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Production practices, value chain mapping, and constraints of Turmeric (*Curcuma longa* L.) cultivation in Chaudandigadhi municipality, Udayapur district, Nepal

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ABSTRACT

The present study was conducted between November 2025 and April 2026 to assess the socio-economic characteristics, production and post-harvest practices, value chain structure, and major constraints faced by turmeric farmers. Primary data were collected from 33 turmeric-producing households in Besare, Thorke, and Siddhipur through structured questionnaires, field observation, and key informant interviews, using purposive and convenience sampling. Data were analyzed descriptively using frequency, percentage, mean, and standard deviation, while marketing margin and price spread were used to assess value distribution along the chain. Results revealed that 93.9% of respondents were illiterate, 81.8% were male, and 97.0% depended on farming as their primary occupation. All farmers cultivated local turmeric varieties using traditional, input-free production practices on an average of 2.4 katha per household, with a mean dry turmeric yield of 135 kg per katha. Farm-gate prices averaged NPR 295 per kg of dry turmeric in Besare and Thorke and NPR 270 per kg in Siddhipur. Value chain mapping identified a single dominant marketing channel - Farmer → Local Collector → Wholesaler → Retailer → Consumer - in which farmers sold exclusively to local collectors at the farm gate and retained approximately 57% of the final consumer price. None of the respondents were cooperative members or had access to regular extension services, and only four had received government subsidies. Pest and disease incidence, lack of quality seed rhizomes, and high input costs were the leading production constraints, while dependence on middlemen, storage losses, and lack of credit access constrained marketing, post-harvest handling, and finance, respectively. Strengthening farmer cooperatives, improving access to quality seed rhizomes, expanding extension services, and enhancing market linkages are recommended to improve the profitability and sustainability of turmeric farming in the study area.

KEY WORDS: *Turmeric*; *Value Chain Mapping*; *Production Practices*; *Marketing Constraints*; *Nepal*

1. Introduction

Agriculture remains the backbone of the Nepalese economy, underpinning employment, food security, and rural livelihoods despite gradual structural transformation toward non-farm sectors. Among the wide range of crops cultivated under Nepal's diverse agro-climatic conditions, spice crops such as ginger, turmeric, large cardamom, garlic, and chili occupy an important position

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because of their economic, medicinal, and cultural value. Turmeric (*Curcuma longa* L.), a perennial rhizomatous herb of the family Zingiberaceae popularly known as the "Golden Spice", is one of the most economically important spices grown worldwide. Its bioactive compound curcumin, valued for antioxidant, anti-inflammatory, antimicrobial, and anticancer properties, has driven sustained global demand across pharmaceutical, nutraceutical, cosmetic, and food-processing industries.

Globally, India dominates turmeric production and trade, accounting for nearly 80% of world output and 60% of exports, with annual global production estimated at around 1.1 million metric tons (Bishnoi *et al*., 2020; TPCI, 2019). In Nepal, turmeric is cultivated on approximately 9,795 hectares with an annual production of about 99,907 metric tons and an average productivity of 10.2 Mt ha^{-1} (AITC, 2021), mainly in the mid-hill and Terai districts including Ilam, Udayapur, Morang, Salyan, and Palpa. Turmeric cultivation in these districts is dominated by smallholder farmers relying on traditional production systems, locally saved seed rhizomes, and rain-fed or partially irrigated conditions.

Despite its economic importance, the turmeric subsector in Nepal continues to be constrained by low productivity, limited access to improved planting material, weak post-harvest infrastructure, and underdeveloped marketing systems dominated by intermediaries (MoALD, 2019). Farmers typically process turmeric using traditional boiling, sun-drying, and manual grinding methods, and most sell their produce immediately after harvest to local collectors because of urgent cash needs and limited storage capacity. This pattern leaves farmers with weak bargaining power and a disproportionately small share of the final consumer price, while intermediaries capture the larger marketing margins (Pokhrel & Thapa, 2007).

Value chain mapping has emerged as a widely used analytical approach for visualizing the flow of products, information, and value among actors involved in agricultural production and marketing systems, from input supply through production, processing, and marketing to final consumption (Porter, 1985; Kaplinsky & Morris, 2000). Mapping the turmeric value chain helps identify bottlenecks in production, processing, and marketing, and clarifies how value and bargaining power are distributed among farmers, collectors, wholesalers, and retailers (Fonseca *et al*., 2019).

Chaudandigadhi Municipality of Udayapur District, in Koshi Province, eastern Nepal, is recognized as an important turmeric-producing area, with commercial cultivation in pockets such as Besare, Thorke, and Siddhipur dating back several decades. Siddhipur alone reportedly sold turmeric worth approximately NPR 20 million in 2024 (NAMP, 2025), underscoring the crop's commercial significance to local livelihoods. Nevertheless, farmers in the municipality continue to face production constraints such as pest and disease incidence and poor-quality seed rhizomes, post-harvest constraints related to storage and processing, and marketing constraints arising from dependence on local collectors and weak institutional support. Empirical, farm-level information integrating socio-economic profiles, production practices, post-harvest handling, value chain structure, and constraints specific to Chaudandigadhi municipality has so far been lacking.

This study was therefore undertaken to assess the socio-economic characteristics of turmeric

farmers, analyze production and post-harvest practices and yield performance, map the existing marketing channels and value chain structure, and identify the major production, post-harvest, marketing, and financial constraints faced by turmeric farmers in Chaudandigadhi municipality, Udayapur district, Nepal. The findings are expected to provide locally relevant evidence to support farmers, cooperatives, extension agencies, and local government in designing interventions to strengthen turmeric production and marketing systems.

2. Materials and Methods

2.1 Study area

The study was conducted in Chaudandigadhi municipality, Udayapur district, Koshi Province, eastern Nepal. The municipality has a total population of 53,631 and lies in the mid-hill region at an elevation of approximately 500 - 1,200 m above sea level, with a subtropical to warm temperate climate and moderate rainfall favorable for turmeric cultivation. Three major turmeric-producing pockets - Besare, Thorke, and Siddhipur - were purposively selected as the study locations because they represent the principal turmeric production hubs of the municipality. Siddhipur has the longest history of commercial turmeric farming, dating to around 1992, and has developed comparatively stronger market linkages than the other two pockets.

2.2 Research design and sampling

A descriptive research design combined with a mixed-methods approach was adopted to obtain a comprehensive understanding of turmeric production and its value chain. Quantitative methods were used to measure socio-economic characteristics, input use, yields, prices, and marketing margins, while qualitative methods - key informant interviews and direct field observation - provided deeper insight into value chain relationships and institutional arrangements. A purposive and convenience sampling technique was applied because the production areas are scattered and no complete sampling frame existed; farmers were selected based on their involvement in turmeric cultivation, accessibility, and willingness to participate. A total of 33 turmeric-producing households were surveyed, distributed across the three locations in proportion to the relative concentration of turmeric farmers (**Table 1**).

Table 1: Sample distribution by location

Sl. No.	Location	Number of households surveyed
1	Besare	19
2	Thorke	5
3	Siddhipur	9
	Total	33

2.3 Data collection

Primary data were collected from November 2025 to April 2026 using a structured questionnaire administered to all 33 respondents, covering socio-economic characteristics, farm characteristics, production practices, input use, yields, selling prices, marketing channels, institutional support, and constraints. Field observations supplemented the survey to verify real-time farming and post-harvest handling practices. Secondary data were obtained from MoALD annual reports, AITC publications, NAMP reports, Agriculture Knowledge Centre records, and relevant journal articles.

2.4 Data analysis

Data were coded, tabulated, and analyzed using Microsoft Excel and R Studio. Descriptive statistics - frequency, percentage, mean, and standard deviation - were used to summarize socio-economic and production-related variables. Marketing performance was assessed using marketing margin and price spread, calculated as:

Marketing Margin (MM) = Selling Price – Purchase Price

Price Spread = Consumer Price – Producer Price

Production, post-harvest, marketing, and financial constraints were ranked by respondents using a five-point ranking scale in which lower rank values indicated higher severity. Results are presented using descriptive tables, charts, and a value chain map.

2.5 Ethical considerations

Participation in the study was entirely voluntary, and verbal informed consent was obtained from all respondents prior to data collection. Respondents were assured that their responses would remain confidential and anonymous and would be used solely for academic and research purposes. The privacy and opinions of all participants were respected throughout the interviews and discussions.

3. Results and Discussion

3.1 Socio-economic characteristics of respondents

Among the 33 surveyed respondents, a large majority (81.8%) were male, while 18.2% were female (**Table 2**), reflecting the broader socio-cultural pattern in rural Nepal whereby men are identified as farm managers even though women contribute substantially to actual field and post-harvest labor. This pattern is consistent with Paudel *et al.* (2021), who similarly found spice farming in Nepal's mid-hills to be predominantly managed by male household heads.

The age distribution (**Fig. 2**) showed that the majority of respondents (57.6%) were aged 41–50 years, followed by 27.3% in the 31–40 age group and 15.2% above 50 years. The dominance of middle-aged farmers and the low representation of younger age groups point toward youth out-migration and declining interest in farming among younger generations, a trend widely reported across Nepal's hill agriculture.

Table 2: Gender distribution of respondents

Gender	Frequency	Percentage (%)
Male	27	81.8
Female	6	18.2
Total	33	100.0

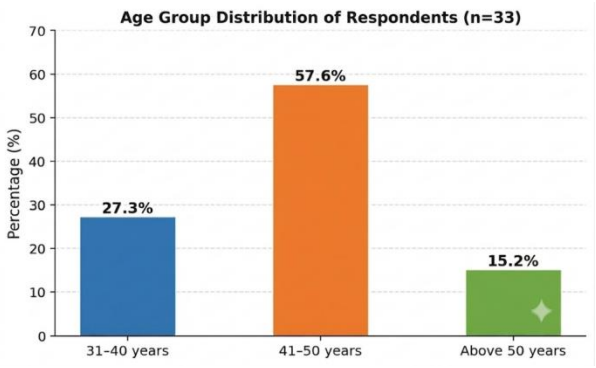

Fig. 2: Age group distribution of respondents (n = 33)

Education levels were extremely low: 93.9% of respondents (31 of 33) were illiterate, with only

one respondent each having completed higher secondary education and a bachelor's degree or above (**Table 3**). This exceptionally high illiteracy rate underscores the socio-economic marginalization of turmeric-growing communities in rural Udayapur and reinforces the conclusion of Paudel *et al*. (2021) that low educational attainment is a fundamental constraint limiting farmers' ability to interpret market signals, adopt improved practices, and engage in formal market channels. It also highlights the need for audio-visual, rather than text-based, extension and training methods in this context.

Table 3: Education level of respondents

Education Level	Frequency	Percentage (%)
Illiterate	31	93.9
Higher Secondary	1	3.0
Bachelor and above	1	3.0
Total	33	100.0

Farming was the main occupation of 97.0% of respondents (32 of 33), with only one respondent engaged in business/trading (**Table 4**). This high dependence on a single agricultural enterprise underscores both the economic importance of turmeric cultivation to household income and the vulnerability of these households to price and yield fluctuations.

Table 4: Main occupation of respondents

Occupation	Frequency	Percentage (%)
Farming	32	97.0
Business/Trading	1	3.0
Total	33	100.0

3.2 Farm characteristics and turmeric cultivation

Landholding under turmeric was generally small: 39.4% of respondents cultivated 1 katha and 27.3% cultivated 2 katha, although two respondents from Siddhipur operated on a larger scale of 15 katha each (**Table 5**). The average area under turmeric cultivation was approximately 2.4 katha per household, and all respondents cultivated their own land, indicating secure land tenure.

Table 5: Farm characteristics and land use under turmeric cultivation

Land Area (katha)	Frequency	Percentage (%)
1 katha	13	39.4
2 katha	9	27.3
3 katha	9	27.3
15 katha	2	6.1
Total	33	100.0

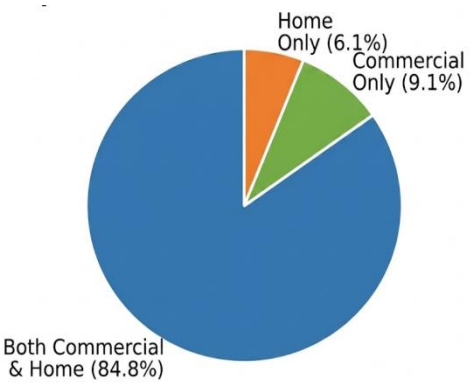

Fig. 3: Purpose of turmeric cultivation (n = 33)

As shown in **Fig. 3**, most respondents (84.8%) cultivated turmeric for both commercial sale and home consumption, while smaller shares cultivated primarily for commercial sale (9.1%) or

Table 6: Variety used and access to quality planting material

Indicator	Response	Frequency	Percentage (%)
Variety used	Local variety	33	100.0
	Improved variety	0	0.0
Main source of planting material	Own farm	29	87.9
	Own farm + Neighbor	4	12.1
Difficulty accessing quality planting material	Yes	4	12.1
	No	29	87.9

home consumption (6.1%). This dual-purpose pattern reflects turmeric's role as both a cash crop and a household dietary and medicinal staple in the study area.

All 33 respondents (100%) cultivated only local turmeric varieties, with none using improved or high-yielding varieties, and the main source of planting material for the large majority (87.9%) was their own farm - *i.e.*, rhizomes saved from the previous harvest (**Table 6**). Only four respondents (12.1%) reported difficulty in accessing quality planting material. The near-universal reliance on saved local seed rhizomes, which can carry disease inoculum and decline in vigor over successive generations, represents an important agronomic constraint consistent with findings that limited access to improved, disease-resistant varieties constrains turmeric productivity in Nepal (MoALD, 2019).

Years of experience in turmeric cultivation varied widely (**Fig. 4**): the largest share of respondents (33.3%) had 21–30 years of experience, followed by 24.2% with 31–40 years. This confirms that turmeric cultivation is a long-established tradition in the study area, while also suggesting limited adoption of new technologies or varieties over the decades.

Seed rhizome quantity used per katha also varied considerably (**Fig. 5**): 39.4% of respondents used 70–90 kg per katha and 36.4% used 91-110 kg per katha, with an average of approximately 97 kg per katha. Because seed rhizomes represent one of the largest single cost items in turmeric production, optimizing the seed rate while maintaining yield is an important economic consideration for farmers in the study area.

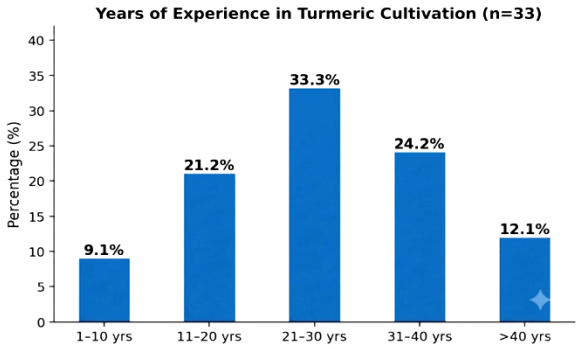

Fig. 4: Years of experience in turmeric cultivation (n = 33).

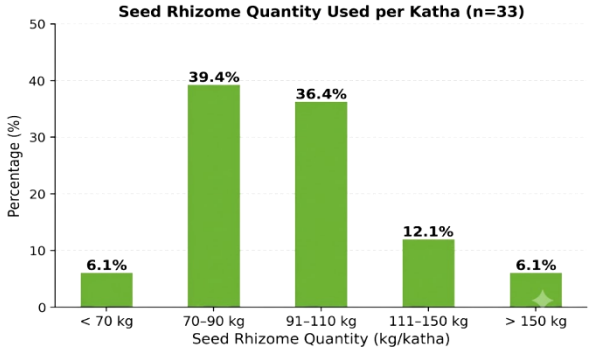

Fig. 5: Seed rhizome quantity used per katha (n=33)

3.3 Production practices and inputs

Production practices were remarkably uniform across all respondents (**Table 7**). All 33 farmers followed traditional land preparation (ploughing), organic/farmyard manure application, irrigation, and weed control, while none used chemical fertilizers or pesticides. All respondents relied solely on self-experience as their source of technical advice, with no respondent reporting access to extension workers, cooperatives, or training programs. This complete absence of chemical inputs, while favorable from an organic-production standpoint, also reflects limited access to inputs and technical knowledge rather than a deliberate organic strategy, consistent with Acharya *et al*. (2021), who reported similar input-use inefficiencies among organic turmeric growers in Surkhet District.

The majority of respondents (78.8%) planted turmeric in Baishak (April–May) and harvested in Mangsir (November–December), the traditional cropping cycle for the mid-hill region, while a smaller proportion planted in Jestha (May–June) and harvested in Poush (December–January) or Mangsir (**Table 8**).

Table 8: Planting and harvesting seasons

Planting Season	Harvesting Season	Frequency	Percentage (%)
Baishak (Apr-May)	Mangsir (Nov-Dec)	26	78.8
Jestha (May-Jun)	Poush (Dec-Jan)	5	15.2
Jestha (May-Jun)	Mangsir (Nov-Dec)	2	6.1
Total		33	100.0

3.4 Post-harvest processing and storage

The majority of respondents (93.9%) processed turmeric through boiling, drying, and grinding into powder, while two respondents (6.1%) from the more commercially advanced Siddhipur area also performed polishing (**Table 9**). All post-harvest processing was carried out manually, with no mechanized equipment used anywhere in the sample. Among the 69.7% of respondents who stored processed turmeric, most (78.3%) stored it in-house, with storage durations ranging from a few days to two months. This finding mirrors the broader pattern reported for Nepal's horticultural and spice value chains, in which the absence of improved drying, grinding, and storage facilities

Table 7: Production practices and inputs

Production Practice / Input	Adoption	Percentage (%)
Land Preparation (ploughing)	All 33 respondents	100.0
Organic/Farmyard Manure Application	All 33 respondents	100.0
Irrigation	All 33 respondents	100.0
Weed Control	All 33 respondents	100.0
Chemical Fertilizer	None	0.0
Pesticide Use	None	0.0
Technical Advice: Self/Experience	All 33 respondents	100.0
Technical Advice: Extension Worker	None	0.0

Table 9: Post-harvest processing methods and storage

Indicator	Category	Frequency	Percentage (%)
Processing Method	Boiling + Drying + Grinding	31	93.9
	Boiling + Drying + Grinding + Polishing	2	6.1
Store After Processing	Yes	23	69.7
	No	10	30.3
Storage Method (those who store)	In-House	18	78.3
	Bags on Floor	3	13.0
	Separate Room	2	8.7

limits both product quality and shelf life (G.C., 2021).

3.5 Yield and price analysis

Dry turmeric yield per katha varied considerably across respondents (**Table 10**) just over half (51.5%) obtained 100–150 kg per katha, while 21.2% obtained less than 100 kg per katha. The overall mean dry turmeric yield was approximately 135 kg per katha, with variability attributable to differences in soil fertility, water availability, seed rhizome quality, and management practices.

Fresh turmeric yield per katha likewise varied by location (**Table 11**) the mean fresh yield was approximately 4.2 quintals per katha in Besare and 3.8 quintals per katha in Thorke, compared with a slightly lower 3.3 quintals per katha in Siddhipur, with an overall average of 4.0 quintals per katha.

Farm-gate prices also varied by location and product form (**Fig. 6**). Respondents in Besare and Thorke received NPR 45 per kg for fresh turmeric and NPR 295 per kg for dry turmeric, while those in Siddhipur received comparatively lower prices of NPR 25-35 per kg for fresh turmeric and NPR 270 per kg for dry turmeric. In all cases, prices were determined entirely by buyers (collectors), reflecting the weak bargaining position of producers - a pattern consistent with Pokhrel and Thapa (2007), who found that limited market information and weak social bargaining power leave Nepalese smallholders vulnerable to buyer-determined pricing. Respondents' perceptions of profitability were mixed: 39.4% considered turmeric farming profitable, 51.5% did not, and 9.1% were unsure. This relatively pessimistic perception among the majority is consistent with the combination of high seed rhizome costs, substantial labor requirements, and farm-gate prices that remain low relative to production costs.

Table 10: Dry turmeric yield per katha

Dry Yield Category (kg/katha)	Frequency	Percentage (%)
Less than 100 kg	7	21.2
100–150 kg	17	51.5
151–200 kg	3	9.1
More than 200 kg	6	18.2
Total	33	100.0

Table 11: Fresh turmeric yield per katha by location

Location	Average Fresh Yield (quintal/katha)	Range (quintal/katha)
Besare	4.2	3.5 – 5.5
Thorke	3.8	3.0 – 5.0
Siddhipur	3.3	3.0 – 3.5
Overall Average	4.0	3.0 – 5.5

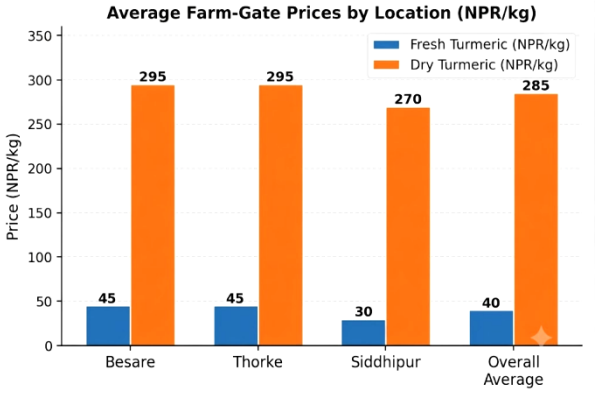

Fig. 6: Average farm-gate prices by location (NPR/kg)

3.6 Value chain mapping

The turmeric value chain in Chaudandigadhi Municipality was found to be structurally simple and highly concentrated. All 33 surveyed farmers sold their produce exclusively to local collectors at the farm gate; none sold directly to wholesalers, retailers, or consumers. The dominant flow of the chain is Input Suppliers → Farmers → Local Collectors → Wholesalers → Retailers → Consumers (**Fig. 7**). This single-channel structure, in which farmers occupy the weakest position, mirrors the governance pattern described by Kaplinsky and Morris (2000), in which power asymmetry and dependence between actors at different stages of the chain limit producers' ability to upgrade their position.

Fig. 7: Turmeric value chain map in Chaudandigadhi municipality

All respondents (100%) used the farm gate as their selling location and head load as their transport mode, with price determination entirely in the hands of buyers (collectors) (**Table 12**). Market price information was obtained by 93.9% of respondents through traders themselves, indicating complete dependence on buyer-provided information rather than any independent market intelligence - a pattern that, as Pokhrel and Thapa (2007) note, structurally favors intermediaries over producers.

Table 12: Marketing channel and buyer type

Indicator	Response	Frequency	Percentage (%)
Main Buyer	Local Collector	33	100.0
Selling Location	Farm Gate	33	100.0
Transport Mode	Head Load	33	100.0
Price Determination	By Buyer (Collector)	33	100.0
Market Info Source	Traders	31	93.9
	None	2	6.1

Marketing margin and price spread analysis (**Table 13**) showed that farmers received approximately NPR 285 per kg for dry turmeric, while local collectors captured a margin of about NPR 65 per kg (selling at ≈NPR 350), wholesalers about NPR 70 per kg (selling at ≈NPR 420), and retailers NPR 80 or more per kg at a final retail price of NPR 500 or above. Overall, farmers retained only about 57% of the final consumer price, with the remaining 43% distributed among collectors, wholesalers, and retailers. This finding is consistent with Rajbanshi *et al.* (2023), who reported that turmeric farmers in Surkhet District similarly received less than half of the final consumer price, underscoring the systemic nature of value capture by intermediaries in Nepal's turmeric subsector.

Table 13: Marketing margin and price spread for dry turmeric

Market Level	Price (NPR/kg)	Marketing Margin (NPR/kg)	Share (%)
Farm Gate (Farmer)	~285	–	57.0
Local Collector	~350	~65	13.0
Wholesaler	~420	~70	14.0
Retailer/Consumer	~500+	~80+	16.0+
Total Price Spread	~215+	–	100.0

Note: Prices are based on field survey data (2025-2026). Collector and wholesale prices were estimated from key informant interviews.

3.7 Institutional support and services

Institutional support in the study area was found to be critically weak (**Table 14**). None of the 33 respondents was a member of any farmer group or cooperative, and none had received any training on turmeric cultivation. Extension worker visits were reported as 'never' by 78.8% of respondents and 'rarely' by the remaining 21.2%, indicating a near-total absence of formal extension contact. Only four respondents (12.1%) had received any form of government subsidy. These findings closely parallel Timsina *et al*. (2011), who found no formal institutions involved in turmeric promotion in their study area in eastern Nepal, and reinforce the view that weak institutional support - limited credit, training, and extension contact - leaves individual farmers to bear production and marketing constraints alone.

3.8 Constraints in the turmeric value chain

Production constraints, ranked by all 33 respondents using a five-point scale, identified pests and diseases as the most critical constraint (Rank 1), followed by lack of quality seed rhizomes (Rank 2), high input costs (Rank 3), labor and facility shortage (Rank 4), and irrigation problems (Rank 5) (**Fig. 8**). The high ranking of pest and disease pressure, particularly rhizome rot caused by *Pythium* spp., reflects substantial yield

Table 14: Institutional support and extension services

Indicator	Response	Frequency	Percentage (%)
Member of Cooperative	No	33	100.0
Received Training on Turmeric	No	33	100.0
Extension Worker Visits	Never	26	78.8
	Rarely	7	21.2
Received Government Subsidy	Yes	4	12.1
	No	29	87.9

losses in the absence of any disease management technology or extension support.

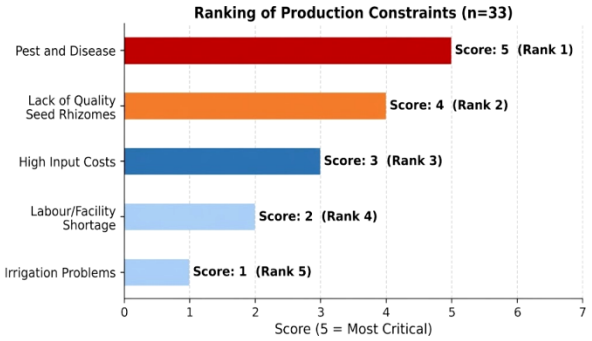

Fig. 8: Ranking of production constraints (n = 33)

Among post-harvest constraints (**Fig. 9**), storage losses were ranked most critical (Rank 1), followed by lack of processing equipment (Rank 2) and poor drying facilities (Rank 3). Storage losses in turmeric are predominantly caused by fungal infection, moisture, and pest damage, while the complete absence of processing equipment means that all operations are performed manually, producing inconsistent product quality.

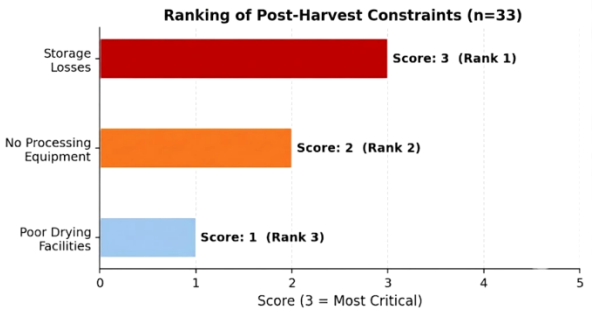

Fig. 9: Ranking of post-harvest constraints (n = 33)

Marketing constraints (**Fig. 10**) were dominated by dependence on middlemen/local collectors (Rank 1), followed by the low price received at the farm gate (Rank 2) and poor roads and transportation (Rank 3). The fact that all 33 respondents sold exclusively to local collectors, with prices fully controlled by buyers, confirms middleman dependence as a structural rather than incidental constraint in this value chain.

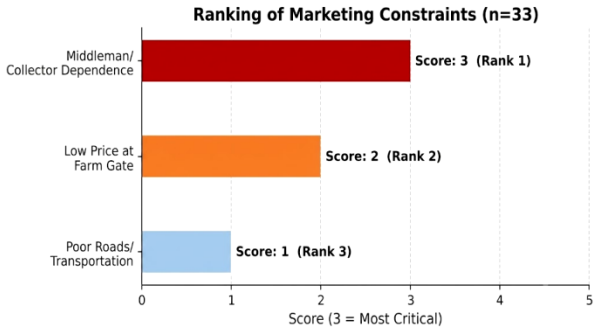

Fig. 10: Ranking of marketing constraints (n = 33)

Financial constraints (**Fig. 11**) were led by lack of credit access (Rank 1), followed by high interest rates (Rank 2). With no respondent belonging to a cooperative, farmers have no access to cooperative credit facilities, which limits investment in quality seed rhizomes, improved inputs, processing equipment, and storage infrastructure - reinforcing a cycle of low investment, low productivity, and low income.

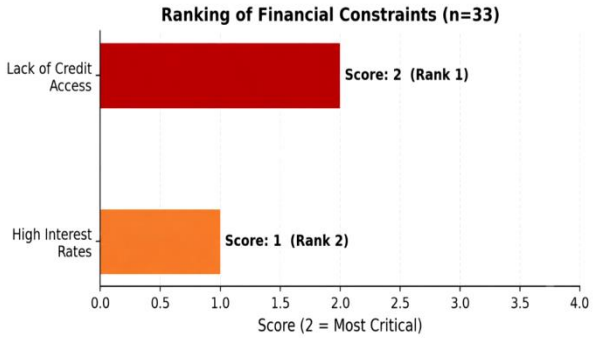

Fig. 11: Ranking of financial constraints (n = 33)

4. Conclusion

Taken together, these findings show that turmeric farming in Chaudandigadhi municipality remains a traditional, experience-based enterprise constrained simultaneously at the production, post-harvest, marketing, and institutional levels. The extremely high illiteracy rate (93.9%) and the complete absence of cooperative membership and formal extension contact reflect a deep institutional isolation of the farming community, while the uniformity of marketing behavior - 100% collector sales at the farm gate, head-load transport, and buyer-controlled pricing - indicates that the constraints identified are structural rather than individual, requiring coordinated, multi-dimensional interventions rather than farmer-level fixes alone. Strengthening farmer cooperatives, improving access to quality and disease-resistant seed rhizomes, expanding audio-visual extension and training services suited to a largely illiterate farming population, facilitating institutional credit, and investing in community-level post-harvest infrastructure and direct market linkages would together help turmeric farmers in Chaudandigadhi municipality capture a larger and more equitable share of the value they help create.

5. Conflict of interest

The authors declare that they have no conflict of interest.

6. Acknowledgment

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