

REVIEW ARTICLE

THE JOURNEY OF LARGE CARDAMOM IN NEPAL: PRODUCTION, TRADE, AND MANAGEMENT

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ABSTRACT

Large cardamom (*Amomum subulatum* Roxb.) is Nepal's most valuable spice crop and a major export commodity, primarily cultivated in Ilam, Taplejung, Panchthar, and Sankhuwasabha. Despite rising global demand, productivity is declining due to price volatility, lack of technical knowledge, poor planting material, traditional curing methods, and high disease susceptibility. Post-harvest losses, limited market access, and trade tariffs further hinder commercialization. India remains the primary buyer and re-exporter. Pests and diseases threaten production, impacting Nepal's hilly agricultural economy. So, this review emphasizes integrated pest management, improved processing, and market expansion to sustain Nepal's competitive edge. Findings are based on published research and government reports, offering insights for policymakers, researchers, and farmers.

KEYWORDS

Spice, productivity, global, diseases, pests

1. INTRODUCTION

Large cardamom (*Amomum subulatum* Roxb.), commonly known as Black Cardamom or Nepal Cardamom, is a vital spice crop native to tropical and subtropical Asia, belonging to the *Elettaria* (small cardamom) and *Amomum* (large cardamom) genera within the Zingiberaceae family (Wikipedia, 2021). Nepal, the world's leading producer of large cardamom, contributes approximately 52% of global production, with India and Bhutan following at 37% and 11%, respectively (Pothula and Singh, 2013). The cultivation of this spice thrives in the humid, shaded, and moist regions of the eastern Himalayan hills, at altitudes between 765 to 1675 meters above sea level (Kumar et al., 2012). Nepal produced 7,954 tons of large cardamom in 2018-2019, a significant portion of the estimated global production of 12,000 tons (MOALD, 2018).

Despite its substantial contribution to global production, large cardamom represents only 10% of the total volume of spices exported from Nepal. However, it dominates the spice export market by accounting for 86% of the total value, underscoring its economic importance (Thapa and Dhimal, 2017). The crop, known for its distinctive aroma, is widely used in culinary, medicinal, and industrial applications, and has even demonstrated pesticidal properties, further increasing its value (Satyal et al., 2012; Gudade et al., 2013). The crop flourishes in altitudes ranging from 600 to 2400 meters above sea level, contributing significantly to Nepal's agricultural exports. Nevertheless, despite these favorable conditions, the productivity of large cardamom has been declining in recent years due to various challenges, including pest infestations, diseases, unfavorable environmental conditions, soil degradation, and market price fluctuations (Pun, 2018; K. Shrestha, 2018; Chakraborty and Chakma, 2019). This herbaceous, evergreen, and partially shade-loving plant is typically pollinated by bumblebees and grows under *Uttis* (*Alnus Nepalensis*) trees in the eastern Himalayan region (Rao et al., 1993; Khatiwada et al., 2019; Sharma et al., 2019). In total, Nepal cultivates around 14 different varieties of large cardamom, which are grown at varying altitudes, contributing significantly to the spice industry (Shrestha, 2018). In response to its increasing economic importance, large cardamom has been prioritized in

Nepal's agricultural strategies, with value chain development programs aimed at improving its production and marketability (MoAD, 2015; MoC, 2016).

In Nepal, approximately 14 different varieties of large cardamom are cultivated, each with its specific altitude range for optimal growth. The names of these varieties and their typical cultivation altitudes above sea level are presented in the table below.

Table 1: Different varieties with their cultivable height (Adhikari, 2020)

Name of Varieties	Cultivated height above sea level (M)
1) Ramsai	1500 to 2000
2) Golsai	1200 to 1600
3) Jirmale	600 to 1200
4) Dambersai	600 to 1200
5) Bharlyange	1200 to 2200
6) Saune	1000 to 1600
7) Chibesai	700 to 1200
8) Serimna	1200 to 1800
9) Madhusai	1200 to 1600
10) Sikkim	1500 to 1700
11) Ramala	1000 to 1500
12) Taplejung golsai	1500 to 1200
13) Jangugolsai	600 to 1200
14) Dzongu golsai	975

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2. PRODUCTION STATUS OF LARGE CARDAMOM IN NEPAL

Large cardamom cultivation is widespread across 52 districts of Nepal, primarily concentrated in the hilly and mountainous regions of Province 1 (MoALD, 2020). Key districts known for large cardamom production include Taplejung, Sankhuwasabha, Panchthar, Ilam, and Khotang (ITC and GoN, 2016). In the fiscal year 2018/19, the total area cultivated with large cardamom was 15,055 hectares, yielding 7,954 metric tons, with a productivity of 0.53 metric tons per hectare (MoALD, 2020). Analysis of the Compound Annual Growth Rate (CAGR) from 1994/95 to 2016/17 reveals a substantial increase in both the area under cultivation and total production. However, productivity has shown a declining trend over the years. A similar decline in productivity, with an annual growth rate of -

3.4%, was noted by (Pokharel, 2019).

Popular local varieties of large cardamom grown in Nepal’s Himalayan regions include Ramsai, Golsai, Chibesai, Dambersai, Saune, Kantidar, Salakpure, Varlange, and Jirmale (Kattel et al., 2020; MoICS, 2021). Among these, Ramsai (235.5 kg/ha), Golsai (196.5 kg/ha), and Chibesai (225.97 kg/ha) are the most widely cultivated varieties (Shrestha et al., 2018). The Large Cardamom Development Center in Ilam reports that 14 varieties of large cardamom are cultivated in Nepal, with five varieties (Ramsai, Golsai, Dambersai, Jirmale, and Varlange) currently undergoing the registration process (Gautam, 2021).

The trend of large cardamom production in Nepal is given below.

Table 2: Area, Production and Yield of Large Cardamom

Large Cardamom	Total Area	Productive area	Production	Yield
2011/12	14206	11665	6026	.52
2012/13	14687	11434	5753	.50
2013/14	14847	11501	5225	.45
2014/15	16043	12485	5166	.41
2015/16	15700	12120	6439	.531
2016/17	17002	12508	6521	.521
2017/18	14004	N/A	6849	N/A
2018/19	18273	15055	7954	.53

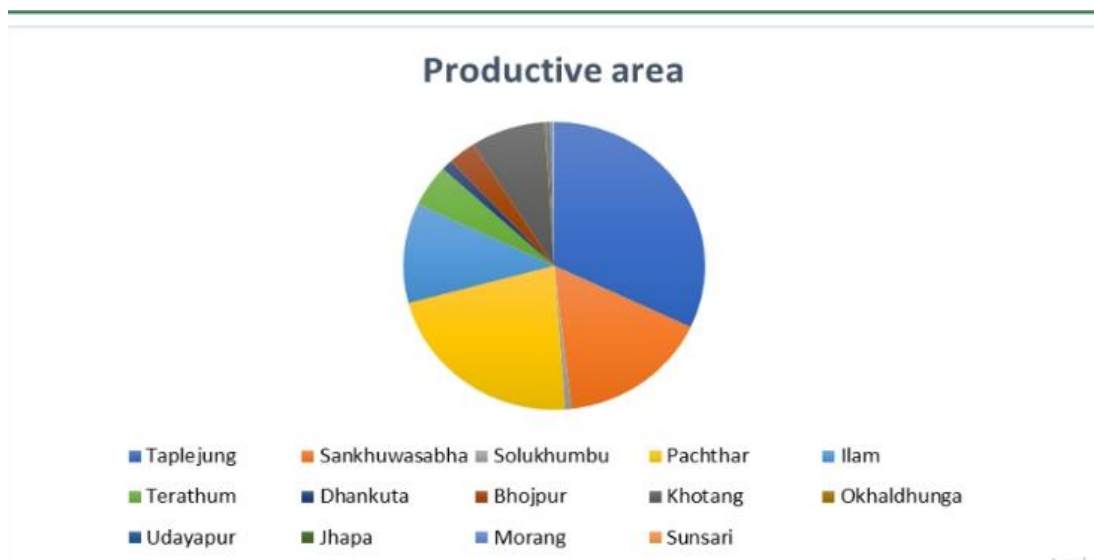


Figure 1: Total Productive Area of Large Cardamom in Eastern Hills (Source: MOALD, 2018)

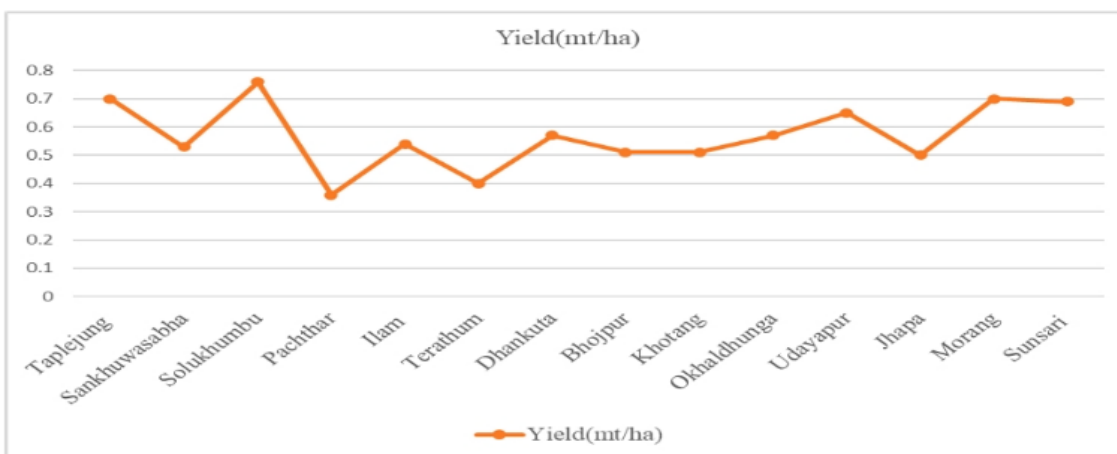


Figure 2: Total Productive Area of Large Cardamom in Eastern Hills (Source: MOALD, 2018)

3. MARKETING AND VALUE CHAIN OF LARGE CARDAMOM

The marketing and value chain of large cardamom in Nepal involves multiple actors such as growers, collectors, traders, and exporters, who perform various processing steps like curing, tail cutting, and grading to add value to the produce (Singh and Pothula, 2013; Shrestha et al., 2018).

Multiple marketing channels are observed, but most of the cardamom produced in Nepal is sold either directly from home to local collectors or through district-level collectors (Kalauni and Joshi, 2020). Around 90% of the produce is exported, with India being the primary market. Of this, 50% is re-exported to other countries, particularly Pakistan.

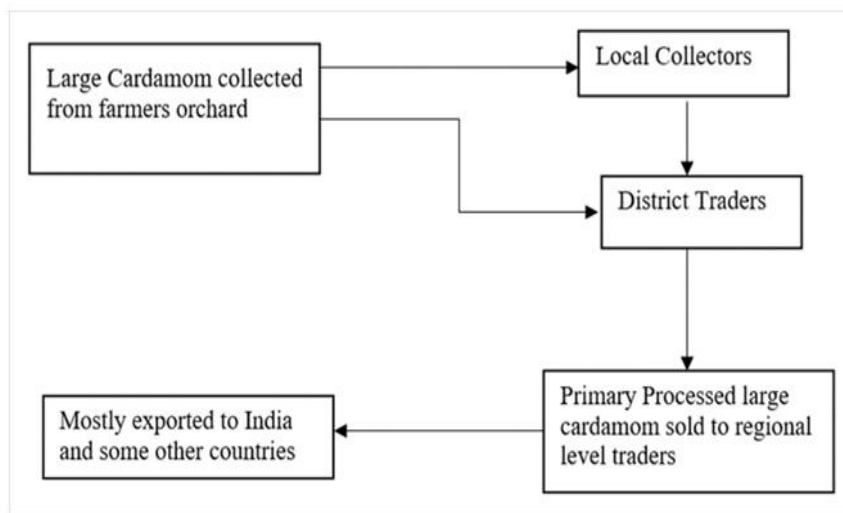


Figure 3: Marketing channel of large cardamom in Nepal (Shrestha, et al., 2018)

Global Marketing Channel of Large Cardamom ;

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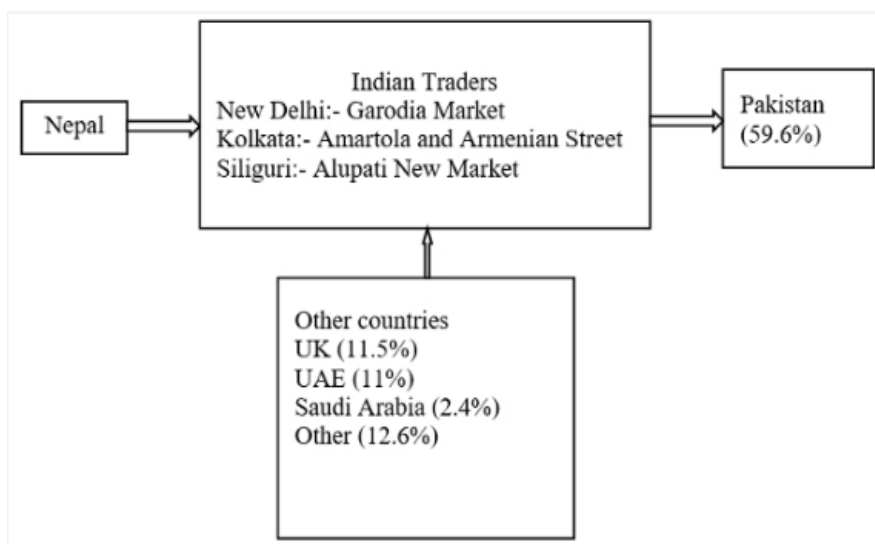


Figure 4: Global Marketing Channel of Large Cardamom

4. DISEASE INFESTATION AND IT'S MANAGEMENT

4.1 Blight

Causal Agent : The fungal pathogen *Colletotrichum gloeosporioides* (Prasad et al., 1984).

Symptoms

- Water-soaked lesions appear on the leaf tips or margins (Prasad et al., 1984; Nair, 2020) and lesions enlarge and coalesce, covering the entire leaf blade, resulting in a blighted or scorched appearance (Pathak, 2008 ;Belbase et al., 2018; Gurung et al., 2020).
- The entire plant clumps dry up completely, and the whole bush takes on a completely burnt appearance (Belbase et al., 2018; Tangjang and Sharma, 2018).

Management

- Prune non-productive shoots at the base of cardamom clumps after harvesting and burn the removed material to prevent disease spread (Prasad et al., 1984; Nair, 2020).
- Fungicide application: Spray 500–600 mL per plant at 15-day intervals in cases of severe infestation (Gurung et al., 2020; Nair, 2020).
- Biocontrol treatment: Treat propagating suckers with *Pseudomonas fluorescens* at a rate of 5 L per 100 L of water from late April to early May, as this period marks peak infestation (Vijayan et al., 2013; Shrestha et al., 2018; Chakraborty and Chakma, 2019).

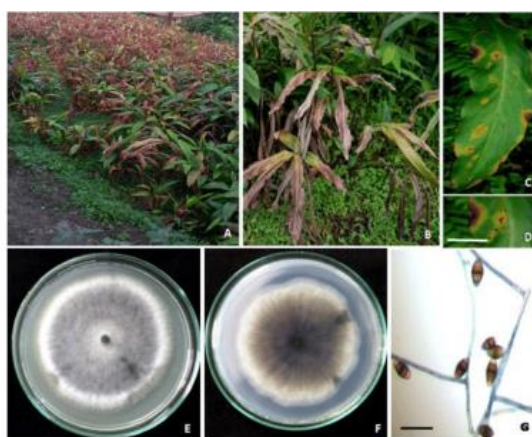


Figure 5: Leaf blight in cardamom

4.2 Phoma Leaf Spot Disease in Large Cardamom

Causal Agent: *Phoma* spp. (Saju et al., 2011).

Symptoms

- Water-soaked lesions, generally ovoid or round in shape, appear on the leaf lamina (Deka et al., 2016; Belbase et al., 2018).
- Under severe infestation, lesions coalesce and expand, causing leaf

yellowing, with the center gradually drying out towards the periphery (Deka et al., 2016; Belbase et al., 2018).

Management

- Collateral and alternate host plants should be removed, and appropriate shade levels should be maintained (Nair, 2020).
- Bordeaux mixture at 1 g per liter of water should be applied, spraying 500–600 mL per bush, with treatments repeated every 20–25 days during the rainy season (Saju et al., 2011)



Figure 6: Phoma leaf spot

4.3 Chirkey Disease of Large Cardamom

Causal Agent

- The disease spreads through mechanical means, such as pruning tools, and by the Corn Aphid (*Rhopalosiphum maidis*), a biological vector.
- Infected rhizomes are a primary source of transmission

Symptoms

- Young leaves show a mosaic pattern with pale green to yellow stripes. This reduces flowering, leading to yield loss (Mandal et al., 2012; Aryal et al., 2018).

Management

- Use systemic herbicides to control aphids (Aryal et al., 2018).
- Propagate seedlings through tissue or meristematic culture (Aryal et al., 2018).
- Maintain 50% shade and inspect aphids during the rainy season (Deka et al., 2014).



Figure 7: Chirkey disease

4.4 Foorkey Disease of Large Cardamom

Causal Agent

- Spread by biological vectors such as the Banana Black Aphid (*Pentalonia nigronervosa*) and Uttis Tree Aphid (*Moltrichosiphum montanum*) (Aryal et al., 2018).

Symptoms

- Affected plants show stunted shoots, curled leaves, and pale green patterns, with broader leaves becoming pan-shaped and unable to

flower or produce fruit (Aryal et al., 2018).

Management

- Use systemic herbicides like 0.075% hydroquinone on rhizomes and 0.1% thiourea for soil drenching (Aryal et al., 2018).
- Spray neem oil or NSKE at 0.3% to control aphids (Dhakal and Shrestha, 2004).



Figure 8: Foorkey disease

5. PEST AND IT'S MANAGEMENT

5.1 Tea Mosquito Bug Infestation in Large Cardamom

Causal Agent

- *Helopeltis theivora* (Sahoo et al., 2016).

Symptoms

- It sucks sap from the leaves, causing brown streaks to form on the leaf surface (Prasad et al., 1984; Sahoo et al., 2016).
- Infested young shoots may curl, leading to stunted plant growth and a reduction in yield (Vijayan, 2020).

Management

- Remove alternate and collateral host plants like Colocasia, ginger, turmeric, and Alder trees, and ensure 50% shade (Sharma et al., 2008).
- Use a chemical treatment by drenching with Malathion 50 EC or Phosalone 35 EC at a concentration of 2 ml/L of water (Prasad et al., 1984).



Figure 9: Tea Mosquito Bug

5.2 Capsule Borer in Large Cardamom

Causal Agent

- *Dichocrocis punctiferalis* (Nair, 2020).

Symptoms

- The capsules of large cardamom are often observed with holes, leading to capsule decay (Shohe and Roy, 2018).

Management Practice

- Clear away weeds and fallen leaves of Alder trees around the capsules to prevent pest infestation (Sharma et al., 2008).
- Apply carbaryl 50 WP at 1 kg a.i. in 600 to 800 L of water per hectare for pest control (Ravindran and Madhusoodanan, 2002).



Figure 10: Capsule Borer

5.3 White Grub in Large Cardamom

Causal Agent

- *Holotrichia* spp (Vijayan, 2020).

Symptoms

- The grubs damage the base of the pseudostem and rhizome, leading to yellowing and eventually wilting of the entire plant (Yadav et al., 2014; Tangjang and Sharma, 2018).

Management

- Apply insecticides like carbaryl or chlorpyrifos to control grub infestation (Ravindran and Madhusoodanan, 2002).
- Practice crop rotation and soil tilling to disrupt the life cycle of the grubs (Sharma et al., 2008)



Figure 11: White Grub

5.4 Stem Borer in Large Cardamom

Causal Agent

- *Glyphetera* spp

Symptoms

- The larvae of *Glyphetera* species bore into the pseudostem above the collar region, feeding on the central part, leading to a condition known as "dead heart" (Acharya, 2019; Chakraborty and Chakma, 2019).
- Tunnels in the pseudostem may be visible, often accompanied by worm castings outside the entry point (Bentley, 2016; Vijayan, 2020).

Management

- Remove and burn infested plant parts (Mandal et al., 2012; Sharma et al., 2016).
- For chemical control, apply Quinalphos 25 EC at a rate of 1L per 500-800L of water per hectare, especially during March, April, May, and August to September, for effective control (Pathak, 2008).



Figure 12: Stem borer

6. CHALLENGES AND OPPORTUNITIES IN LARGE CARDAMOM INDUSTRY

The productivity of large cardamom in Nepal has been in steady decline since 2010, despite the country remaining the largest global producer. This decline is primarily attributed to aging plantations, which are more susceptible to severe diseases such as chirkey, foorkey, and clump/rhizome rot. The frequent use of suckers from old mother plants for new plantations further exacerbates disease transmission. Additionally, cultivars like Jirmale and Salakpure, while drought-resistant, are highly vulnerable to viral infections in lower altitudes due to increased aphid activity. Post-harvest processing also affects product quality, as the traditional bhatti curing method deteriorates capsules due to direct exposure to fire and smoke, whereas oven drying offers a superior alternative. Furthermore, the industry faces challenges related to price volatility, limited technical expertise in orchard management, and reliance on Indian market trends for price determination. Market inefficiencies, including weak supply chain linkages and poor communication among stakeholders, further hinder commercial expansion.

Improper cultivar selection based on altitude and climatic conditions has also contributed to declining yields. For instance, the Ramsay cultivar, suited for higher altitudes, has been planted in lower regions, resulting in poor performance. Despite the identification of multiple diseases affecting large cardamom, management and control efforts remain inadequate. Farmers report that over 40% of their losses are due to diseased orchards, with some plantations facing the risk of complete collapse within two to three years.

7. CONCLUSION

The study highlights Nepal's high potential for large cardamom production and trade, with the country being the largest global producer. However, production is declining due to factors like aging orchards, diseases, lack of disease-resistant varieties, and limited technical support. Although the cultivation of large cardamom is expanding in several districts, the government has failed to provide adequate planting material and technical knowledge. The Indian market's monopoly on pricing and export challenges are significant barriers. Nepal's large cardamom is mainly exported to India, Pakistan, and the Middle East, with production concentrated in eastern districts like Ilam, Taplejung, and Panchthar. Despite being a high-demand export commodity, productivity is declining due to issues such as pest infestations, disease management, and traditional farming practices. The lack of modern techniques and disease-resistant varieties further hinders production. To improve the industry, there is a need for better coordination among stakeholders, improved training for farmers, and government policies that support the sector. Additionally, research and extension services focused on pest control, disease management, and market access are essential to enhance competitiveness in the global market.

Overall, while large cardamom remains a profitable crop for Nepal, there are significant challenges in production, quality, and market access that need to be addressed to boost its international competitiveness.

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