSSION

The findings from this study reveal significant challenges faced by cashew growers in Kerala and Tamil Nadu, aligning with and expanding upon previous research. For instance, the severe infestation of the Cashew Stem and Root Borer (CSRB) reported by 100% of respondents in both states corroborates the findings of Jayasankar et al. [13], who also identified pest-related issues as critical constraints in cashew cultivation. This persistent challenge emphasizes the need for integrated pest management strategies that can effectively address such infestations.

Labor scarcity emerged as a prominent issue, particularly in Kerala, where 97.50% of farmers expressed difficulties in securing an adequate workforce. This aligns with the observations made by Kandeegan and Mahendran [12], who noted high labour demand during harvesting periods. In Tamil Nadu, while labour cost concerns were highlighted, the overwhelming

focus was on market pricing issues. This variation underscores regional differences in challenges faced by farmers, reflecting how local economic conditions and agricultural practices influence the specific barriers encountered.

The low market prices for raw cashew kernels reported by 93.75% of farmers in Kerala and 98.75% in Tamil Nadu indicate a significant vulnerability in both regions, revealing a pattern of exploitation by intermediaries. This situation is exacerbated by market monopolies and fluctuations, as highlighted by Pattanayak and Padhy [14]. The urgent need for regulated pricing systems and minimum support prices is evident, suggesting that policy reforms must prioritize market stability to safeguard farmer incomes.

The discussion also reveals broader implications for agricultural policies. The similarities in constraints across both states point to a need for regional policies that consider local contexts while addressing common issues, such as pest management and labour availability. The absence of value-added processing facilities, highlighted by 30% of farmers in Kerala and 25% in Tamil Nadu, indicates a significant gap in the supply chain that limits profitability. Investment in processing infrastructure could enhance the economic viability of cashew farming in both regions, fostering resilience against market fluctuations.

The significance of technical interventions cannot be overstated. Improved extension services and training programs are crucial for equipping farmers with the knowledge and skills necessary to adopt better agricultural practices. The lack of adequate technical guidance reported by a significant percentage of respondents suggests that existing support systems must be strengthened to facilitate the dissemination of vital information.

In conclusion, addressing the constraints faced by cashew growers in Kerala and Tamil Nadu requires a multifaceted approach that encompasses technical support, market improvements, and policy reforms. By implementing these strategies, stakeholders can enhance productivity and sustainability in the cashew sector, ultimately benefiting farmers and contributing to the overall stability of the agricultural economy in these regions.

6. CONCLUSION AND RECOMMENDATIONS

This study highlights the wide array of constraints faced by cashew farmers in Kerala and Tamil Nadu, which significantly affect their productivity, profitability, and the long-term sustainability of cashew cultivation in India. Major issues like pest and disease infestations, labour scarcity, and fluctuating market prices were found to be the most frequent challenges. However, lower-ranked issues, such as the absence of crop-specific schemes, inadequate training opportunities, and lack of value addition industries, though mentioned by fewer farmers, indicate deeper systemic challenges that affect the broader cashew industry. These constraints, often raised by more experienced and knowledgeable farmers, underscore their relevance to the long-term viability of the cashew sector.

External factors such as climate change, global market conditions, and the impact of the COVID-19 pandemic on labour shortages also to be considered, as these issues have had widespread effects on agricultural production, including cashew farming. Climate change, for instance, is contributing to unpredictable weather patterns and affects crop yield, while global market fluctuations directly influences on cashew price and export potential. Moreover, the pandemic has exacerbated labour shortages, particularly during peak harvest seasons, worsening an already significant constraint for farmers in both Kerala and Tamil Nadu. Addressing these external challenges alongside internal constraints is crucial for formulating holistic strategies that ensure the resilience and sustainability of the cashew sector in an increasingly uncertain global environment.

For policy-makers, government agencies and cashew development bodies, it is crucial to address not only the most frequently mentioned challenges but also these lower-ranked, yet critical, concerns. The findings call for a comprehensive and cashew-specific policy approach, focusing on both immediate and systemic issues. Practical recommendations include the development of targeted pest control measures, ensuring labour availability and affordability, establishing stable market pricing mechanisms, and fostering value addition through the creation of processing infrastructure.

Furthermore, there is an urgent need for enhancing technical training and extension services to equip farmers with practical, location-specific knowledge that can improve their productivity. Future research should explore the long-term impacts of these constraints, particularly the less frequently mentioned ones, to provide a more complete understanding of the sector's challenges. Addressing both the prominent and lesser-reported constraints through focused strategies is essential for building resilience and ensuring the sustained growth of cashew farming in India.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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