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EXPLAINER

Strengthening mango value chains in Nepal's Madhesh Province

Why is it important; what are the drivers and constraints; how is ICIMOD's HI-GRID project addressing the adverse issues?

Background

Lying in the southernmost part of Nepal, the lowlands of the Terai Region form the hub of mango production in the country. Accounting for nearly 46% percent of total summer fruit production and almost 56% of the productive area (i.e., the area covered by plants bearing fruits) under summer crops, mango is a significant summer crop for Nepalese agriculture (Regmi 2020)[1], and in tandem, for the income and livelihood of the farmers of the Terai region, in particular.

Agroclimatic conditions of the region – including its topology, fertile soil, summer temperatures normally ranging from 25°C–35°C and usual annual precipitation level from 890–1015 millimetres (mm) – provide optimal flowering and fruiting conditions for mango trees (Normand et.al 2015[2]; MoALD 2020[3]). This is to such an extent that the region evidences three periods of twig growth of mango plants in a year: February–March, April–May, and June–July and concomitant varietal diversity (depending on varied maturing periods) between April–July, which is the only season of mango harvest/production in Nepal.

Mangoes of this region are known for their rich sweetness and juiciness, making them sought after, both in domestic and international markets. With mango production in Nepal being on the rise over the past quinquennial or so – production, yield, overall area, and productive area having increased at compounded annual growth rates (CAGR) of 6%, 5%, 1.11% and 0.77% respectively, from 2018/19–2023/24 (see Table 1 for details) – most of the domestic supply of fresh mangoes (circa > 90%) is met through domestic production (Figure 1).

Although the volume of both exports and imports remain low – exports were less than 1% of the total volume of production vis-à-vis imports, which were at around 4% of the total domestic supply in 2022/23 – the total value of exports is estimated to be 549 times higher than that of imports (ICIMOD 2025), implying an opportunity for expanding export income by boosting local production capacity.

46%

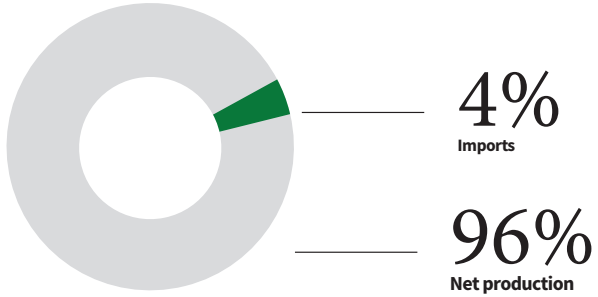
percent of total summer fruit production

The total value of exports is estimated to be

549

times higher than that of imports (ICIMOD 2025),

FIGURE 1: SHARE OF NET DOMESTIC PRODUCTION* AND IMPORTS IN TOTAL DOMESTIC SUPPLY OF MANGOES IN 2022/23



Note: *Net domestic production = Total domestic production – Exports

[1]Regmi, S. (2020) An Analysis of Agriculture Production Scenario in Nepal. International Journal of Graduate Research and Review6(3): 84-89.

[2]Normand, F., Lauri, P.E. and J.M. Legave (2015). Climate change and its probable effects on mango production and cultivation. Acta Horti. 1075, 21-31.

[3]MOALD (2020) Statistical Information in Nepalese Agriculture 2075/76. Ministry of Agriculture and Livestock Development, 290. https://nepalindata.com/resource/statistical-information-nepalese-agriculture-207374-201617/

Besides its economic potential, mango in the Terai region is also finding traction with development and policy practitioners as a climate resilient crop, especially in the context of the escalating climate extremes in the region.

A mango plant's long tap root system can reach a depth of nearly 20 feet for accessing water during dry spells and its trunk surface can develop hypertrophied lenticels or enlarged pores that enable the plant to breath in waterlogged conditions, making the plant resilient to both drought and flood conditions. While extreme climate events may affect the flowering potential of a mango plant, the plant in general is less susceptible to climate-induced damages given its unique adaptations.

Recognising the economic and ecological potential of the mango crop for the Terai region, the International Centre for Integrated Mountain Development's (ICIMOD) 'Building capabilities for green, climate-resilient and inclusive development' or HI-GRID project, is working towards strengthening / facilitating the mango value chain in the Terai region, among its other efforts for promoting "green, climate-resilient, and inclusive development" (GRID) in the lower Koshi river basin (LKRB) spanning across the Terai, mid-hill, and high-hill districts of eastern Nepal.

While the overarching mandate of the project is to mitigate the growing threat of 'too much and too little' (TMTL) water – floods versus droughts and water management – in LKRB through capacity building and innovative solutions for increasing climate resilience, one of its specific interventions is to develop and strengthen GRID-based agricultural value chains for unlocking and enhancing sustainable livelihood opportunities for local farmers.

Significance of Madhesh in Nepal's mango sector

Production and area under mango cultivation in Nepal are geographically concentrated in the Madhesh Province of the Terai region, with the province accounting for approximately 76% of the average annual national production, 69% of the total productive area, and 65% of the overall area under mango in the country, on average, from 2018/19 to 2023/24.

Area (including productive area, which has been around 87% of the overall area under mango in the province between 2018/19 and 2023/24), production, and yield of mango in the province, all increased at CAGRs of 1.39%, 7.37% and 6.5% respectively – all higher than the national CAGRs from 2018/19–2023/24. The average yield of mango in Madhesh, over this period, is estimated to be higher than the national average – 12.11 Mt/Ha versus 11 Mt/Ha, respectively. (See Table 1 for details)

THE PROVINCE ACCOUNTING FOR

Approx
76%
of the average annual national production

Approx
69%
of the total productive area

Approx
65%
of the overall area under mango in the country

TABLE 1: AREA, PRODUCTION AND YIELD OF MANGO IN NEPAL AND MADHESH PROVINCE FROM 2018/19 TO 2023/24

	Nepal				Madhesh			
	Area (Ha)	Productive Area (Ha)	Production (Mt)	Yield (Mt/Ha)	Area (Ha)	Productive Area (Ha)	Production (Mt)	Yield (Mt/Ha)
2018/19	49588	42461	366144	8.62	32025	29138	258509	8.87
2019/20	51163	42196	453416	10.75	33648	30089	344140	11.44
2020/21	51681	43688	466266	10.67	33392	30231	357150	11.81
2021/22	53458	40570	498859	12.3	35552	27653	386659	13.98
2022/23	52449	42773	513055	11.99	34116	29099	395794	13.6
2023/24	52975	44449	517552	11.64	34798	30600	395962	12.94
Average*	**51886**	**42690 (82%)**	**469215**	**11.00**	**33922**	**29468 (87%)**	**356369**	**12.11**
CAGR (%) **	1.11	0.77	5.94	5.13	1.39	0.82	7.37	6.50

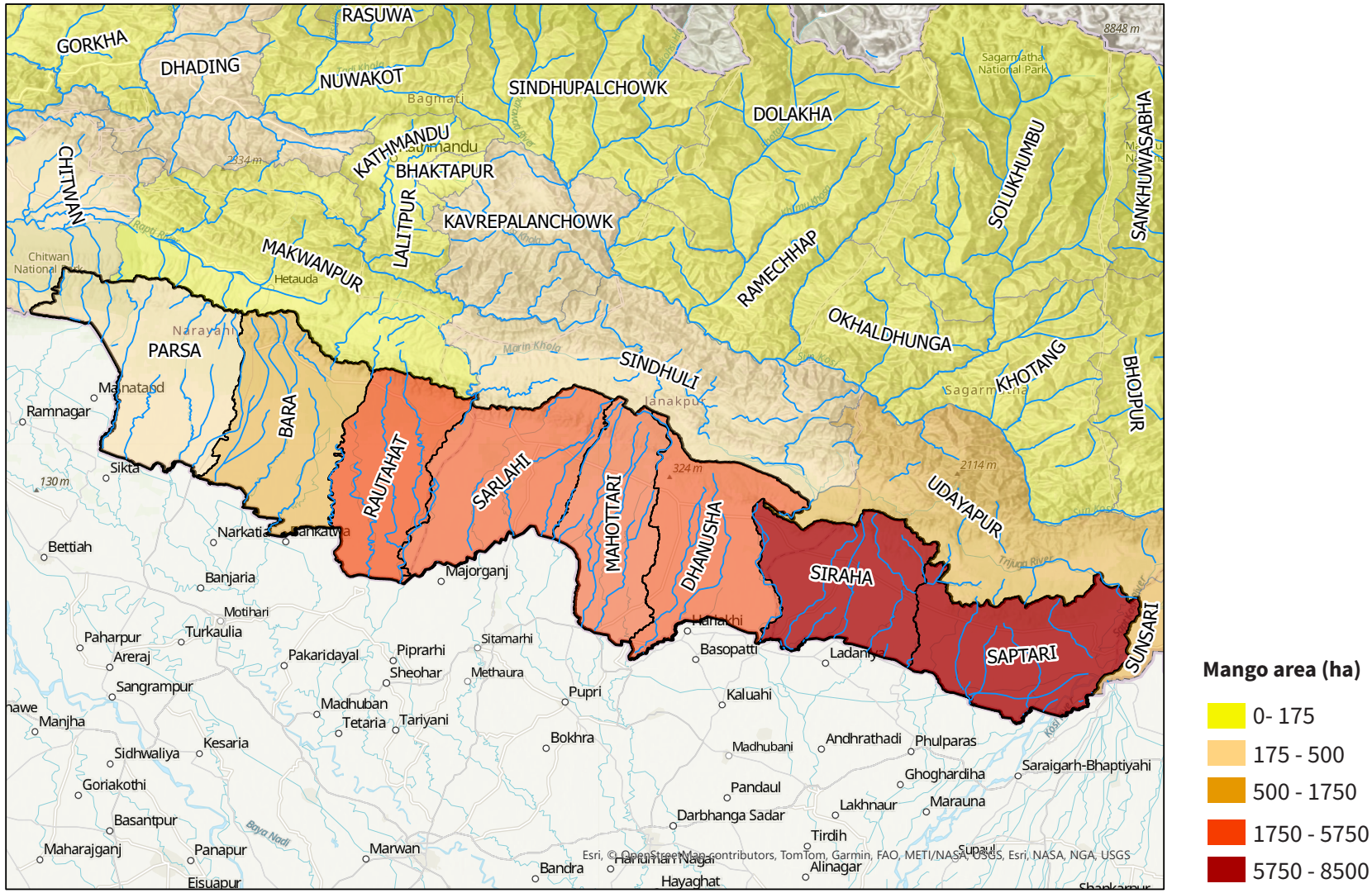
*Figures in the parentheses show the average share of productive area in overall area under mango

** CAGR is a metric (in percentage) for estimating the growth rate of a parameter over a certain period. It is calculated using the formula: ((End Value/ Beginning Value) ^(1/t))-1) x100, where t stands for the length of the period.

Source of annual data: Various issues of Statistical Information on Nepalese Agriculture, Planning and Development Cooperation Coordination Division, Ministry of Agriculture and Livestock Development, Government of Nepal.

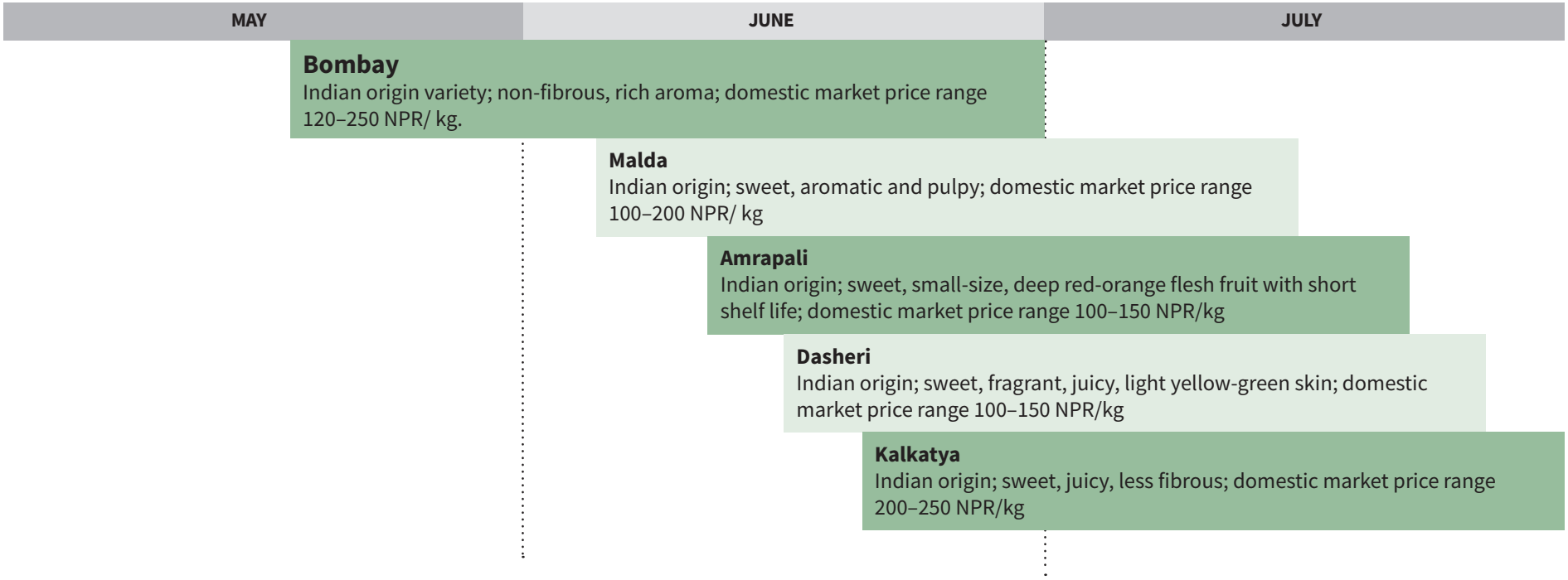
The two districts of Saptari and Siraha, with the highest concentration of mango cultivation area in the province (see Figure 2), together accounted for almost 50%–54% of the total mango produced in Madhesh between 2018/19 and 2023/24; while the remaining share came from the province's other six districts – Rautahat, Barsa, Parsa, Dhanusha, Mahottari and Sarlahi.

FIGURE 2: MANGO PRODUCTION IN MADHESH PROVINCE, TERAI, NEPAL (IN HECTARES, HA)



Market supply, on the other hand, is concentrated during the peak harvest months. ICIMOD's rapid survey of the mango sector in Saptari, one of the two major mango producing districts in Madhesh, revealed that the end of May to July is the peak harvest season of mangoes in the district, with 60% of the five major varieties of the district being harvested through the month of June till early-mid July (Figure 3).

FIGURE 3: MANGO HARVEST CALENDAR OF MADHESH PROVINCE

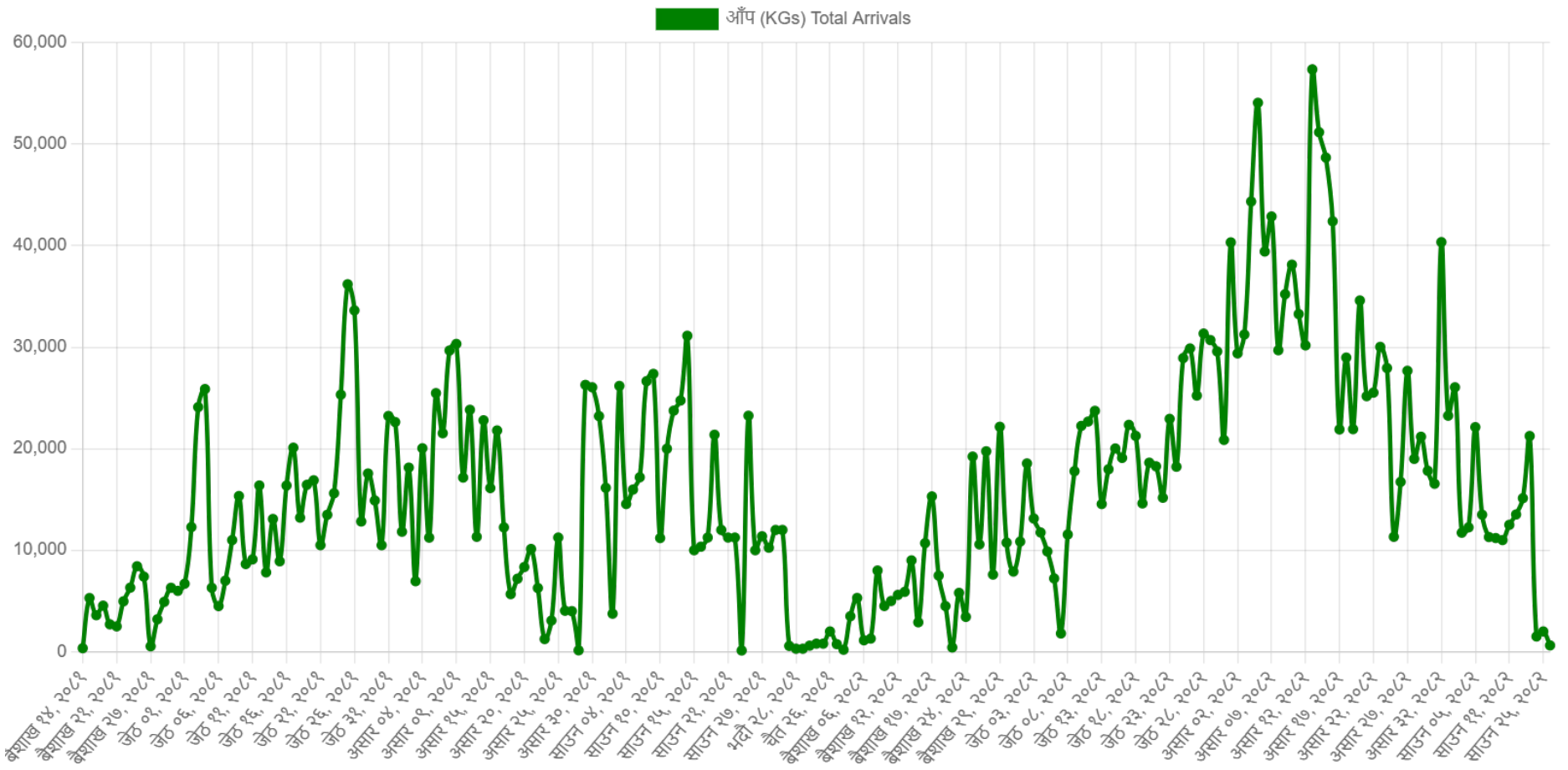


Source: District Agriculture Development Office (DADO) (2016) and ICIMOD's Project Rapid Survey (2024)

Supply management and price variability

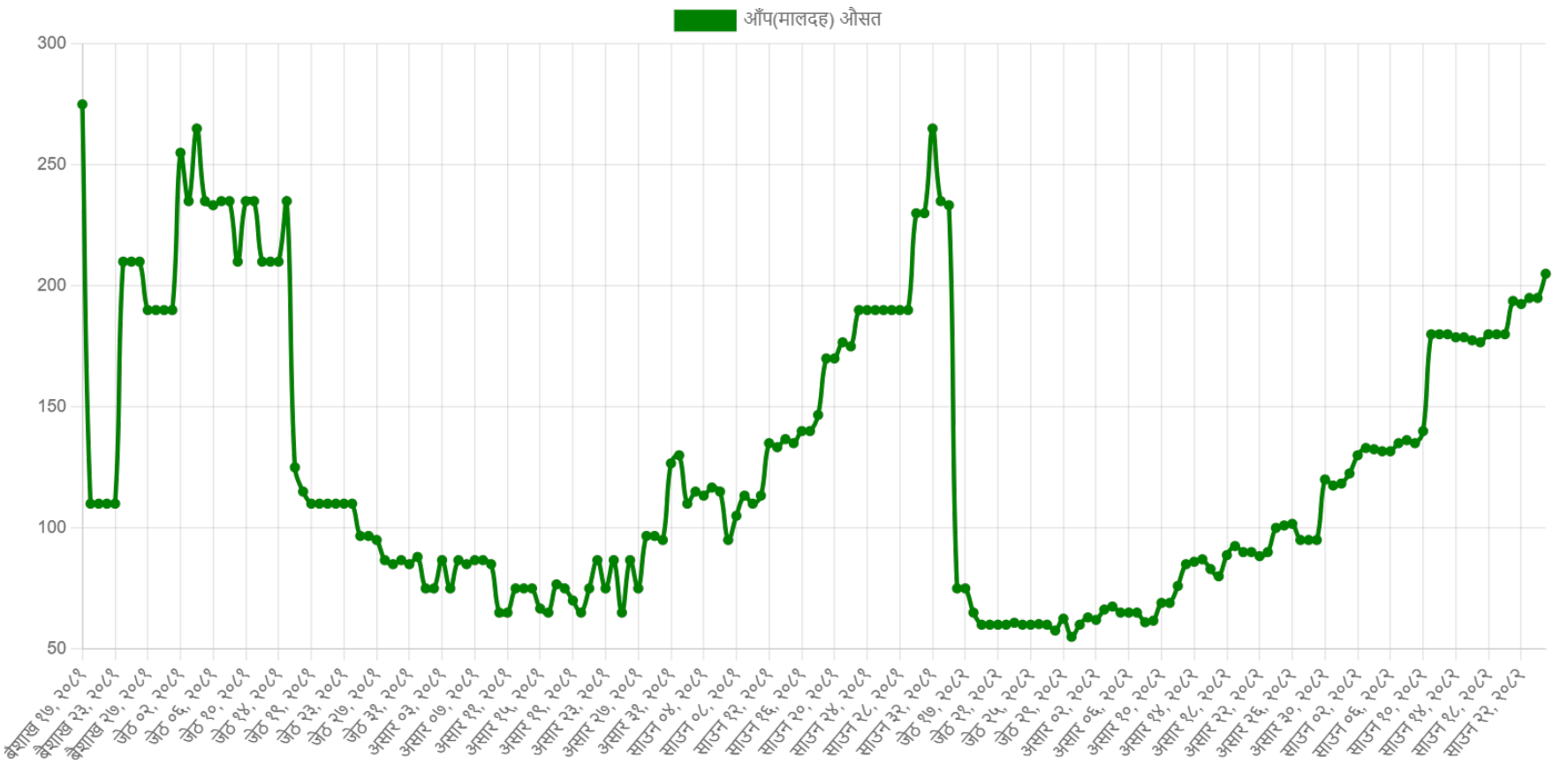
In tandem, seasonal market arrival data (April 2024–July 2025) from the Nepal Government's Kalimati Fruit and Vegetable Market Development Committee in Kathmandu, show a surge in the market supply of mangoes, particularly between June and July (Panel A, Figure 4). Consequently, (wholesale) market prices – for instance, of the two major varieties, Malda and Dasheri – show a downward trend during this period (Panels B and C of Figure 4)

FIGURE 4: SEASONAL MONTHLY WHOLESALE MARKET ARRIVAL AND PRICES OF MANGO IN KATHMANDU FROM APRIL 2024 TO JULY 2025



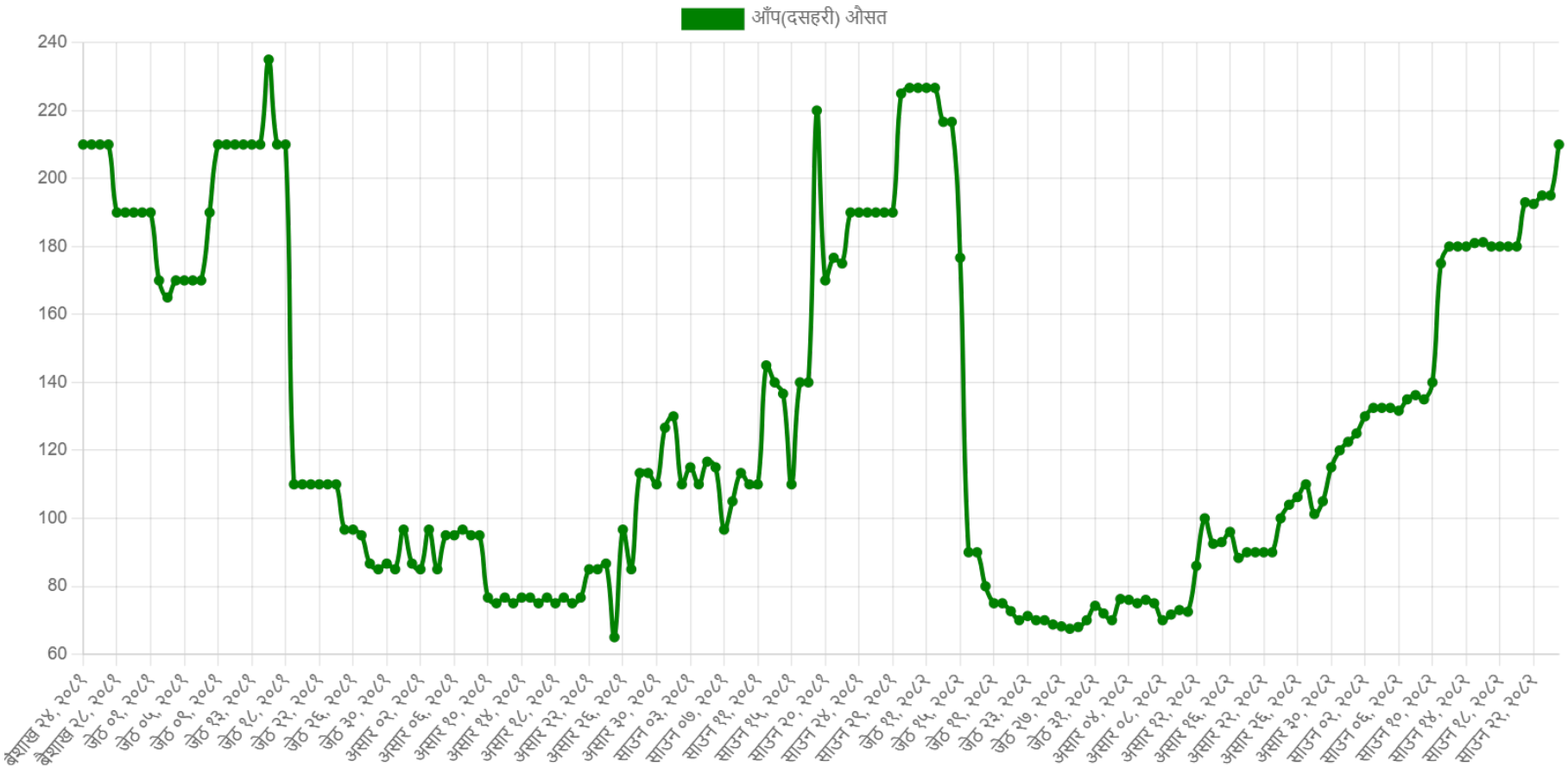
Panel A: Wholesale market arrival of mangoes at the Kalimati market in Kathmandu from April 2024–July 2025

Source: Kalimati Fruit and Vegetable Market Development Committee (2025)



Panel B: Wholesale price of Malda variety mangoes at the Kalimati market in Kathmandu from April 2024–July 2025

Source: Kalimati Fruit and Vegetable Market Development Committee (2025)

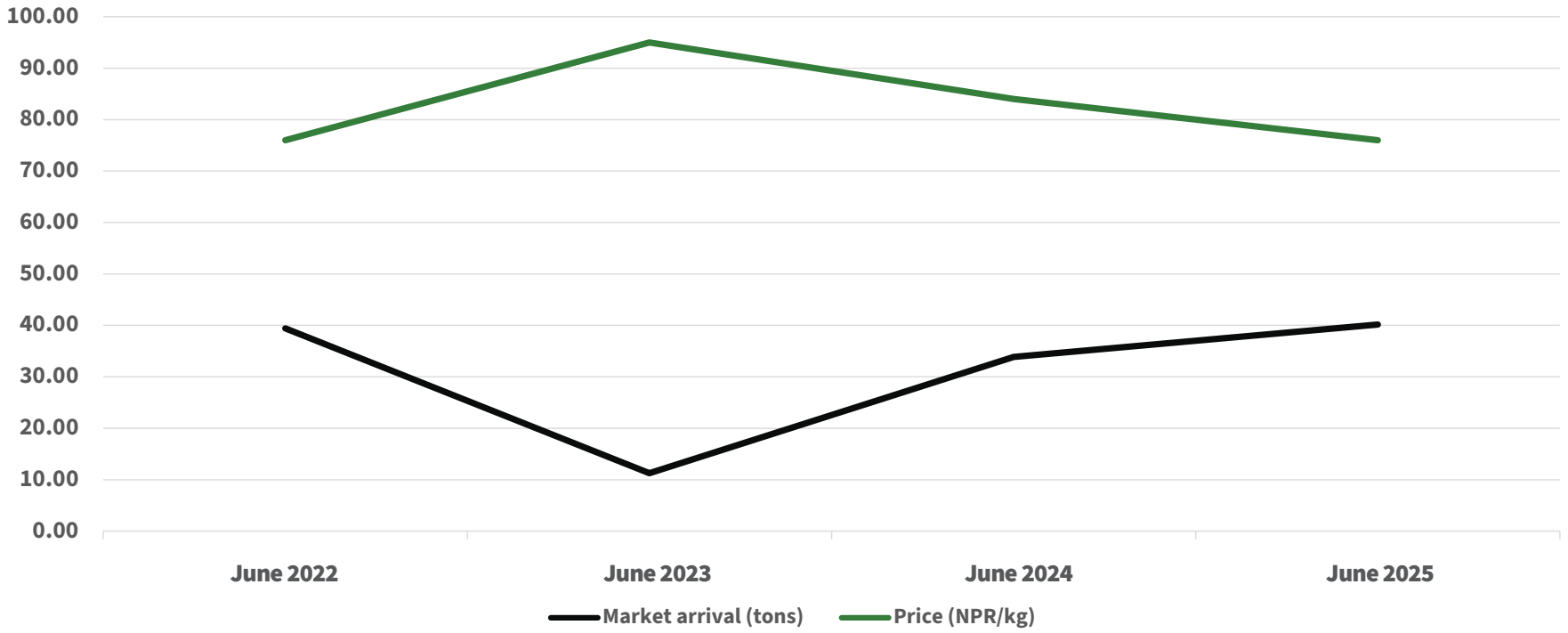


Panel C: Wholesale price of Dasheri variety mangoes at the Kalimati market in Kathmandu from April 2024–July 2025 |Source: https://kalimatimarket.gov.np

Source: Kalimati Fruit and Vegetable Market Development Committee (2025)

Supply shocks also contribute to annual price variability of mangoes, with years of supply abundance evidencing a market glut and fall in wholesale prices vis-à-vis the years of low supply when prices rise (Figure 5).

FIGURE 5: ANNUAL VARIATION IN MARKET SUPPLY AND PRICES OF MANGOES IN THE KALIMATI WHOLESALE MARKET BETWEEN 2022 AND 2025



Data source: https://kalimatimarket.gov.np

How does price variability affect mango farmers?

Farmers in South Asia, in general, receive a low share of the final prices of fresh fruits and vegetables due to the high cost of cultivation, shorter shelf life of produce and inefficient / fragmented value chains of agricultural commodities with multiple layers of intermediaries managing the logistics (transportation, storage), marketing and distribution (grading, sorting, branding, and sales) of the produce. This, in effect, drives up the farmers' costs on account of fees/ commissions to intermediaries for accessing the marketing facilities and services, and reduces their share in the final prices of their produce.

A study of the mango value chain in the Saptari district of Madhesh conducted by Shrestha et.al (2020)[4] found that farmers' share in the final retail price of mangoes varies between 31%–45% vis-à-vis that of the retail market margins between 54%–69%, implying that the higher market power of the intermediaries vis-à-vis the farmers can hamper the speed and magnitude of farm price adjustments (asymmetric price transmission) during seasonal and/or annual price fluctuations due to supply shocks. Given the high per-hectare initial investments for mango cultivation and the gestation lag in the returns from mango farming, price uncertainty and asymmetric price transformation are major deterrents to farm income of mango farmers.

How are mango farmers in the Terai tackling the income risk?

HI-GRID's rapid assessment survey conducted in 2023 found that over 60% of farmers in the Terai Region prefers to advance sell their harvest to local traders/contractors at a pre-determined price negotiated by both parties during the flowering season itself. While this arrangement can protect farmers from a price crash due to market gluts, they may lose the opportunity to earn more if the prevailing market prices are higher than the pre-negotiated price.

In addition, some attempts towards processing fresh mangoes (Table 2), help in boosting/diversifying farm income streams through value addition to the fresh produce, reducing wastage.

TABLE 2: VALUE ADDITION TO RAW/FRESH MANGOES THROUGH PROCESSING

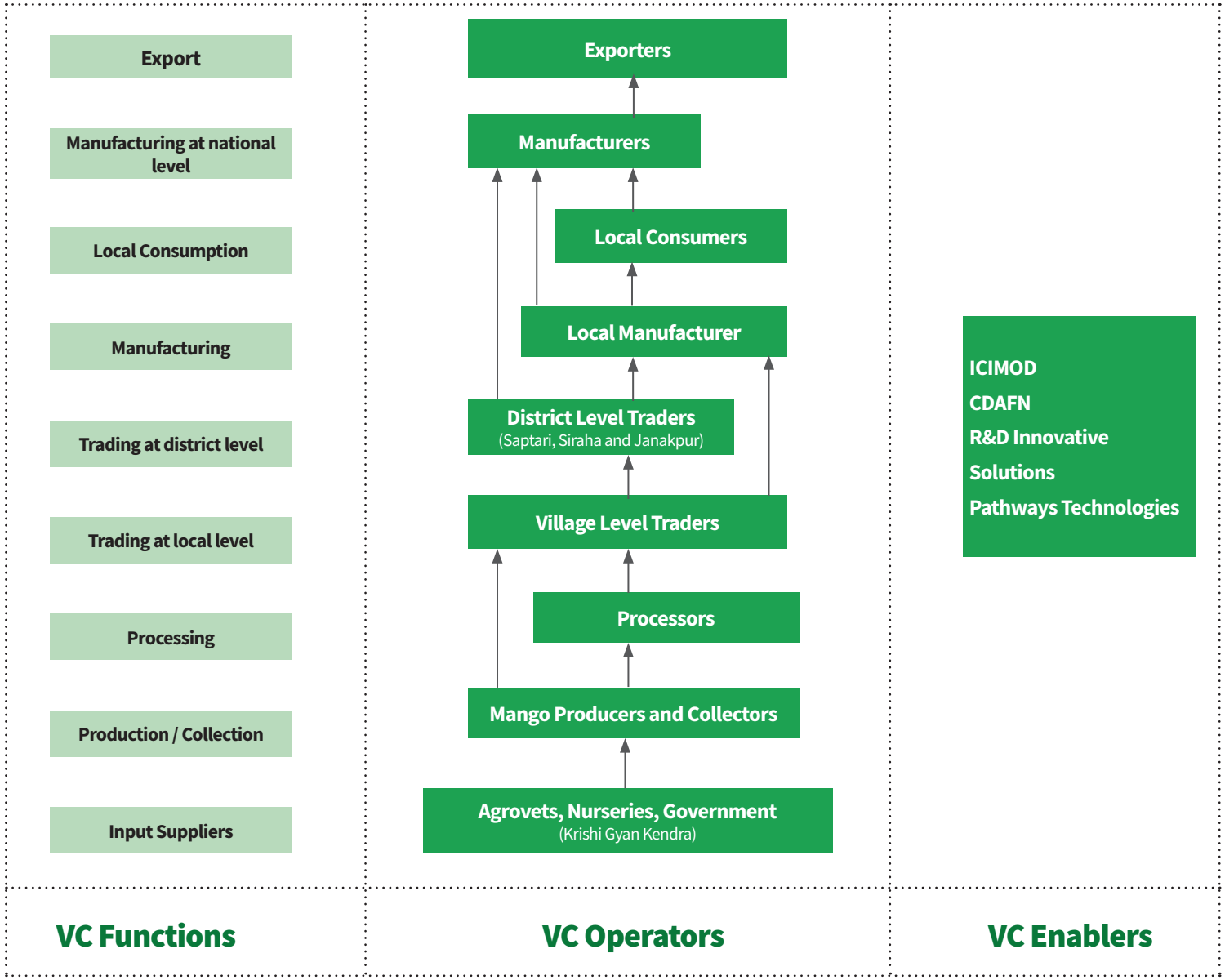
Product	Time taken to make the product	Quantity of fresh mangoes required	Cost (in NPR)
Pickle	20–25 days	3 medium-sized raw mangoes (~750g) yield a 250ml jar	250–300/ per 250ml jar
Aamchoor (mango powder)	5–7 days	25% conversion rate (e.g. 100kg mango yields 25kg powder)	50–80 per 100 gm
Aamot	5–10 days	2–4 medium-sized mangoes yield 100g sheets or pieces.	15–150 / per 100 gm

Source: ICIMOD's Project Rapid Survey (2024)

[4]Shrestha, S., Joshi, N.R., and S. Pandey (2021). Value Chain Analysis of Mango (Mangifera Indica L.) In Saptari District, Nepal. Malaysian E Commerce Journal, 4(1): 07-19.

Mango value chain mapping and SWOT analysis of the value chain in Madhesh Province

FIGURE 6: MANGO VALUE CHAIN IN NEPAL



Source: Authors (2025)

Key actors and processes in Nepal's mango value chain

Producers

CULTIVATION (FROM SAPLING TO HARVEST)

- Farmers source inputs including saplings, fertilisers, and pesticides from government-run agriculture extension centres or the Krishi Gyan Kendra (local private agro-vets and /or nurseries). The farmers usually pay upfront for these inputs, although price subsidies on inputs are sometimes available through government schemes.
- Farmers use a mix of traditional/conventional knowledge and know-how of modern techniques obtained through government or private-sector extension training programmes in mango cultivation.
- Harvesting is done broadly in two ways: either by the farmers themselves through hired labours, or by contractors who make purchase agreements directly with individual farmers, farmer cooperatives, or via intermediaries/collectors, at the beginning of the cropping season.

POST-HARVEST SUPPLY MANAGEMENT: MARKETING AND PROCESSING

- Farmers either sell their harvest / produce to intermediaries ranging from village level collectors to wholesalers in the agri-commodity markets or retailers such as local shopkeepers, small-scale fruit vendors in local markets (*hat bazar*) or through contact farmers who have buy back / advance-sale agreements with the farmers and supply to the traders or processors.
- In the absence of storage facilities and thus given the short post-harvest life of the fresh produce, selling through intermediaries is the most common practice. Dearth of post-harvest facilities such as cleaning, refrigerated warehousing (cold storage) and proper transportation facilities can lead to around 20%-30% loss of produce in the post-harvest stage.
- Some producers process the fruit into value-added products like aamot (mango pulp products), pickles, and amchoor/ amchur (mango powder).

INTERMEDIARIES

- The main intermediaries are village-level collectors, wholesalers, and retailers. They play a vital role in the movement of mangoes from the producer to the consumer and are the most common buyers at collection centres.
- The village-level collectors purchase mangoes directly from the farmers and then sell them to the wholesalers; the wholesalers purchase in turn to sell to the retailers and other buyers, including the processors; and the retailers sell to the end consumers in local markets, which could be different/distant from the production locations.

TRADERS

- Road-head traders connect village producers with the markets.
- District-level traders sell to other districts across Nepal, and also to states in India, especially Bihar.
- Some wholesalers in Nepal engage in informal contract farming arrangements, primarily by providing advance payments to mango producers – a widespread practice across the sector. According to the 2023 survey, most farmers reported that contractors typically assess the mango flowering stage to estimate potential yields, rather than waiting for the actual harvest. Based on these informal assessments, contractors offer advance payments ranging from 30% to 50% of the expected value per tree. These arrangements are generally based on verbal agreements and lack standardised pricing or formal contracts, which can lead to uncertainty and imbalance in negotiating power for smallholder farmers.

PROCESSORS

- The number of mango processors in Nepal remains limited, with most falling under the category of small and medium enterprises (SMEs) or micro, small, and medium enterprises (MSMEs). Engagement in value addition is still at a nascent stage. While some producers possess traditional knowledge, such as preparing aamot, these practices have not been commercialised or scaled up. Moreover, the absence of comprehensive data on processing enterprises highlights the need for targeted support and formalisation to unlock the sector's value-adding potential.
- The value-added products they process include aamot, pulp, mango bars, dried mangoes, and pickles.

RETAILERS

- End traders such as local fruit vendors, grocery shops, roadside stall operators, and urban retail outlets, deal directly with consumers. Retailers often hold significant market power as they influence final pricing for the fruit.

CONSUMERS

- Consumers purchase mangoes and mango-based products directly from farmers, retailers, roadside vendors, and local processors. In the Terai region, roadside markets along major highways attract travellers who buy both raw and ripe mangoes. Processed products like aamot and dried mango slices are sold by local processors or farmers. Mangoes from Saptari are particularly favoured by consumers for their natural sweetness and distinct flavour, giving them a strong local brand identity.

ENABLERS

- Providers of support services to all value chain actors, including capacity building, facilitating access to markets and finance.
- Providers of legal frameworks or enabling policy mechanisms i.e. local and national government.
- Providers of information services such as market information related to price trends, nearest market locations, buyer linkages, and weather forecasts, play a crucial role in enabling farmers to make informed production and marketing decisions. These services are often delivered through digital platforms, local FM radio, extension agents, and community-based networks like Krishidoots ('agriculture ambassadors').

A SWOT ANALYSIS OF THE MANGO VALUE CHAIN IN MADHESH PROVINCE, NEPAL

STRENGTHS	WEAKNESSES
• High quality – flavourful, juicy and pulpy • High demand in local, national, and international markets • Long-term revenue potential for exports • Well suited for value addition through product diversification and processing • Shade-tolerant crops can be intercropped with mangoes – opportunities for augmenting farm income through crop diversification	• Lack of labour for harvesting • Deficiency of fertilisers and poor pest/disease management • Lack of coordination among traders • Farmers' lack of access to information about the market and its processes • Lack of access to cold storage and post-harvest technology • Long gestation period of five to six years before fruiting
OPPORTUNITIES	**THREATS**
• Opportunities for value addition – by processing mangoes into items like juice and jam, the overall value of the chain is enhanced, and the producers are better served financially • Establishment of post-harvest collection centres • When backed by inclusive policies, the mango sector is potentially a source of income for economically disadvantaged and marginalised communities	• Short post-harvest life • High susceptibility to pests and diseases • Monopoly of intermediaries • Price volatility and market shocks

Source: ICIMOD's HI-GRID Project Rapid Survey (2023, 2024), Teyung & Luitel (2023)[5]

[5]Teyung, P. and G. Luitel (2023) Int. J. Appl. Sci. Biotechnol. Vol 11(4): 197-208.

How is the HI-GRID project enabling Madhesh's mango value chain?

There are six interventions that the HI-GRID project is involved in for strengthening the mango value chain:

CAPACITY BUILDING

- Training farmers and entrepreneurs on good agronomic practices, including pest control, application of fertiliser, etc, post-harvest management, value addition, and business development.
- Providing mentorship and technical assistance to scale up youth-led enterprises, with the aim of creating employment and improving local economic resilience.
- Strengthening cooperative networks and farmers' groups to improve collective bargaining skills and access to services.

ACCESS TO SERVICES AND INFORMATION

- Building capacity and deploying digital champions within the Saptari and Mahottari district communities to facilitate technology adoption and information dissemination on the mango value chain.
- The e-Chautari platform, developed by HI-GRID partner Pathways Technologies, is a web-based platform that delivers customised digital agricultural advisory services, particularly for farmers in rural areas. Functioning as a community-based digital hub, it enables farmers to access expert guidance, participate in training sessions, discuss agricultural challenges, and receive tailored support through the GeoKrishi platform – especially on topics such as mango cultivation, pest management, and market trends. For those with limited access, field-based staff provide direct support to help farmers engage with the platform. The project is also actively conducting training sessions for key stakeholders to enhance effective use.

ACCESS TO FINANCE

- Introducing the Kisan Card – a financial card system that can be used by farmers, including mango farmers, to make agri-related purchases, pioneered by R&D Innovative Solutions. The Kisan card functions in a similar way to an ATM card but with controlled usage, allowing farmers to access finance exclusively for agriculture-related purposes. Through support from cooperatives and banks, farmers can use the card to purchase essential inputs, machinery, and other agricultural items.
- The HI-GRID project is providing financial literacy training sessions for farmers, which aims to help them use the card effectively. Future training courses include bookkeeping for farmers.
- Deploying Krishidoot services – 'agriculture ambassadors' who are focused on empowering farmers and transforming traditional agriculture into profitable, sustainable, and technology-driven enterprises by providing real-time advisory services, market linkages, access to finance, aggregation, and promoting mechanisation, all coordinated through partnerships with various stakeholders. This has begun in local communities in Dhanusha, Saptari and Mahottari districts.
- Investing in value addition projects and strengthening the post-harvest infrastructure.

VALUE ADDITION PRACTICES

- More processing centres to be set up for mango-based products to increase their shelf life – this will help tap the LKRB's huge potential in mango value addition businesses, such as those related to pulp extraction, pickles, aamot, aamchoor, dried mangoes, juice, candies, and bars.
- Establishing more cold storage units and collection hubs to minimise post-harvest losses.

IMPROVED POST-HARVEST MANAGEMENT THROUGH TECHNOLOGY

- Introducing CoolBot technology to establish affordable cold storage facilities, which reduces post-harvest losses and maintains mango quality.
- Training smallholder farmers in grading, sorting, and packaging techniques so as to enhance product quality and shelf life.
- Developing community-based cold storage units through the Krishidoot scheme to benefit farmers who cannot afford individual storage solutions.

ACCESS TO MARKET LINKAGES AND DISTRIBUTION

- Establishing smooth and strong connections between farmers and retailers, in order to reduce dependence on intermediaries, and to improve the farmers' income share. For example, farmer groups leveraging the Krishidoot network to engage directly with major retailers such as Bhat-Bhateni Supermarket, without the influence of intermediaries.
- Developing unique brand identities for premium-quality mangoes from the Terai, such as in the case of "Saptari ko Aap." (Mangoes from Saptari).

A snapshot of HI-GRID interventions and expected outcomes towards strengthening mango value chains in Madhesh

Enablers	R&D Innovative Solutions, Community Development and Advocacy Foundation Nepal (CDAFN), Pathways Technologies, ICIMOD, Government of Nepal, Business Financial Institutions.
Project interventions	Related to: strengthening of market linkages and distribution networks; scaling of value addition practices; access to finance; improved access to services and information; post-harvest management through capacity building and technology adoption.
Expected outcome	1) Mango producers (including cooperatives and farmers' groups), agro-vets and collectors at the local level trained in value-added / processed product development and engaged in product design. 2)Strengthened linkages of producers with collection centres and markets within and distant from the production zone. 3)Demonstrated application of cooling centre facilities in reducing post-harvest loss 4)Branding strategy for crafting a market niche for Madhesh mangoes 6)Adoption of GeoKrishi App by farmers for data-driven decision making 7)Adoption of climate-smart cultivation practices to improve mango yield and quality 8)Strengthened advocacy for developing Madhesh as a business hub for mangoes.

Source: Compiled by authors from HI-GRID's project work (2025)

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International Centre for Integrated Mountain Development
GPO Box 3226, Kathmandu, Nepal
T +977 1 5275222 | E info@icimod.org | www.icimod.org