

# EXPORT ORIENTED VALUE CHAIN STUDY

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## Mango- Uttar Pradesh

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## A. ABBREVIATIONS

ADB	Asian Development Bank
AMD	Agricultural Market Development
APEDA	Agricultural and Processed Food Products Export Development Authority
APMC	Agriculture Produce Market Committee
C&F	Clearing and Forwarding
CHCs	Custom Hiring Centres
CISH	Central Institute for Sub-tropical Horticulture
CIMAP	Central Institute of Medicinal and Aromatic Plants
CSIR	Council of Scientific and Industrial Research
DA&FW	Department of Agriculture and Farmer welfare
DGCIS	Directorate General of Commercial Intelligence and Statistics
EU	European Union
FAO	Food and Agriculture Organization
FPC	Farmer Producer Company
FPO	Farmer Producer Organization
FYM	Farm Yard Manure
GAP	Good Agricultural Practices
GI	Geographical Indication
Gol	Government of India
GoUP	Government of Uttar Pradesh
Ha	Hectare
ICAR	Indian Council of Agricultural Research
Kg	Kilogram
KVK	Krishi Vigyan Kendra
Mn	Million
MT	Metric Tonne
NGO	Non-Government Organization
NHB	National Horticulture Board
PoP	Package of Practices
Qty	Quantity
Rs.	Rupees
SAU	State Agriculture University
UAE	United Arab Emirates
US	United States
USA	United States of America
VHT	Vapour Heat Treatment
WHT	Water Heat Treatment
Yr	Year
%	Percent
€	Euro

## B. EXECUTIVE SUMMARY

The Indian mango is a special product that substantiates the high standards of quality and bountiful nutrients packed in it. In India, Uttar Pradesh is one of the leading states for mango production with a share of 23.33% among the leading producers of the country. The average productivity of the crop in Uttar Pradesh is estimated at 17.58 MT/Ha, which is substantially higher than the national average productivity of 9.3 MT/Ha. The mangoes produced in the state have a high potential of export but lack of proper supply chain development has restricted the global market. To promote the export of mangoes from Uttar Pradesh, the Indo-German Cooperation on Agricultural Market Development (AMD) project is envisioned to support sustained economic growth in the agricultural sector and improved livelihoods in rural regions of India.

The study on “Export Oriented Value Chain of Mangoes” deals with the assessment of existing value chain of Mangoes in Uttar Pradesh and recommends the development of sustainable export-oriented value chains for the mangoes in the state. The study was conducted at Varanasi and Lucknow clusters where four FPC’s were shortlisted for the promotion of export of Mango from the state. Existing value chain studies revealed that most of the mangoes are sold at domestic market where farmers share varies from 50% to 82% of consumer price in marketing of mangoes. Various gaps like lack of quality planting material, technical knowledge about Good Agricultural Practices (GAP) and adoption of latest cropping techniques; poor postharvest management facility; lack of marketing facilities or market approach and lack of awareness among export compliances were observed during the study which hampers production of quality produce for export.

There are opportunities for mango growers in both domestic and export market, but to gain profit from market access, they need to substantially increase the quality of their fruits. Various interventions are suggested to mitigate the gaps found during the study at pre-harvest, post-harvest, market development and institutional support phases. These are:

Pre-harvest	Development and Introduction of export-oriented agronomical practices
	Promoting required certification at the field level (Global GAP / EURO Gap / APEDA certification / any other)
	Developing a mechanism for product traceability
	Selection and promotion of varieties compatible to importing market
Post-Harvest	Cluster-based multi-product pack-houses
	Financial and institutional support for export-oriented (Air/Sea) logistic protocol
	Product and market based innovative packaging material
Market Development	Product promotion in the destined markets
	Market identification for an exclusive window
Institutional Support	Training and capacity building of private sector stakeholders
	Efficient convergence with public sector schemes

There is a need to improve the efficiency along with whole value chain and reduction in cost of doing business through investments in production, postharvest infrastructure, storage and aggregation facilities for promoting the export of mangoes from the state.

## 1. INTRODUCTION

India has emerged as one of the leading producers of various agricultural products globally. This increase in production has created a marketable surplus and therefore, various Indian products need to explore global markets. However, access of Indian products in global markets has remained limited due to issues relating to competitiveness, quality, market access, and other factors (policies, phytosanitary restrictions, trade agreements, and non-tariff trade barriers) affecting exports. The supply chains of various Agri-commodities have not evolved to meet the requirements of the global markets because of general inefficiencies that exist at different levels and negligence towards the understanding of the global market requirement.

The Indo-German Cooperation on Agricultural Market Development (AMD) project, therefore, is intended to support India's strategy in modernizing its agricultural markets leading to the sustainable economic growth of India's agricultural sector and improving livelihoods in the rural regions. To achieve its project activities, the project strategically endeavours promoting exchange of technical dialogues between the German and Indian stakeholders, imparting export-oriented trainings & capacity building measures, and strengthening sustainable and market-oriented value chains enabling ecosystem for Farmers Producer Organization's (FPOs). As part overarching project objectives, one of the key result areas of the project is to demonstrate with pilot activities how the integration of FPOs into sustainable and market-oriented value chains can work. During the project's inception phase (August 21 to April 22), under this result area, various analytical studies were undertaken by the project, both based on empirical evidences and providing strategic guidance. Specifically, the studies were commissioned to identify the export potential of 23 different Agri-commodities, under the frame of "One District One Product list" (listed in the project's pilot states as proposed by DA&FW<sup>1</sup>) and assessed its export potential to the European Union markets. Secondly, State's agri-food profile assessment was carried out for Rajasthan, Odisha, and Uttar Pradesh to outline the broad contours of agri-food systems existing in the states. Furthermore, a diagnostic study was undertaken to identify the learning and challenges faced by the FPOs engaged in export-oriented activities. The findings of the different studies, later coupled with the state level consultations, the Project's Steering Committee agreed to strengthen the value chain of up to six most potential commodities (Table 1) in its pilot states and recommended to undertake three inclusive strategic pathways during its implementation phase (May 2022 onwards), namely-

1. Implementation of the export-oriented sustainable value chain for Mangoes and Green Chilies in Uttar Pradesh;
2. Piloting a model that would Institutionalize Agricultural Produce Marketing Committees (APMCs) as an export-oriented service provider; and
3. Supporting FPOs in development and implementation of viable export-oriented business plans in the three project pilot states.

<sup>1</sup> Project pilot states are Rajasthan, Uttar Pradesh, and Odisha states.

This particular study deals with the assessment of the existing value chain of Mangoes and Green Chillies in Uttar Pradesh state and recommends the development of sustainable export-oriented value chains for these two commodities. Scope of the study covers following aspects -

- Exploring commodity-wise value chain structures, activities, seasonality and the relationships among agents (Input suppliers, Government department & institutions, farmers, cold storage/warehouse, processors, commission agents, traders, wholesalers, exports, transports and logistic);
- Examining the infrastructure capacity and utilization capacities/efficiencies, testing and quality facilities, traceability, certification, packaging, labelling, logistics and transport systems;
- Examining the flow of commodities and their distribution patterns through different agents and through different channels;
- Understanding the value-added for different agents and analysing their costs, margins, profits, and losses;
- Identifying the bottlenecks, opportunities, and areas of potential improvement for export-oriented value chain development; and
- Proposing areas of interventions and strategic recommendations that strengthen and promote export-oriented value chains from pilot regions to the EU markets

The approach adopted to conduct this particular study has been discussed in the following chapter.

## 2. METHODOLOGY

For conducting the value chain study of mango, initially, intensive interactions were held with the ADT team to understand the overall objectives of the project. After rounds of discussion, the approach for the project was concluded, which included secondary research, a literature review and detail methodology for primary survey in the project area.

For the promotion of exports of Mango and Chilli, the project has targeted Lucknow and Varanshi clusters, and four farmers' producer companies (FPCs) have been shortlisted for this purpose. Therefore, for primary research, mango value chain stakeholders were selected from these clusters. Respondents for the primary survey included representatives of these FPCs, traders / aggregators and exporters already working in the project area.

For interactions, an interview guide was prepared in consultation with the ADT team and other consultants. These interview guides included roles and responsibilities of various value chain players, costs, margins and mark-ups at different levels, key challenges, and inefficiencies in the value chain. Based on the analysis of secondary literature and information compiled from the field, the value chain analysis report has been prepared. The report has been divided into different chapters, such as a Review of Existing Value chain studies, Product profile, Value Chain analysis, and Proposed Interventions for Export.

### 3. REVIEW OF EXISTING VALUE CHAIN STUDIES

In India, different varieties of mangoes are grown in different geographies and states. Therefore, a large number of mango value chain studies have been undertaken by different agencies and departments. However, most of these value chain studies focus on domestic markets only.

Important findings from some of these studies have been discussed hereunder –

A value chain study of mango in Pratapgarh district of Uttar Pradesh (S. K. Dubey) has given a reference that there are multiple channels of marketing of mangoes exists in the state, which are as below -

- i) Channel-I:(Producer - Wholesaler cum commission agent - Wholesaler-Retailer - Consumer),
- ii) Channel-II: (Producer-Wholesaler-Retailer Consumer),
- iii) Channel-III: (Producer-Village Merchant Processor),
- iv) Channel IV: (Producer- Retailer-Consumer),
- v) Channel-V: (Producer-Consumer).

In another study conducted by ADB, the following channels of mango marketing exists in the state –

- Channel 1: Mango grower - Postharvest contractor or lease contractor - Wholesaler in distant market - Retailer - Consumers (70%–85% of produce)
- Channel 2: Mango grower - Commission agent at the nearest market/Delhi market - Local wholesale suppliers and vendors (retailers) and wholesalers in distant markets - Local traders and retailers - Consumers (15%–25% of produce)
- Channel 3: Mango grower - Commission agent at the nearest market/Delhi Market - Procurement agent - Processing companies - Distributors - Retailers - Consumers (2%–3% of produce)
- Channel 4: Farmers - FPOs - Commission agents and wholesalers in local or distant markets - Consumers (1%–2% of produce)

As per different studies, farmers share varies from 50% to 82% of consumer price in marketing of mangoes.

#### **At the production level –**

Lack of availability of quality planting material has been highlighted in different value chain studies. In surveys of farmers and other stakeholders, it has been mentioned that number of nurseries in production clusters are not sufficient to supply the planting material. This requires support for setting-up of private sector nurseries as well as scientific monitoring of planting material supplied from these nurseries to the farmers. In a study conducted by Central Institute of Subtropical Horticulture (Lucknow), many nurseries are operating in Saharanpur district but only two are accredited with 2-3 stars by NHB, Govt. of India. This seems to be the weakest link in the value chain since certified planting material from registered nurseries is scanty available to mango growers. As per observation of this particular study, no commercial nurseries are offering improved varieties/hybrid of mango.

Most of the mango orchards in Uttar Pradesh are old and senile orchards with age of 35 years and above. These old orchards need rejuvenation by adopting to modern package of practices.

Very few farmers are aware of the improved package of practices for mango cultivation. Even the progressive mango growers in the state of Uttar Pradesh are not applying fertilizers based on the soil

and leaf nutrient content test report even if they got soil tested of orchards for nutrient level regularly. Lack of awareness and technical knowledge were the major issues for quality production. Study conducted by the ADB suggests that there is a significant dependence of farmers on local input dealers for advice on pest control. In particular, smallholder orchard owners who buy input material on credit from a local supply shop mostly end up buying the chemicals that dealers suggested.

In some of the areas, wild animals are creating menace in mango orchards and farmers are looking for government support for creating fencing around the orchards. Lack of availability of labour is another issue, that many of mango orchard farmers are facing to manage the orchard optimally. This, therefore, require the mechanization of various activities of orchard management, including intercultural operations, pruning etc. It has also been highlighted that is the network of Custom Hiring Centres (CHCs) can be improved in the mango production clusters, it can help in reducing dependencies on labour.

CISH (Lucknow) has recommended paper bags for bagging of fruits before harvesting for improving physical quality of the fruits, however, no farmer has adopted this practice. The CISH report has mentioned that the majority of the growers had poor awareness about the standard of ICAR/SAU developed package of practices for quality mango production resulting in poor adoption of technologies.

Harvesting techniques used by farmers are rudimentary and have a very negative impact on fruit quality. As per the ADB study, traditional harvesting methods result in 10%–15% waste through fruit bruising and cracking.

#### **At the post-harvest management level –**

In most of the studies, the lack of appropriate infrastructure for the post-harvest management of mangoes has been highlighted. In addition to suggestions for setting up of farm-based infrastructures, such as cooling chambers and pack-houses, it has also been highlighted that if these facilities can be made solar powered and provision for adequate subsidy is made by the government departments.

#### **At the marketing level –**

For distant marketing of mango, there is the requirement for developing scientific protocols for packaging and transportation. This can also include specifications developed for packing materials such as corrugated boxes and crates etc. For long-distance and export supplies, cargo and logistics services via rail, air, and sea routes need to be strengthened. Different wholesale markets / regulated market yard can have facilities for handling of mangoes, including ripening chambers and cold rooms, which can be made available on a custom hiring basis.

For market information, farmers are generally dependent on informal sources such as fellow farmers, traders, commission agents, etc. In this manner, they do not receive real time market prices for different varieties and grade of mangoes in different markets. CISH has recommended in its report that a Market strategy should be developed to provide necessary information and guidelines to

mango growers so that they can market their produce in a profitable manner as per the requirements of the customer.

#### **For the exports –**

For exports, the value chain study reports highlights two things, one, the air freight charges for perishable products shall have subsidy and two, the promotion of Integrated Pack houses with vapor heat treatment and irradiation facilities to export to European and other destinations. Presently, there are only four APEDA-recognized packing houses in the entire state, one each in Lucknow and Saharanpur and two in Gautam Budh Nagar.

In another study titled “Food Safety Management in Market Value Chain of Mango in Uttar Pradesh: Issues, Challenges and Opportunities” has shown that the market value chain of mango in the study area confronted with the adoption of various food safety laws required to flow of quality mango from producers to consumers due to large network of value chain actors, lack of activity-oriented food safety measures/ practices for the mango value chain in the Nation's food safety law and also disparity among the various food safety laws (public, private and international food safety laws).

Mangoes produced in Malihabad, Maal, and Kakori of Lucknow District have a Geographic Indicator tag. GI Tag can be used as a USP for marketing and branding of mangoes from this region in export as well as in the domestic market. At present, farmers are unable to fetch premium prices for Geographic Indicator-tagged fruits and sell them at the prevailing market rates.

#### **For the Institutional arrangement –**

Farmers Producer Organisations (FPOs) can play important role in developing mango value chains in Uttar Pradesh, however, there is a limited number of FPOs working on mango in major clusters in Uttar Pradesh. Additionally, the existing FPOs also need intensive training on various aspects of governance, business development, trading & marketing etc. These FPOs shall also be provided technical support, infrastructure, and access to finance to compete in the market as well as exposure to explore new markets, including exports.

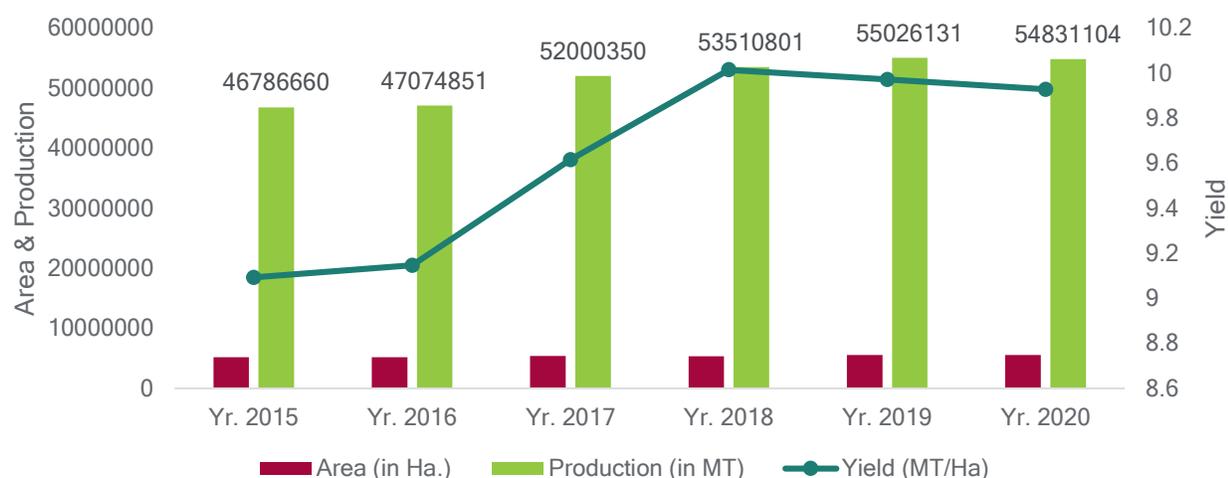
## 4. COMMODITY PROFILE – MANGO

### 4.1 Market Overview

#### 4.1.1 Global Production of Mango

Globally, mangoes are now growing in more than 100 countries, wherein the production is concentrated mainly in Asia and more precisely in India. The total global production of mangoes is about 54.83 million MT (the year 2020, FAO), which has been almost at the same level during the last three years. In recent years, mangoes have become well-established as fresh fruit and processed products in the global market. India contributes 45% of total global production (24.75 million MT), followed by Indonesia (7%), China (5%), Mexico, Pakistan, Brazil and Malawi (each 4%).

Global mango production trends



Mango production trends in the world (2015-20)



Global exports of mango, guava and mangosteen rose to an estimated 2.3 million tonnes in 2021, an increase of approximately 3 percent, or 75 000 tonnes, from the previous year (2020). Mexico, is the largest exporter of mango with 21% of total global mango export, followed by Thailand, Brazil, Peru and India. Approximate 90 percent of Mexican mangoes are exported to the United States, and the remaining 10 percent to Canada. For Thailand, the most important mango export destination is China.

India and Pakistan are emerging as the fastest growing exporting countries of mango. Although India is the largest producer of the mango in the world, in comparison to total production (24 Mn MT) export of mango from India is at an estimated 170000 tonnes (2021) is very small. This is mainly due to large demand of mango in the domestic market. Some 30percent of shipments from India are typically supplied to the United Arab Emirates and Saudi Arabia, where demand for tropical fruits has been burgeoning in recent years.

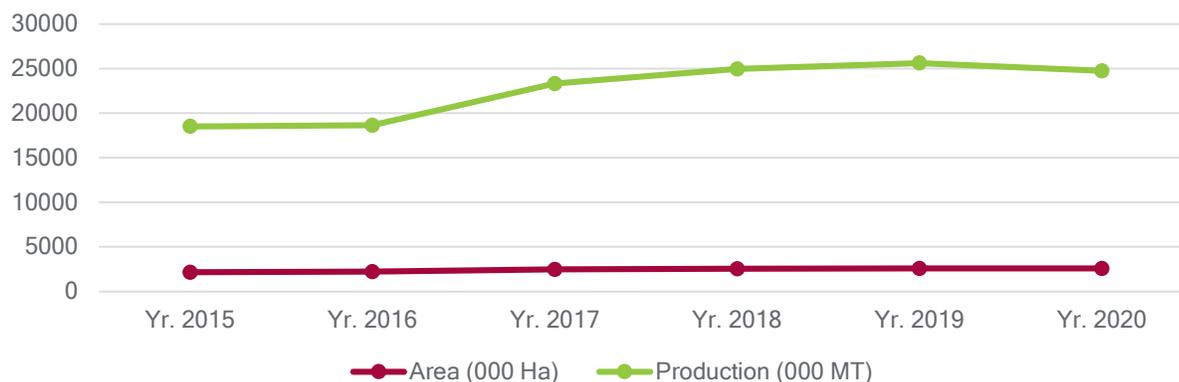
Worldwide total import of fresh mangoes (including mangosteens, and guavas) was 2.1 million tonnes in 2021, Global import of mangoes increased slightly in year 2021 by 5 percent from year 2020. The United States and the European Union (EU-27) remained the two leading global importers, at estimated import shares of 26 percent and 19 percent, respectively (FAO). Import growth was higher for the European Union at an estimated 10 percent, (400 000 tonnes). Brazil and Peru are the two major sources of supply to the European Union. Higher imports from several emerging importers, notably Saudi Arabia, the United Arab Emirates and the Russian Federation further contributed to the overall growth in global imports.

India, as an exporter of mango, has one big disadvantage of the very short harvesting season of April to July against 8-10 months of harvesting in Brazil, Columbia, Kenya and Venezuela. There are many mango varieties grown in different countries; India alone has nearly 1,300 mango varieties (20 grown commercially) and Thailand has about 100 varieties.

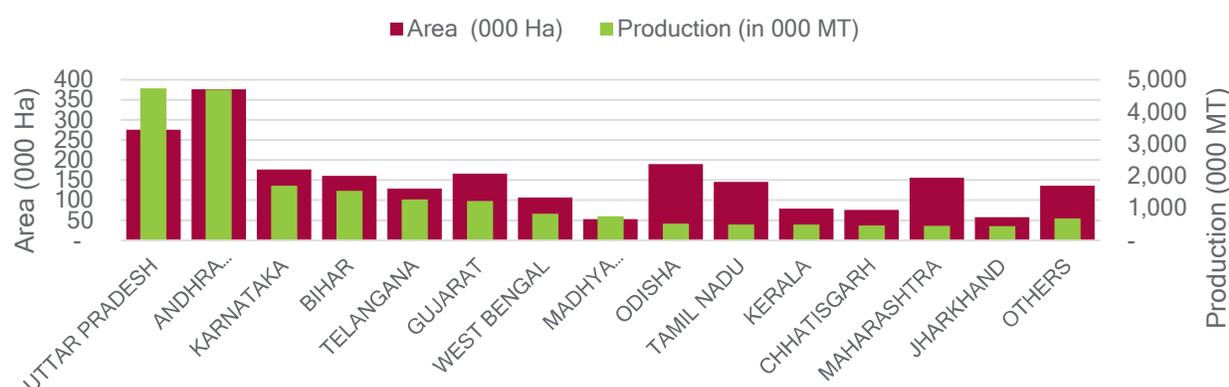
#### 4.1.2 Indian Production of Mango

Total mango production in India during 2019–2020 was estimated to be 21.3 million MT from an area of 2.3 million Ha with average productivity of 9.3 MT/ha. There is slight difference in data available from Ministry of Agriculture & Farmers Welfare and from FAO. Numerous varieties of mangoes are grown in almost all states in India. *Uttar Pradesh is ranked first in mango production with a share of 23.33% followed by Andhra Pradesh (23.13%).* Karnataka, Bihar, Telangana, Gujarat, West Bengal, Madhya Pradesh, Odisha, Tamil Nadu, Kerala, Chhattisgarh, Maharashtra and Jharkhand are also among the major producers.

### Trends of area and production of mango in India



### State-wise Area and Production of Mango in India (2019-20)



Important varieties of mango grown in different states are discussed as blow –

State Name	Important Varieties
Andhra Pradesh	Banganapalli, Suvarnarekha, Neelum and Totapuri
Bihar	Bombay Green, Chausa, Dashehari, Fazli, Gulabkhas, Kishen Bhog, Himsagar, Zardalu and Langra
Gujarat	Kesar, Alphonso, Rajapuri, Jamadar, Totapuri, Neelum, Dashehari and Langra
Haryana	Chausa, Dashehari, Langra and Fazli
Himachal Pradesh	Chausa, Dashehari and Langra
Karnataka	Alphonso, Totapuri, Banganapalli, Pairi, Neelum and Mulgoa
Madhya Pradesh	Alphonso, Bombay Green, Dashehari, Fazli, Langra and Neelum
Maharashtra	Alphonso, Kesar and Pairi
Punjab	Chausa, Dashehari and Malda
Rajasthan	Bombay Green, Chausa, Dashehari and Langra
Tamil Nadu	Alphonso, Totapuri, Banganapalli and Neelum
Uttar Pradesh	Bombay Green, Chausa, Dashehari and Langra
West Bengal	Fazli, Gulabkhas, Himsagar, Kishenbhog, Langra and Bombay Green

Many of these varieties have been received geographical indication (GI) tag due to their specialties.

<b>G.I. Certified mango varieties from different geographical areas of India</b>				
<b>S. No.</b>	<b>Name of Geographical Indication</b>	<b>Application No.</b>	<b>Specific Geographical Area</b>	<b>State</b>
1	Laxman Bhog	111	Malda	West Bengal
2	Khirsapati (Himsagar)	112	Malda	West Bengal
3	Fazli	113	Malda	West Bengal
4	Malihabadi Dusseheri	125	Lucknow (Malihabad, Mal, Kakori and Bakshi Ka Talab along with banks of Gomti river)	Uttar Pradesh
5	Appimidi	132	Shimoga, Uttar Kannada, Dakshina Kannada, Chikmagalur, Hassan and Udupi regions	Karnataka
6	Gir Kesar	185	Junagadh (Around Gir Forest)	Gujarat
7	Marathwada Kesar	499	Marathwada Division (Aurangabad, Nanded, Parbhani, Latur, Beed, Hingoli, Jalna and Osmanabad)	Maharashtra
8	Banganapalle	241	Banganapalli (Kurnool)	Andhra Pradesh
9	Alphonso	139	The Konkan region comprising Palghar, Thane, Raigad, Ratnagiri and Sindhudurg district	Maharashtra
10	Zardalu	551	Bhagalpur and surroundings of Banka and Munger district	Bihar
Mango varieties that have been applied for Geographical Indicators				
11	Rataul	206	Baghpat	Uttar Pradesh
12	Salem Mango	406	Krishnagiri, Salem, Namakkal, Dharmapuri	Tamil Nadu
Source: www.icar.org.in				

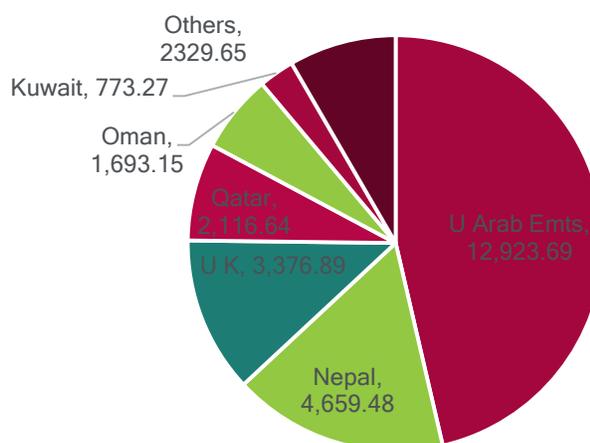
In international markets, mangoes are generally exported to relatively shorter distances. In addition to the financial viability of longer distance travel, lack of established export protocol and stringent quality control holds Indian mango export to major markets. As per NHB and also analysis of FAO data it shows that, Mexico, Haiti and Brazil account for the majority of North America's imports. India and Pakistan are the predominant suppliers to West Asia. Southeast Asian countries get their supplies mostly from the Philippines and Thailand. European Union sources mangoes from South America and Asia.

For India, UAE is the largest importer accounting 46% of total export from India, followed by Nepal (quantities keep fluctuating), United Kingdom, Qatar, Oman and Kuwait. At peak, India had exported approximately 49,000 MT of mangoes (during 2017-18 and 2019-20), however during last two years, i.e. 2020-21 and 2021-22, it has been 21,033 MT and 27872 MT respectively.

The US, the world's largest importer of mangoes, had for long banned imports from India due to the use of pesticides. This ban was lifted in 2007 but exports are still slow because of the pre-condition that shipments have to be cleared by a US phytosanitary inspector. This problem became acute after Covid 19-led restrictions made it difficult for the US

inspectors to come to India and the exporters here were hesitant to send shipments for inspection to America. Exporters feared that once the mangoes reach US shores and the inspector happens to reject them, the whole cargo will go to waste. In India, even if the produce is rejected, it can still be sold in local markets.

### Export of Mango from India to different countries (2021-22)



Variety / type of Mango	2020-21		2021-22	
	Qty	Rs. Lacs	Qty	Rs. Lacs
Other Mangoes	15,795.09	19,087.06	17,448.90	17,465.28
Alphonso (Hapus)	3,195.85	4,557.25	5,994.86	7,511.64
Kesar	983.73	2,206.21	2,319.08	5,106.34
Banganapalli	830.55	1,089.44	1,674.03	2,232.32
Totapuri	47.47	48.22	151.01	124.43
Langda	48.99	63.58	122.16	121.09
Dasheri	49.49	71.29	75.93	82.2
Mallika	41.4	26.43	61.16	65.18
Chausa	40.98	38.35	25.64	36.67
Mangoes, Fresh/Dried,	0	0	0	0
<b>Total</b>	<b>21,033.55</b>	<b>27,187.83</b>	<b>27,872.77</b>	<b>32,745.15</b>
Source: DGCIS / APEDA				

According to APEDA's website, Agri Export Zones have been established in almost all mango growing areas and packhouses on modern lines have been provided in all mango exporting regions, including

in Ratnagiri and Sindhudurg in Maharashtra and in Navsari and Borsad in Gujarat for Alphonso variety; in Latur and Aurangabad for the Kesar mango; in Saharanpur and Malihabad in Uttar Pradesh for Dashehari and Chausa mangoes.

Also, facilities for facilitating mango exports like a Post-Harvest Management Centre have been established at Malihabad and Saharanpur. Similarly, a mango Export Facility Centre has been established at Ratnagiri and mango farmers of Alphonso and Kesar have been trained in global standards requirements.

Mangoes are processed by the registered packhouse facilities having ripening chambers, pre-cooling facilities, and cold storage facilities for shipments to UAE and other West Asian countries. Mangoes to these destinations are exported in refrigerated containers with the requisite temperature of 12°C, as per its website.

While there is no shortage of availability of refrigerated containers for sea shipments, mangoes are exported by air to distant destinations like the EU and USA. To facilitate exports of mangoes by refrigerated vans, APEDA provides financial assistance for the purchase of insulated/reefer transport/mobile pre-cooling units. (Source: Ministry of external affairs, GoI)

## 4.2 Mango Production in Uttar Pradesh

### 4.2.1 Area and Production

As it has been discussed above, Uttar Pradesh is the largest mango-producing state in the country, it has 0.27 million ha of area under mango production and is producing 4.73 million MT (2019-20) of mango.

The state's share in national production is 23.58% and the share of area stands at 12%. This states the improvement in yield using cost-optimizing inputs have produced beneficial effects. Apparently, the average productivity of the crop in Uttar Pradesh is estimated at 17.58 MT/Ha, which is substantially higher than the national average productivity of 9.3 MT/Ha.

Agro-climatically, districts in the mid-plain zone generate more than 25% of the total mango production in the state. The other suitable agro-climatic zones are Bhabhar terai, the eastern plain zone, and the western and mid-western plain zone. Lucknow and Saharanpur are the major mango-producing districts in the state, accounting for 27% of total state production; Unnao (8%), Bulandshahr (6%), Amroha (5%), Sitapur (4%), Faizabad (3%), Sultanpur (3%), Meerut (3%), Ambedkar Nagar (3%), Muzaffarnagar (2%), Kasganj (2%), Bijnor (2%), and Aligarh (2%) are the other major mango-producing districts. Cumulatively, these districts account for 75% of the total state mango production.

The leading commercial varieties are Dussheri, Langra, and Chausa, which have a huge demand in the domestic and export markets. The other varieties in the state include Safeda, Ramkela, Malika (hybrid Neelum-Dussheri), Amrapali (hybrid Dussheri-Neelum), and Ambika (hybrid Amrapali-

Janardan Prasad). Chausa is considered more suitable for long-distance transport because of its long shelf life.

S. No.	District Name	2015-16		2016-17	
		Area (000 Ha)	Production (000 MT)	Area (000 Ha)	Production (000 MT)
1	Lucknow	29.47	585.20	29.66	588.77
2	Saharanpur	29.55	575.10	29.74	578.60
3	Unnao	16.99	355.97	17.10	358.13
4	Bulandshahr	15.22	261.48	15.32	263.08
5	Amroha	9.24	196.29	9.30	197.49
6	Sitapur	15.89	185.49	15.99	186.62
7	Faizabad	7.60	150.97	7.65	151.89
8	Sultanpur	9.25	141.77	9.30	142.64
9	Meerut	8.01	128.01	8.06	128.79
10	Bijnor	5.87	117.38	5.91	118.09
11	Muzaffarnagar	5.18	94.51	5.21	95.08
12	Hardoi	5.60	92.17	5.64	92.73
13	Kasganj	5.20	91.27	5.23	91.82
14	Ambedkar Nagar	5.01	84.07	5.04	84.58
15	Aligarh	4.91	81.53	4.94	82.03
16	Kheri	4.23	75.91	4.26	76.37

Source: <https://www.mofpi.gov.in/> (2018)

#### 4.2.2 Mango Crop Seasonality

In Uttar Pradesh, multiple varieties of mangoes are grown and the crop seasonality can vary slightly for different mango varieties. Additionally, the mango belt in Uttar Pradesh is very vast, starting from the districts of Meerut in western Uttar Pradesh to Lucknow in Central and Varanashi in Eastern Uttar Pradesh. This wide range has huge diversity of agro-climatic conditions and soil types, therefore, activities performed in different regions vary accordingly. Below table gives broad activity schedule followed by farmers in Uttar Pradesh.

In the adoption of various practices at orchards, there is again an enormous difference in different types of farmers. The progressive farmers maintain orchard with desired care and adapt various scientific practices and follow the schedule for the application of fertilizers, nutrients and spray. However, in general, the other farmers seldom adapt to these practices.

Month	Activity	
June	Harvesting followed by Pruning	Application of fertilizers and FYM.
July		
August		
September	Ploughing, mainly to remove grasses and other weeds from the field.	Short-duration crops such as vegetables
October	Fertilizer application	
November	Pruning of dead woods, if any seen in the orchard.	
December		
January	Application of pesticides, specifically for midge insects and mealy bug infestation, mango hopper.	Progressive farmers also keep honeybee boxes in orchards for efficient pollination and fruit set.
February		
March	Some farmers apply fungicides for controlling powdery mildew.	
April	Irrigation, post onset of fruit.	
May	Harvesting of fruits	

Harvesting of mango in the state is mainly concentrated between May and July months. First of all, harvesting of Dussheri variety starts in second half of April and it lasts still June end. This is followed by Langra and then other varieties. Harvesting of the Chausa variety continues till mid of August.

Variety (Uttar Pradesh)	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Dussheri												
Chausa												
Langra												
Mallika												
Amarpali												

There are other varieties, such as Fazli, Gulab Khas, Nawab etc., which are grown in smaller areas in the State.

## 5. VALUE CHAIN ANALYSIS

### 5.1 Major Actors in Value Chain

In Uttar Pradesh, mango is being produced for a long period and is a traditional fruit. The value chain of mango in the state has evolved over a period of time, wherein not only the roles and responsibilities of various value chain actors have changed, but even the actors themselves have also changed. In past, mango orchards were proud possessions of *nawabs* and *zamindars* (ruling class) in the region. Over the period, the land sizes have reduced due to family bifurcations. However, many farmers are still growing mango orchards with old emotions and passion, although a few in number. Malihabad, Mall and Kakori regions are known as the mango capital of Uttar Pradesh.

*Aur dauayiae kias kahan, jane sheerin mein mithas kahan...*

(What else can we do with first the imagination? Mango is sweeter than the best in life, nay, even life itself). By – Mirza Ghalib

Most of the mango varieties grown in Uttar Pradesh are table varieties and therefore, most of the produce goes to market as fresh fruit. In the mango value chain in the state, following actors play important roles –

Actor	Profile and Role & Responsibilities
Nursery growers / Planting material suppliers	<p>There are approximately 63 mango nurseries registered with the National Horticulture Board (NHB) from the state of Uttar Pradesh, out of which 52 are in the Lucknow region only. In addition to these registered nurseries, there are a large number of unregistered planting material suppliers in the region.</p> <p>Nurseries in Lucknow region not only fulfill the planting material requirement of this particular region but also supplies saplings to other regions in the state as well as to other states such as Haryana, Punjab, Rajasthan, Madhya Pradesh, and Uttarakhand.</p> <p>Central Institute for Subtropical Horticulture (CISH, ICAR), KVKs at the district level and other institutions also supply planting material to the farmers.</p>
Agri-input dealers and retailers	<p>Farmers fulfill their agri-input needs from the local dealers and retailers of fertilizer, pesticides, and other chemical companies. There is a wide network of input retailers in all the regions. Agri-input retailers have a high influence in the selection of chemicals, fertilizers, pesticides, and other inputs. To some extent, they play the role of extension workers and advisors to the farmers.</p> <p>Some of them also keep small tools such as sprayers and orchard tools for selling them to the farmers.</p> <p>In recent times, new ag-tech start-ups and FPOs have also started supplying various inputs required for agronomical practices (pest management, nutrient management etc.).</p>
Orchard Owners	<p>In the region, there are different types of orchard owners. Unlike Western Uttar Pradesh, where the mango orchard is owned by relatively large farmers (owning</p>

Actor	Profile and Role & Responsibilities
	<p>&gt;4.0 Ha of land) (Manoj Kumar, RN Yadav, DK Singh, Dan Singh, Yogesh Prasad and Manoj Kumar, S.V.P.U. &amp; T. Modipuram Meerut U.P); in Central Uttar Pradesh, most orchard owners belongs to marginal category (&lt; 1.0 Ha.) (SP Singh &amp; AK Nandi, CIMAP, CSIR). Most of the orchard owners are of older age group (age above 50 yrs).</p> <p>Mango orchard owners are the key actors in the value chain, as they are the decision maker on all the activities relating to production practices and managing finance for mango production.</p>
Orchard Care Takers (Baag mali)	<p>The orchard caretaker is also one player in the mango value chain, as he is responsible for the maintenance of the orchard. Although, with reducing size of orchards, not many orchard owners are able to afford the caretaker, however many large orchard owners, who live in cities are completely dependent on caretakers for day-to-day activities and maintenance. The caretaker ensures timely application of inputs, irrigation etc. on behalf of the orchard owners. Quality of fruit and yield also depends on the knowledge and experience of these caretakers. In some cases, these caretakers also help in linking the orchard owners to the traders.</p>
Orchard contractors	<p>Some of the orchard owners lease out their orchards to the contractors for a fixed time period (ranging 1 yr – 5 yrs) at a fixed rate on lump sum basis. In such cases, the contractor is responsible for undertaking all farm activities and has the right to market the fruits during the period of the contract. The estimated lease amount is fixed based on the factors such as the orchard area, the variety grown, the number and age of the trees, and the yield and value realization during previous seasons.</p>
Pre-harvest contractors and local aggregators	<p>Prevalent way of marketing mango is to sell the fruit at the pre-harvest stage itself. Pre-harvest contractors, who are either local aggregators, seasonal traders or representatives of wholesalers'/commission agents in the major markets, visit the orchards at pre-harvest stage to assess the fruits and negotiate the full orchard.</p> <p>These contractors have the responsibility of watch &amp; ward, irrigation, if required, harvesting of fruits, sorting-grading, packaging and marketing. There are different types of price arrangements between the orchard owners and farmers such as a single amount negotiated for full orchard or per kg basis price. These contractors are also responsible for any kind of price risk, as the rates with the orchard owners are already fixed.</p> <p>In the case of the export value chain of mango, these pre-harvest contractors play a very significant role. Generally, exporters or back-end suppliers of exporters prefer buying mango from these contractors, as they can ensure the quality and supply consistency of mango required as per export demand.</p>
Commission agents, traders, and wholesalers	<p>Orchard owners and pre-harvest contractors, both send their harvests to different markets as per their own trade linkages, prevailing market price and understanding. From the orchard itself, mangoes are loaded for these markets.</p>

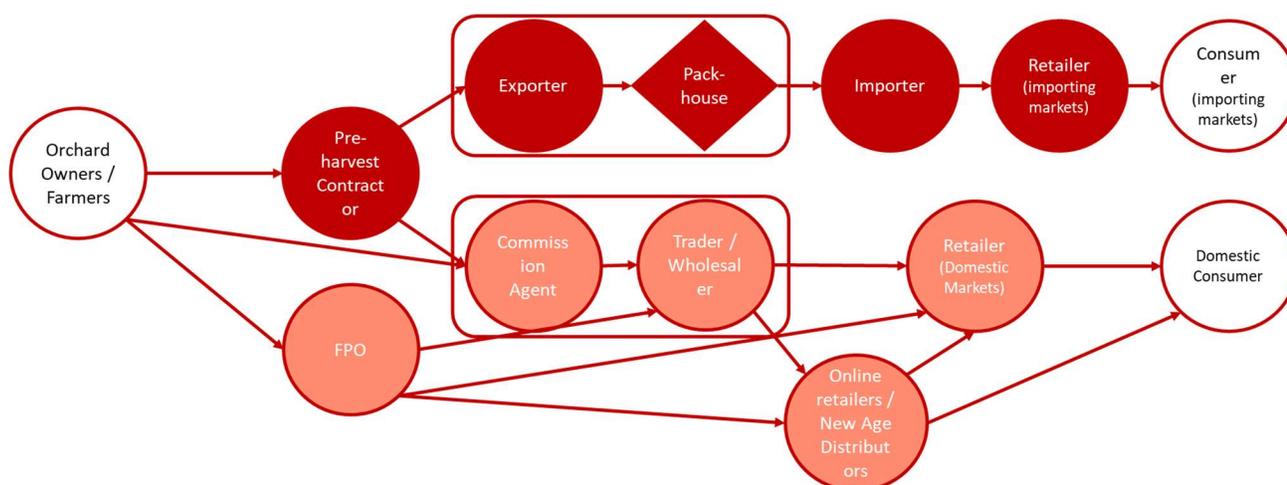
Actor	Profile and Role & Responsibilities
	<p>In markets, mostly the regulated APMC markets, mango boxes are auctioned. The Auction is facilitated by the commission agent in the market. Commission agents take responsibility for payment from the buyer and make payments to farmers/contractors. Traders and wholesalers, after purchasing through auction, supply fruits to retailers, including organised players and online retailers.</p>
Exporters	<p>A few numbers of exporters based out of Lucknow are engaged in opportunistic export of mango either direct or through exporters based out of Mumbai. Some of the exporters are having their own mango orchards and are better placed to master the export supply chain.</p> <p>Exporters procure export quality mango through pre-harvest contractors as well as from the markets / mandi. Exporters work in close coordination with pre-harvest contractors/aggregators, wherein specific orchards, having a high percentage of export-quality produce are booked at relatively higher rates. Exporters organize the packaging of mango either at field itself (for exporting to gulf countries) or at APEDA-certified pack-houses (for exports to Japan, Europe and USA). Exporters also fulfill all the requirements of documentation for exports with the help of Clearing and Forwarding (C&amp;F) agents. Exporters also organise financing for export, which depends on payment terms at the back end with the suppliers as well as terms of trade with the buyers in the importing countries.</p>
Pack-house operators	<p>For exporting mango, it shall be packed at APEDA certified pack-house having the adequate facility to process the mango as per the requirement of the destined market. For example, for the export of mango to Japan, it requires Vapour Heat Treatment (VHT) facility at the pack-house and for exporting to USA it needs irradiation facility and for China, it requires hot water treatment etc.</p> <p>There are a total of 37 APEDA-certified mango pack-house in the country for facilitating export, out of which only two (2) are in Uttar Pradesh. Exporters generally use Maharashtra (Navi Mumbai) based pack-houses for the packaging of mango.</p>
Certification, Compliance, and Documentation agencies Clearing and Forwarding Agents	<p>Importing countries are having different phytosanitary requirements apart from different post-harvest protocols.</p> <p>These mandatory requirements are met with the support of government institutions, pack-houses processors and clearing and forwarding agents (C&amp;F agents).</p>
Extension services and financial support from	<p>Different government agencies, such as the Department of Horticulture (Govt. of UP), Agricultural Universities, Krishi Vigyan Kendra (KVKs) and ICAR Institutes (CISH) are engaged in providing extension support to farmers on the package of practices of mango cultivation. However, the general perception is that farmers are not much connected with these agencies/institutions for extension support.</p>

Actor	Profile and Role & Responsibilities
the Government agencies	Farmers also dependent on the government for financial assistance for various activities such as the plantation of new orchards, irrigation infrastructure and marketing of mangoes, creating marketing infrastructure etc.
Farmers Producer Companies / Organisations (FPCs / FPOs)	In the recent past, Farmers' Producer Organisations (FPOs) have also started playing their role in the production, marketing, and export of mango in Uttar Pradesh. Some of the FPOs are engaged in various activities of the mango value chain. Although, as of now, the role of these institutions is not very significant, however, given the government thrust, these institutions may play important role in the export value chain of mangoes in near future.

In addition to the above-mentioned mango value chain actors, there are other actors as well. Such as organised players and new age ag-tech start-ups, developmental agencies, NGOs, etc. who have been working in the supply chain in one way or another.

## 5.2 Commodity Flow Analysis

The majority of mango in Uttar Pradesh, approximately 99.0 - 99.5% is sold in the domestic market only, therefore the flow of product is predominantly controlled by the domestic supply chain players. Within the domestic supply chain, there are different channels by which mango is made available to consumers.



### 5.2.1 Domestic Supply chain –

In the domestic supply chain of mango, there are multiple channels, out of which some are traditional ones and others are evolving channels as new institutional mechanisms are emerging and new players are entering the market. Most common channels have been discussed hereunder –

**Channel 1: Marketing through pre-harvest contractors and traditional markets** – this channel is the most common and dominant supply chain system for marketing of mango in Uttar Pradesh and controls as much as 70-75% of the total supply. In this channel, the most important player is pre-harvest contractor, who performs maximum activities relating to marketing, such as fruit harvesting,

sorting-grading, and packaging, transportation to the markets etc. Pre-harvest contractors also invest money in the marketing of mango (as he provides advance to the farmers at the time of booking of the orchard as well as make payment during the season) and also get exposed to maximum market risks (e.g. price fluctuation, product quality, market rejections and disputes, payment failure from front end etc.). Fruit is sold through commission agents in large markets, across India, mostly through auction systems. From the auction, traders/wholesalers purchase the fruit and distribute it further to sub-wholesalers (in smaller towns) and retailers.

Although, on the ground, this channel looks very rudimentary and rustic, as the supply chain players generally do not have any infrastructure for sorting / grading and packaging, most of the activities are performed at farm level itself in open field manually by unskilled / semi-skilled laborers. However, the channel is most efficient from financial perspective as there are hardly any overhead that pre-harvest contractor incur. Commission agents at markets generally do not add any physical value addition to the product but they take a guarantee of payment from the market (traders/wholesalers etc.)

**Channel 2: Orchard owners' market through traditional markets** – This is another important channel, wherein orchard owners play the additional role of the pre-harvest contractor (mentioned in Channel 1). The roles and responsibilities of other actors in the supply chain remain the same as mentioned in Channel 1.

**Channel 3: Emerging alternate marketing channels through new institutions** – In the mango supply chains, a few new institutions such as Farmers' Producer Organisations (FPOs), agri-tech start-ups and organised retailers have started finding space for themselves. Different institutions are trying to create niches for themselves, such as FPOs are trying to engage at the back-end, ag-tech start-ups exploring their role as facilitators of direct market connections from farmers to consumers (through the online market platform). Organized retailers are also trying to establish their procurement centers at the back end for direct procurement from orchards.

This channel is emerging

### 5.3 Price mark-up for Mango exports

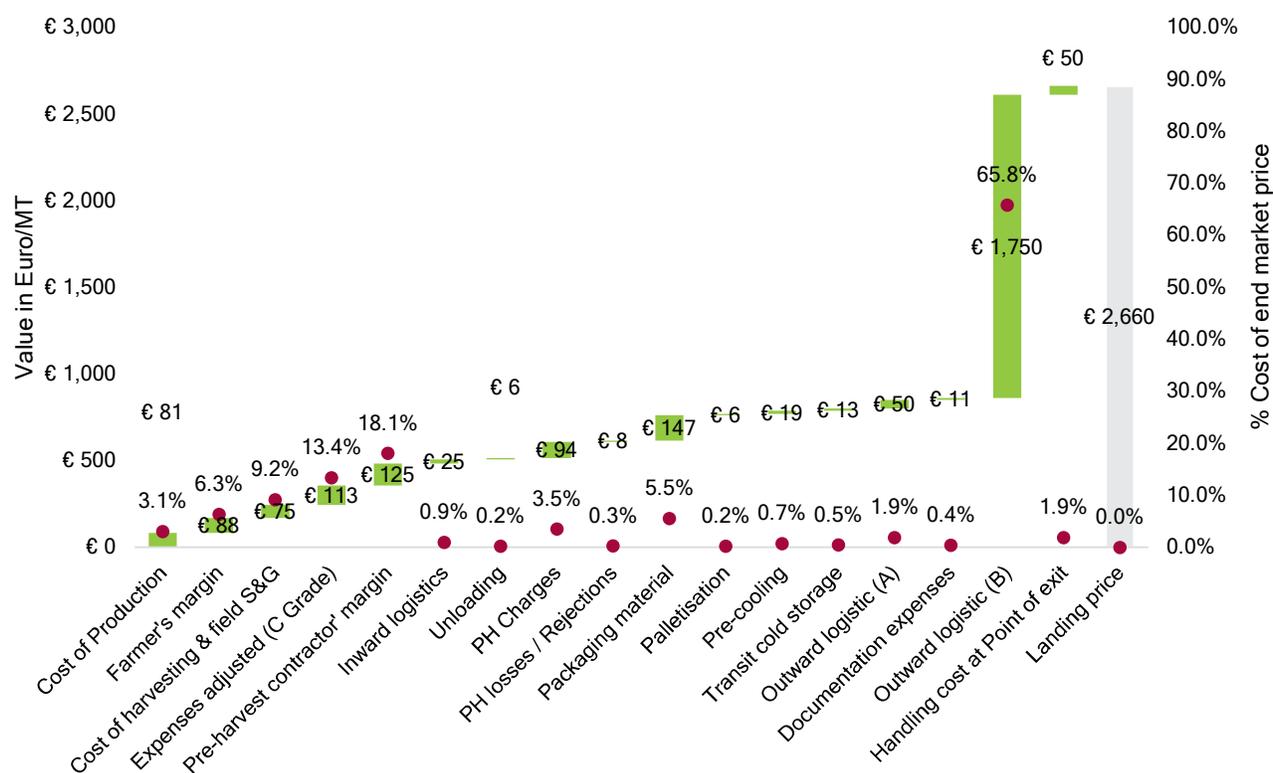
For estimating price markup at different stages of the mango supply chain, two approaches have been used, one, by taking inputs from previous studies and second, by primary interaction with supply chain stakeholders. Specifically, for the cost of production, secondary information has been used. Major observations of cost mark-up are as under –

- For farmers, the average cost of production of mango is approximately Rs. 6.50 per kg (€ 0.08 per Kg), which includes the cost of orchard management, application of inputs (fertilizer, pesticides etc.)
- Farmers earn a gross margin of Rs. 6.00 – 8.00 per kg (€ 0.09 per kg), depending upon the market situation and prevailing prices during the season.
- Pre-harvest contractors incur the approximate cost of Rs. 6.00 per Kg (€ 0.08 per Kg) for watch & ward, harvesting, sorting & grading and primary packaging at the field level. Given that the orchard has all grades of fruits and export quality fruits are generally 25-40%

(depending upon orchard quality), pre-harvest contractors build a sufficient portion of it on A-grade / export quality fruit. This adjusted additional cost is estimated at approximately Rs. 9.00 per kg (€ 0.11 per Kg). By adjusting all these expenses, theoretically, the pre-harvest contractor earns Rs. 10.00 per kg (€ 0.13 per Kg), however, this purely depends on market price realization.

- Exporter or export facilitator incur Rs. 10.65 per kg (€ 0.13 per Kg) for pack-house operation. This includes the cost of inward transportation, VHT / WHT, sorting-grading, packaging and margin of the pack-house operator.
- One of the major cost components is the packaging material, which includes the cost of boxes and pallets etc. The total cost of packaging material is calculated at Rs. 12.25 per kg (€ 0.15 per Kg). Cost of packaging material also varies depending upon packaging size and quality of packaging material.
- A small expense is incurred if mango is pre-cooled or kept in transit cold storage to make a lot at the pack-house. Additionally, export also need to pay for documentation, which are organised by C&F agents. All these costs add to Rs. 7.50 – 8.00 per kg.
- Biggest expense in the export supply chain of mango is air freight from the sourcing country to the destination country. Approximately, this is Rs. 140.00 per kg (€ 1.75 per Kg), which makes around 65% of the total cost of landing. A small amount is incurred at the destination port for handling of material.

### Mango Value chain margin build-up



The approximate landing cost of mango to Europe is Rs. 213.00 per kg (€ 2.66 per Kg) and based on these cost estimates, exporters further negotiate their price in the importing market. Given that

the biggest differentiator of cost is air freight, large exporters try to negotiate hard with air carriers in advance as well as based on bulk booking in advance. Small exporters are not able to compete on cost optimization with the large exporters.

#### 5.4 Gaps in the Value Chain

As it has emerged in the value chain analysis of mango and assessment of various marketing channels mango from Uttar Pradesh is mostly marketed as fresh fruit in the domestic market only. Export value chains are not very well structured and therefore, there are wide gaps at different stages, which need to be addressed to build an export-oriented value chain. During discussions with different stakeholders, these gaps were highlighted by the stakeholders in different manners and have been compiled here under -

##### Production Gaps:

Mango production in Uttar Pradesh has been a delicacy in itself, however, mango production has traditionally been for local consumption only (mostly reaching to northern markets till recently). With the expansion of markets, now mango has started reaching to the majority of the markets in the domestic market. But the export markets have still remained a distant dream for mango producers of Uttar Pradesh. Given that export markets were never targeted in a focused way in the past, the production practices followed in the major mango belts have wide gaps from an export-oriented production perspective. Some of the important gaps highlighted at production level by the stakeholders are as under –

- i) **Old and senile orchards** – in the primary survey as well as in secondary research, this point was highlighted very prominently that a large number of mango orchards in the Lucknow (central Uttar Pradesh) region are very old. Many trees in these orchards, specifically in orchards, where the orchard owners have moved to cities, have become senile and have got infested with diseases. Due to this, the quality of fruits in these orchards are many times not market-worthy or is of poor quality.
- ii) **Indiscreet or uncertified planting material** - Lucknow is the hub of mango plant nurseries in Uttar Pradesh. However, there is no system in place to certify the nurseries or to genetically differentiate the pure variety of plants at the nursery level. Although, National Horticulture Board has started registering and rating of nurseries based on certain packages of practices, a Very limited quantity of authentic and disease-free planting material is available to the farmers.
- iii) **Lack of adoption of good agricultural practices for orchard management** - Most orchards are being managed by the traditional orchard caretaker who has seldom got trained on improved packages of practices for orchard management. Very few progressive farmers have adopted scientific orchard management practices. Poor management of orchards is not only impacting the orchard yield but also affecting the quality of output from the orchard. Farmers are not aware of PoPs required for preparing an orchard for the export market. There is hardly any orchard in the region, which has been prepared to target exports.
- iv) **Injudicious use of chemical inputs** - Farmers refer agri-input retailers for advice on disease and pest management. In absence of a scientific approach, pesticides (insecticides and fungicides) are used indiscriminately, which makes the produce residue laden. This is not a desirable

situation for developing an export-oriented value chain. Excess use of pesticides has become one of the major causes for the rejection of lots at importing countries, specifically in USA.

- v) **Lack of access to good extension services, training and capacity building** – Orchard owners and caretakers need, not only sensitization for export-oriented production but also need appropriate training and capacity building. During field visits and interaction with the stakeholders, this point was raised that in the region, there is no such institution, which has worked with the orchard owners or farmers in a consistent manner to provide training on export oriented production practices.
- vi) **Absence of certification at the production level** – For exporting mangoes to European markets and to USA need GAP certification of orchards. However, farmers and other value chain players have limited knowledge of this practice. While discussing this requirement, stakeholders also highlighted that cost of certification is also one of the important issues for small and marginal farmers.

#### **Harvest and Postharvest Management Gaps:**

The promotion of an export-oriented value chain of mango will need alignment of all the activities as per the requirement of the market and this includes harvesting of fruits at the right stage of maturity as well as in the right manner so that fruit is not damaged physically and quality of fruit can be maintained throughout its handling and transportation. There is a poor understanding of these aspects at the ground level amongst farmers as well as pre-harvest contractors and aggregators. Some of the specific challenges at this stage are as under –

- i) **Mixed harvesting** – During harvesting, generally labour mixes mangoes of different maturity, this leads to high level of rejection from export lot and causes losses for the farmers / pre-harvest contractors/aggregators. This requires adequate training of harvesting labour and stringent monitoring and supervision of harvesting activity by trained supervisors.
- ii) **Poor harvesting techniques** - In the case of mango, harvesting is still being done manually or traditional way of harvesting by use of a sickle and sticks etc. These practices cause mechanical injuries to the fruit and make it ineligible for export. Harvesting laborers need to be trained and equipped suitably to minimise these quality losses.
- iii) **Poor Sorting & Grading practices** – After harvesting, preliminary sorting & grading of mango is done in the orchard itself. For this, harvesting contractors use make-shift arrangements on the field floor itself. This practice make fruit vulnerable to soil-born fungal infections. Additionally, the sorting & grading criteria are very limited such as fruit size and colour, however, for export, sorting & grading need to incorporate many more criteria including maturity level, sugar content, chemical testing of fruits before harvesting etc.
- iv) **Lack of infrastructure for sorting, grading and packaging** – In Uttar Pradesh, there are only two pack-houses for packaging of mango for export and only one facility has VHT facility. Given that Uttar Pradesh is the largest mango-producing state in the country, this infrastructure is inadequate. While discussing with exporters, it was highlighted that as the current level of exports is very low from the state, setting up of this infrastructure by the private sector is not feasible. Therefore, to trigger the exports, initially, the government needs to take initiative in developing these facilities. Once the minimum required volume for export is arrived at, private sector players may find it feasible to invest in pack-houses infrastructure.

### Marketing Gaps:

Mango from Uttar Pradesh is, though famous in the domestic market for its test and flavor, has not been able to make a mark in the international markets, specifically the European Union markets. There are lacunae in the marketing and promotion of mango from Uttar Pradesh in these markets. Some of the specific marketing gaps, highlighted by the stakeholders are as under –

- i) **High cost of transportation** – Uttar Pradesh is a landlocked state, therefore, exports of mango from the major production cluster of Lucknow, either need land transportation up to Mumbai / Navi Mumbai and then through sea route or need air transportation from Lucknow, Varanasi or Delhi airport. In all the cost for the export of mangoes from Lucknow to a market in Germany, incur over 65% of the total landed price on outward transportation alone. This makes these mangoes uncompetitive in the markets. Therefore, there is a need to reduce transportation costs by increasing quantities and optimizing utilization. This incentive from the government can increase volumes of mango export to Europe multi-fold.
- ii) **Absence of export ecosystem in production cluster** – Promotion of export of any product from a specific cluster needs support from all the stakeholders and actors in a value chain, starting from farmers; pre-harvest and harvesting contractors; logistic services providers, concerned government officials at field level, pack-house operators, banking system, C&F agents and others
- iii) **Lack of awareness of the products in the market**– Mango from Uttar Pradesh is not available on retail shelves in targeted markets, therefore the customers in these markets are not aware of the quality and test of mango from Malihabad / Lucknow (Uttar Pradesh). This restricts in creating demand from importing countries.

Few other challenges, which have been identified from secondary review are, availability of fewer varieties for exports, limited cargo space, poor labelling and costly packaging (specific packaging for each produce made of bio-degradable materials only). In Uttar Pradesh other major challenge is lack of processing units, therefore, state is unable to export processed mango products.

Exporters also mentioned that in export markets, sometimes there is fear of 100% rejection of consignment at the destination port. For such risks, there is no support available from any government agency.

## 6. INTERVENTIONS TO ACCESS EU MARKETS

### 6.1 Potential Interventions

Given the nascent stage of exports from the region, targeting European markets for exporting mango from Uttar Pradesh will need interventions across the value chain. Based on the discussion with all the existing value chain players, different interventions have been proposed, which shall be taken up under the project. These interventions have been divided into i) Pre-harvest; ii) Post-harvest; iii) Market development and iv) Institutional support.

Stage of Value Chain	Proposed intervention	Implementation mechanism
Pre-harvest	Development and Introduction of export-oriented agronomical practices	<p>Promoting export-oriented agronomical practices and developing an aligned package of practices will need a commercial approach. Project shall take help of a commercial agency, which has experience of working in the export value chain as well as understands the orchard management aspect from scientific perspective. Detail PoPs shall be developed for different varieties grown in the production cluster. These PoPs shall have detailing of plant canopy management, intercultural operations, schedule of pesticides and fertilizer use as well as adoption of modern production practices (e.g. Drip Irrigation, Drone application, compatibility for integrating with weather forecasting, climate proofing etc.).</p> <p>These PoPs shall be deliberated thoroughly on scientific parameters and thereafter shall be promoted amongst the farmers.</p> <p>A dedicated programme, with specific targets for training and capacity building of key stakeholders, shall be planned for the complete year and there shall be provision to handhold farmers to ensure adoption of proposed PoPs in the field.</p>
	Promoting required certification at the field level (Global GAP / EURO Gap / Apeda certification / any other)	<p>Export of mango to European markets will need mango orchard certification as well as registration with a designated authority (APEDA). Given that the PoPs developed shall make orchards fulfill the certification requirement, the project shall facilitate certification of the orchards through organisation appointed by these agencies in India.</p> <p>Certification of orchard will also need awareness amongst the orchard owners, training and financial commitment. The project shall have required budgetary provision, having suitably converged with schemes of the Department of Horticulture (GoUP) and APEDA for desired outreach and adoption.</p>
	Developing a mechanism for	For the export of Indian mangos to some of the developed markets, there are high incidences of rejections. From 2002 to

Stage of Value Chain	Proposed intervention	Implementation mechanism
	product traceability	2019, out of the total refusal of mango lots in the USA, around 30% of refusals were of India-originated mangoes ( <a href="http://indianecologicalsociety.com/">http://indianecologicalsociety.com/</a> ; <a href="http://www.accessdata.fda.gov/scripts/importrefusals">http://www.accessdata.fda.gov/scripts/importrefusals</a> ). The project shall work with APEDA for setting-up a traceability system, wherein online systems shall be introduced such as GRAPNET.
	Selection and promotion of varieties compatible to importing market	For long-term, the project shall work parallel in identifying varieties, which have good demand in importing markets. Experiments shall be conducted for introducing these varieties in the Lucknow cluster. This will need a long-term plan of importing planting material, approvals from concerned authorities, field trials, commercial trials, and introduction in farmers' field. The project shall explore technical collaboration with institutions such as CISH-ICAR for taking up this scientific intervention.
Post-harvest	Cluster-based multi-product pack-houses	Operating an export pack-house for short (2-3 months) season is financially not feasible. This is one reason that no private sector player is coming forward to set-up pack-house for mango export in Lucknow cluster. To overcome this challenge, the project shall conduct scientific study to design a multi-product pack-house, which can handle mango during the season and other crops (fruits / vegetables) during off season (for mango). Project shall work in collaboration with APEDA to get the feasibility study done and also explore convergence with APEDA for promoting these facilities. This initiative shall also explore options for different types of public-private partnership models for ensuring viability of financial structure of the project.
	Financial and institutional support for export-oriented (Air/Sea) logistic protocol	As it has been highlighted in the price mark-ups of mango in export supply, the biggest cost component is transportation / air freight. To make product competitive in the market, this cost must be brought down. This will need financial support, at least during initial period of the project. This financial support (may be in terms of export transport subsidy) will trigger the export volumes. Once the minimum required volumes are achieved, capacity utilisation is optimised or logistic system is optimised, slowly these financial supports for logistics can be withdrawn.

Stage of Value Chain	Proposed intervention	Implementation mechanism
		Project shall conduct study to assess the unit economics and also to estimate the budgetary provision for proposing this intervention to the government. This will need convincing state government and APEDA to make necessary budgetary provisions and also to help them in designing the support structure.
	Product and market based innovative packaging material	As of now, small quantities of fresh mangoes are being exported to European markets and therefore, the development and design of packaging part has not been taken-up seriously. With increase of volumes, innovation will be needed in preparing cost-effective packaging, which is suited to the different markets as well as well-suited to long-haul transportation. This will require packaging material, which can sustain load, suitable for storage and transportation conditions (temperature, humidity etc.), fulfil food safety norms and other phytosanitary requirements of the importing countries. This may need collaborative research with the scientific institution (e.g. Indian Institute of Packaging) and packaging industry.
Market development	Product promotion in the destined markets	<p>Mangos from Uttar Pradesh have not been promoted adequately in the western markets and therefore customers are just not aware about the test of these mangoes. For stimulating the test buds of the consumers in destined markets, project shall plan targeted promotional activities, as listed hereunder –</p> <ul style="list-style-type: none"> <li>- Tie upup with major retailers for providing prominent space at retail shelves.</li> <li>- Taking up promotional activities in the well-planned manner (market testing, participating in exhibitions and fairs and other such activities).</li> <li>- Facilitating exposure to Indian exporters and other value-chain players in the markets.</li> <li>- Facilitating market linkages and networking by organizing focused trade-events.</li> <li>- Facilitating promotion of Joint / Individual brands of mangoes from Lucknow region.</li> </ul> <p>For conducting these activities, the project needs to collaborate with agencies such as APEDA, Indian Embassies in targeted markets, state government and other agencies.</p>
	Market identification for an exclusive window	European markets must be getting mangoes from different production areas in the world. There is need for identifying specific seasonal windows for Indian mangoes. This will need

Stage of Value Chain	Proposed intervention	Implementation mechanism
		comparative analysis and creating a niche during a particular time period of availability of mangoes from Uttar Pradesh.
Institutional Support	Training and capacity building of private sector stakeholders	<p>Training and capacity building of actors along the value chain is necessary for sensitisation of these stakeholders about the export market and its need as well as to make them capable to participate in the targeted markets. Project shall prepare a training calendar for following private sector stakeholders –</p> <ul style="list-style-type: none"> <li>- Orchard owners</li> <li>- Orchard caretakers</li> <li>- Pre-harvest contractors and aggregators</li> <li>- Pack-house operators</li> <li>- Exporters</li> <li>- Field level Government officials (facilitating exports)</li> </ul>
	Efficient convergence with public sector schemes	<p>Different government departments at Central and state level have large number of schemes and programmes in which provision for various proposed components must already be existing. However, the implementation of these interventions remains a challenge due to various field level issues. The project shall identify these programmes/scheme components and shall try to ascertain bottleneck or pain area for the concerned department. Based on this assessment, convergence plan shall be designed and implemented. This will need collaboration with different departments at different level of hierarchy (at Central, State and District level).</p>

Implementation of proposed intervention will need a complete project set-up at the state level. Project shall select and prioritise these activities in consultation with the Government partners and considering the available financial resources. In addition to this, project will also need identification of project partners for implementing activities on the ground.

## 7. Actional Intervention

Stage of Value Chain	S. No.	Proposed actionable intervention	Responsibility
Pre-harvest	1.	Development and Introduction of export-oriented agronomical practices	Central Institute for Subtropical Horticulture-Rehman khera, P.O, Kakori, Uttar Pradesh 226101
	2.	Promoting required certification at the field level (Global GAP / EURO Gap / APEDA certification / any other)	Indo-German Cooperation on Agricultural Market Development, APEDA and State Horti dept
	3.	Developing a mechanism for product traceability	-Do -
	4.	Selection and promotion of varieties compatible with importing market	Central Institute for Subtropical Horticulture-Rehmankhera, P.O, Kakori, Uttar Pradesh 226101
Post-harvest	5.	Cluster-based multi-product pack-houses	State Horti Dept-APEDA and State Agricultural Marketing Board
	6.	Financial and institutional support for export-oriented (Air/Sea) logistic protocol	Directorate of Agricultural Marketing and Foreign Trade and APEDA
	7.	Product and market-based innovative packaging material	Indian Institute Packaging and Industry expert
Market development	8.	Product promotion in the destined markets	APEDA and Indo-German Cooperation on Agricultural Market Development-
	9.	Market identification for an exclusive window	