



Development status of disease management practices and their impact on the production of Nepal Cardamom (*Amomum subulatum* Roxb.) in Bhojpur district, Nepal



Ajita Mahat, Sunita Phago, Ashika Baraili and Roshan Katwal
Ilam Community Agriculture Campus, Purwanchal University, Nepal

Received: 02 May 2026 | Accepted: 20 June 2026

DOI: <https://doi.org/10.65791/cias.96>

ABSTRACT

Nepal Cardamom (*Amomum subulatum* Roxb.), locally regarded as the country's "Black Gold", is one of Nepal's most valuable cash crops and a major source of rural income and export earnings in the eastern hill districts, including Bhojpur. In recent years, however, productivity has declined markedly because of increasing disease pressure, pest infestation, climatic variability, limited irrigation, and inadequate farmer knowledge of disease and pest management. This study was carried out in Bhojpur district from November 2025 to April 2026 to assess the status of major Nepal Cardamom diseases, document the disease management practices adopted by farmers, and evaluate their influence on production. A descriptive research design combining quantitative and qualitative approaches was used. Data were collected from 64 Nepal Cardamom growing households selected through convenience sampling across Bhojpur Municipality, Tyamke Maiyum Rural Municipality, Ram Prasad Rai Rural Municipality, and Shadananda Municipality, supplemented by key informant interviews and field observation. Rhizome rot was identified as the most prevalent and destructive disease, affecting approximately 70% of the surveyed plantations, followed by leaf blight (60%) and wilt (under 40%). Around 86% of the respondent households reported a decline in production over the preceding five years, and none reported an increase. Cultural practices, such as field sanitation, shade regulation and removal of infected material, were adopted almost universally, whereas only about one-fifth of farmers used chemical inputs and none practiced biological control. Where chemical treatment was applied, it markedly reduced the incidence of rhizome rot, leaf blight, wilt and damping-off compared with cultural practices alone, while cultural measures performed comparably well or better against chirke (mosaic) disease. The study concludes that inadequate access to disease-resistant planting material, weak extension support, and limited technical knowledge are the principal constraints to effective disease management in Bhojpur, and recommends strengthening farmer support systems and promoting Integrated Pest and Disease Management (IPDM) to restore productivity and safeguard the long-term sustainability of Nepal cardamom cultivation in the district.

KEY WORDS: Nepal Cardamom; Rhizome rot; Leaf blight; Disease management; Bhojpur

1. Introduction

Agriculture remains the backbone of the Nepalese economy, engaging more than 60% of the population and contributing about 24% of the

national gross domestic product, with cash crops assuming an increasingly important role alongside traditional cereal production (MoF, 2022; GoN, 2021). Among these cash crops, Nepal Cardamom

(*Amomum subulatum* Roxb.), a perennial rhizomatous herb of the family Zingiberaceae, has emerged as one of the country's most important export commodities, with the area under cultivation expanding from about 14,000 ha in 2009/10 to nearly 18,800 ha in 2020/21 (MoALD, 2021). Known locally as Alaichi and internationally marketed as the “Queen of Spices”, Nepal Cardamom is cultivated predominantly in the shaded, humid conditions of the eastern hill and mountain districts and supports the livelihoods of an estimated 67,000 farming households (ITC, 2017; Kalauni & Joshi, 2019).

Bhojpur district, in Koshi Province, is one of the traditional growing areas for this crop, where it provides a critical source of household income. In recent years, however, farmers across the district have reported a consistent decline in Cardamom yield and plantation longevity, a trend widely attributed to the increasing incidence of diseases such as rhizome rot, leaf blight, wilt, damping-off and chirke (mosaic), together with pest pressure and climatic variability (Kalauni & Joshi, 2019; Pun, 2019). Although farmers continue to rely on cultural practices, traditional planting materials and, to a lesser extent, chemical inputs to manage these diseases, the effectiveness of such measures in the specific agro-ecological context of Bhojpur has not been systematically documented. Limited access to extension services, disease-resistant planting material and technical knowledge further constrains farmers' ability to respond to disease outbreaks (Shrestha *et al.*, 2018; Khatiwada *et al.*, 2024).

Comparable studies in other Nepal Cardamom growing districts have similarly linked declining productivity to disease incidence and weak farmer knowledge of management options (Basnet *et al.*,

2021; Gotame & Santosh, 2025; Bhandari *et al.*, 2025), underscoring the need for location-specific evidence to guide interventions. In the absence of such evidence for Bhojpur, it remains difficult to design disease management strategies that are both effective and appropriate to local farming conditions. The present study was therefore undertaken to assess the current status of major Nepal Cardamom diseases, document the disease management practices adopted by farmers, and evaluate the effect of these practices and disease incidence on Cardamom production in Bhojpur district, with the broader aim of informing more effective, sustainable and farmer-appropriate disease management strategies.

2. Materials and Methods

2.1 Study area

The study was conducted in Bhojpur district, Koshi Province, Eastern Nepal (26°53′-27°46′ N, 86°53′-87°17′ E), a traditional Nepal Cardamom growing area with elevations ranging from about 300 m to over 4,000 m above sea level and a climate that varies from subtropical to temperate. Survey sites were purposively selected within Bhojpur Municipality, Tyamke Maiyum Rural Municipality, Ram Prasad Rai Rural Municipality and Shadananda Municipality, representing major Cardamom-producing areas with a comparatively high frequency of disease occurrence.

2.2 Research design and sampling

A descriptive research design combining quantitative and qualitative approaches was used to assess disease status, existing management practices, and their effect on production. A total of 64 Nepal Cardamom growing households were selected using a convenience sampling technique

from a farmer list obtained from the NAMP Nepal Cardamom Zone Implementation Unit, drawing on producers across the four selected municipalities.

2.3 Data collection

Primary data were collected between November 2025 and April 2026 through structured household surveys covering respondent demographics, cultivation practices, disease incidence, disease management practices, and perceived impacts on production. These were supplemented by key informant interviews with progressive farmers, agro-vet personnel, staff of the Agriculture Knowledge Centre, and officials of the Project Implementation Unit, together with direct field observation. Secondary information was obtained from reports of the Ministry of Agriculture and Livestock Development, the Nepal Agricultural Research Council, the Agro-Enterprise Centre, the Central Bureau of Statistics, and relevant published literature.

2.4 Data analysis

Completed questionnaires were checked for completeness and consistency, coded, and entered into Microsoft Excel. Data were summarized using descriptive statistics (frequencies and percentages) and presented in tables and charts to characterize respondent demographics, disease incidence, management practices, and their reported effectiveness.

3. Results and Discussion

3.1 Socio-demographic characteristics of respondents

The surveyed households were predominantly male-headed (73.4%), reflecting the labour-

intensive nature of Cardamom cultivation, which involves harvesting, irrigation and weeding operations that are typically undertaken by male household members. Most respondents (84%) were between 30 and 60 years of age, and more than three-quarters (76.6%) had 10–20 years of experience in Cardamom farming, indicating that the crop is managed largely by an experienced, middle-aged farming population. Agriculture was the primary occupation for 82.8% of respondents, and land holdings were generally small, with 59.4% of households cultivating less than 10 ropani and only about 11% managing more than 20 ropani. Educational attainment was modest, with just 4.7% of respondents having completed a bachelor's degree, while planting material was overwhelmingly sourced from rhizome division (93.7%) rather than tissue culture (6.3%) ([Table 1](#)). These characteristics point to a smallholder-dominated production system in which limited education and reliance on traditional planting material may constrain farmers' access to, and adoption of, improved disease management technologies.

3.2 Status and incidence of major diseases

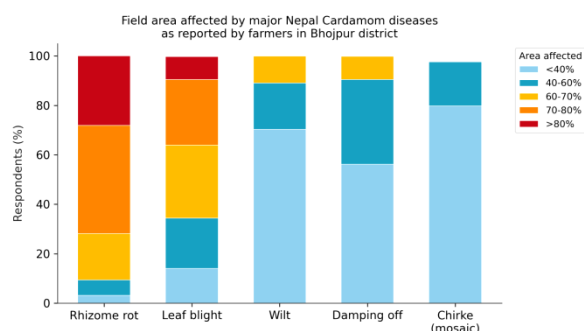
Disease and insect infestation was reported by nearly all respondents, with 98% having experienced disease incidence and 90% pest attack in their plantations, broadly consistent with the findings of Adhikari and Acharya (2026) from a comparable eastern-hill setting. Rhizome rot emerged as the most damaging disease, with 71.9% of respondents reporting that it had affected more than 70% of their plantation area, making it by far the most severe constraint identified in the survey. Leaf blight was also widespread, with the

Table 1: Socio-demographic characteristics of the respondent households (n = 64)

Characteristic	Category	Frequency	Percentage
Gender	Male	47	73.44
	Female	17	26.56
Age group (years)	20–30	4	6.25
	30–50	27	42.19
	50–60	27	42.19
	>60	6	9.37
Education level	Illiterate	19	29.69
	Primary	23	35.94
	Secondary	19	29.69
	Bachelor and above	3	4.68
Farming experience (years)	<10	4	6.25
	10–20	49	76.56
	20–30	11	17.18
Primary occupation	Agriculture	53	82.81
	Government job	4	6.25
	Business	3	4.69
	Foreign employment	4	6.25
Cardamom land holding	<10 ropani	38	59.38
	10–20 ropani	19	29.69
	20–30 ropani	4	6.25
	>30 ropani	3	4.69
Planting material used	Rhizome division	60	93.75
	Tissue culture	4	6.25

Source: Field survey, 2026

largest share of respondents (55.9%) reporting 60–80% field-level severity, while wilt, damping-off and chirke (mosaic) were generally confined to smaller proportions of the plantation, each affecting less than 40% of the field for the majority of respondents (**Fig. 1**). This pattern suggests that soil-borne and foliar fungal diseases, rather than viral or damping diseases, pose the greatest threat to Cardamom productivity in Bhojpur, consistent with reports that rhizome rot and associated fungal pathogens are the principal yield-limiting diseases of Nepal Cardamom in the eastern hills (Belbase *et al.*, 2018; Shrestha *et al.*, 2018).

**Fig. 1:** Field area affected by major Nepal Cardamom diseases as reported by farmers in Bhojpur district.

The economic consequences of this disease burden were evident in respondents' own assessment of production trends: 86% of households reported a decline in Cardamom production over the preceding five years, while the remaining 14% reported no change and none reported an increase (**Table 2**). Farmers attributed this decline principally to disease and pest pressure, together with inadequate irrigation and climatic variability, a pattern that mirrors findings from other Cardamom-growing districts of eastern Nepal where disease incidence has been closely

linked to production decline (Gotame & Santosh, 2025; Pun, 2019).

Table 2: Reported change in Nepal Cardamom production and disease management practices adopted by farmers in Bhojpur district

Indicator	Category	Percentage of respondents
Reported change in production (last 5 years)	Decreased	86
	No change	14
	Increased	0
Disease management method adopted	Cultural practices	75
	Chemical control	20
	Biological control	0
Perceived effectiveness of current management practices	Effective	70
	Not effective	28

Source: Field survey, 2026.

3.3 Disease management practices adopted by farmers

Cultural and mechanical measures, such as field sanitation, removal and burning of infected plant debris, drainage management and winter pruning, were practiced almost universally, with three-quarters of respondents relying on these methods as their main line of defence against disease. Chemical control was used by only about one-fifth of farmers, generally without consistent attention to recommended dosage or timing, and no respondent reported using biological control methods (Table 2). Awareness of the Bordeaux mixture, a low-cost and widely recommended fungicide for Cardamom disease control, was

fairly high (83%), yet actual adoption was low (13%), pointing to a substantial gap between farmers' awareness and their practical uptake of recommended chemical measures. This pattern is consistent with the findings of Basnet *et al.* (2021) and Adhikari and Acharya (2026), who similarly reported that cultural practices dominate Cardamom disease management in Nepal while chemical and biological options remain under-utilised because of limited access, cost, and technical guidance.

3.4 Effectiveness of disease management practices

The relative effectiveness of cultural and chemical management differed markedly across diseases (Fig. 2). For rhizome rot and leaf blight, chemical treatment was clearly more effective than cultural practice alone: 85.9% and 82.8% of households using chemical control reported no disease, respectively, compared with none of the households relying solely on cultural measures, most of which continued to experience moderate-to-severe disease levels (50–90% of the field affected). For wilt and damping-off, chemical control again outperformed cultural practice, with 96.9% and 70.3% of chemically-treated households reporting no disease, against 73.4% and 12.5% for cultural practice, respectively. In contrast, for chirke (mosaic) disease, cultural practices were somewhat more effective than chemical control (93.8% versus 81.3% reporting no disease), likely reflecting the viral etiology of chirke, against which sanitation and vector-avoidance measures may offer more direct protection than fungicidal treatment.

These results suggest that, while cultural practices are important and widely accessible, they are on

their own insufficient to control the fungal and soil-borne diseases that presently cause the greatest production losses in Bhojpur, particularly rhizome rot and leaf blight. Targeted chemical intervention applied at the correct dose and timing, appears necessary to bring these diseases under control, whereas cultural sanitation measures remain appropriate and effective for managing chirke. This is broadly consistent with findings from Taplejung and Sankhuwasabha districts, where combinations of fungicide application and cultural sanitation have been shown to substantially reduce foliar and rhizome disease severity in Nepal Cardamom (Kharel et al., 2025; Subedi et al., 2022).

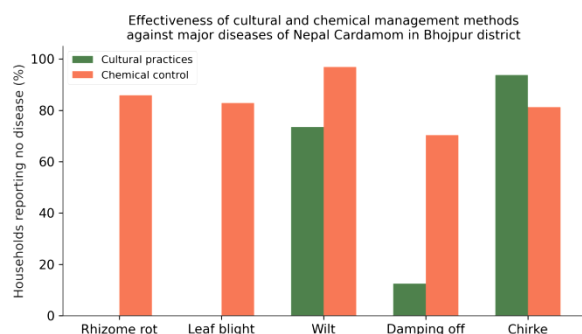


Fig. 2: Effectiveness of cultural and chemical management methods against major diseases of Nepal Cardamom in Bhojpur district (percentage of households reporting no disease).

3.5 Constraints and farmers' support needs

Respondents identified disease and insect attack as the most serious constraint to Cardamom production, with all respondents rating it as a major problem, followed by lack of technical knowledge and unpredictable weather. Farmers expressed strong demand for practical support measures rather than general awareness training:

about 89% requested access to disease-resistant planting materials, 81% sought subsidies for fungicides, and 81% requested regular field visits by agricultural technicians. This ranking of priorities indicates that farmers in Bhojpur are already aware of the importance of disease management, and that the principal barriers to more effective control lie in access to inputs, affordability, and consistent technical support rather than a fundamental lack of awareness.

4. Conclusion

This study shows that disease incidence, rather than a single dominant factor, is the principal driver of the decline in Nepal Cardamom production recorded by farmers in Bhojpur district over the past five years, with rhizome rot and leaf blight identified as the most damaging diseases. Farmers currently rely heavily on cultural practices, which, although widely adopted, are insufficient on their own to control fungal and soil-borne diseases; chemical control, though considerably more effective against rhizome rot, leaf blight, wilt and damping-off, remains under-used and inconsistently applied, while biological control is entirely absent from current practice. Strengthening farmers' access to disease-resistant planting material, fungicide subsidies, and regular technical field support, alongside the promotion of Integrated Pest and Disease Management combining cultural, chemical and biological approaches, is therefore essential to reduce production losses and secure the long-term sustainability of Nepal Cardamom cultivation and farmer livelihoods in Bhojpur district.

5. Acknowledgement

The authors thank the Nepal Cardamom farmers of Bhojpur district for their time and cooperation,

the NAMP Nepal Cardamom Zone Implementation Unit for facilitating farmer selection, and Ilam Community Agriculture Campus, Purwanchal University, for institutional support during the study.

6. References

Adhikari, R., & Acharya, S. (2026). Farmers' perception of pest and disease incidence in Nepal cardamom: Evidence from the eastern hills of Nepal. *Journal of Agriculture and Natural Resources*.

Basnet, B., Yadav, P. K., & Devkota, A. R. (2021). Insect pests' infestation, diseases and management practice of Nepal cardamom in Nepal: A review. *ITECH Magazine*, 3, 9–18. <https://doi.org/10.26480/itechmag.03.2021.09.18>

Belbase, S., Paudel, J., Bhusal, R., & Gautam, S. (2018). Fungal diseases of Nepal cardamom (*Amomum subulatum* Roxb.) and its integrated management. *International Journal of Current Microbiology and Applied Sciences*, 7(3), 3316–3321.

Bhandari, T., Mehata, D. K., Acharya, S., Poudel, R., Nepal, S., Pandit, D. L., & Ghimire, B. (2025). Comparative bio-efficacy of botanical and chemical pesticides against leaf-eating caterpillars in Nepal cardamom fields of Bhojpur. *Turkish Journal of Food and Agriculture Sciences*, 7(1), 127–137. <https://doi.org/10.53663/turjfas.1622536>

Gotame, M., & Santosh, B. K. (2025). Farmers' perception, knowledge and practices towards decline in production of Nepal cardamom in Sankhuwasabha district of Nepal. *Journal of Spices and Aromatic Crops*, 34(1), 30–38. <https://doi.org/10.25081/josac.2025.v34.i1.9773>

Government of Nepal. (2021). *Economic survey 2020/21*. Ministry of Finance, Government of Nepal.

International Trade Centre. (2017). *Nepal cardamom sector export strategy 2017–2021*. International Trade Centre.

Kalauni, D., & Joshi, A. (2019). Production, economics, marketing and critical success factors of Nepal cardamom in Bhojpur, Nepal. *Cogent Food & Agriculture*.

Kharel, A., Mehata, D., Chaulagain, K., Yadav, P. K., Gautam, R., & Adhikari, N. (2025). Evaluation of strobilurin and triazole-based fungicides for managing foliar blight in Nepal cardamom in Taplejung, Nepal. *Journal of Agriculture*, 8(2), 76–86.

Khatiwada, H., Pant, K., & Neupane, A. (2024). Nepal cardamom farming in eastern Nepal: SWOT analysis. *Adhyayan Journal*, 11(11), 61–68. <https://doi.org/10.3126/aj.v11i11.67076>

Ministry of Agriculture and Livestock Development. (2021). *Statistical information on Nepalese agriculture 2020/21*. Ministry of Agriculture and Livestock Development, Government of Nepal.

Ministry of Finance. (2022). *Economic survey 2021/22*. Ministry of Finance, Government of Nepal.

Pun, A. B. (2019). A review on different factors of Nepal cardamom decline in Nepal. *Asian Journal of Research in Crop Science*, 2(4), 1–6. <https://doi.org/10.9734/AJRCS/2018/46732>

Shrestha, K. P., K. C., G., Chaudhary, R., Pun, A. B., Shrestha, J., Yadav, S., & Mandal, D. L.

(2018). Assessment of production constraints of Nepal cardamom in the eastern hills of Nepal. *Asian Journal of Agricultural and Horticultural Research*, 2(4), 1–10. <https://doi.org/10.9734/AJAHR/2018/45905>

Subedi, A., Kattel, S., Chaudhary, L. B., & Thapa, S. B. (2022). Efficacy of bioagents and fungicides against *Colletotrichum* blight of Nepal cardamom under field conditions in Sankhuwasabha, Nepal. *Archives of Agriculture and Environmental Science*, 7(4), 529–534.