PHILIPPINE MANGO INDUSTRY ROADMAP 2021-2025

DEPARTMENT OF AGRICULTURE
1898

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PHILIPPINE MANGO INDUSTRY ROADMAP 2021-2025

Department of Agriculture
HIGH VALUE CROPS DEVELOPMENT PROGRAM

The Philippine Mango Industry Roadmap (2021-2025)

Published by:

Department of Agriculture - Bureau of Agricultural Research
through the UPLB Foundation, Inc.
in collaboration with the *Philippine Council for Agriculture and Fisheries*

Coordinating Office:

High Value Crops Development Program
Department of Agriculture
Diliman, Quezon City, Philippines

Cover & Book Design:

Alphabet Communications Graphics & Print
Quezon City, Philippines
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ACRONYMS AND ABBREVIATIONS

ACPC	Agricultural Credit Policy Council
AFID	Agriculture and Fisheries Information Division
AMAS	Agribusiness and Marketing Assistance Service
ATI	Agricultural Training Institute
BAFE	Bureau of Agricultural and Fisheries Engineering
BAR	Bureau of Agricultural Research
BARMM	Bangsamoro Autonomous Region of Muslim Mindanao
BEC	Brick-Walled Evaporative Cooler
BPI	Bureau of Plant Industry
CA	Controlled Atmosphere
CAGR	Compound Annual Growth Rate
CALABARZON	Cavite, Laguna, Batangas, Rizal, Quezon
CAR	Cordillera Administrative Regiom
CCMAP	Cecid Fly Control and Management Action Plan
CIF	Cost, Insurance, and Freight
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DA	Department of Agriculture
DAFI	dDays After Flower Induction
DOST PCAARRD	Department of Science and Technology - Philippine Council for Agriculture, Aquatic, and Natural Resources Development

DRC	Domestic Resource Cost
DTI	Department of Trade and Industry
EU	European Union
EUP	Experimental Use Permit
FOB	Free on Board
FTA	Federal Trade Agreement
GAP	Good Agricultural Practices
GVA	Gross Value Added
GDP	Gross Domestic Product
GVC	Global Value Chain
ha	Hectare
HVCDP	National High-Value Crops Development Program
HWT	Hot Water Treatment
ICTS	Information and Communications Technology Service
IPB	Institute of Plant Breeding
IQF	Individual Quick Frozen
IRM	Insecticide Resistance Management
ISP	Industry Strategic Science and Technology Program
kg	Kilogram
LGU	Local Government Units
MIMAROPA	Mindoro, Marinduque, Romblon, Palawan
MIRDT	Mango Industry Roadmap Development Team
m	Meter
MOA	Mode of Action
MT	Metric Ton
NSIC	National Seed Industry Council

NSPP	Non-Woven Spun-Bond Polypropylene
NSQS	National Seed Quality Control Services
NSW	New South Wales
°C	Degree Celcius
PCIC	Philippine Crop Insurance Corporation
PEF	Pulsed Electric Field
PhilMech	Philippine Center for Postharvest Development and Mechanization
PhP	Philippine Peso
PMI	Plant Material Inspector
PMIFI	Philippine Mango Industry Foundation, Inc.
PNE	Plant Nursery Evaluators
PNS	Philippine National Standards
ppm	Parts per Million
PRDP	Philippine Rural Development Project
PRS	Policy Research Service
PSA	Philippine Statistics Authority
PSB	Philippine Seed Board
R&D	Research and Development
R4D	Research for Development
RA	Republic Act
RCR	Resource Cost Ratio
RLOFT	Regional Loan Facilitation Team
RFO	Regional Field Office
ROI	Return of Investment
ROS	Research Outreach Station
SHDPE	Spun-Bond High-Density Polyethylene

SOCCSKSARGEN	South Cotabato, Cotabato, Sultan Kudarat, Sarangani and General Santos City
SPS	Sanitary and Phytosanitary
SUC	State Universities and Colleges
TWG	Technical Working Group
UMSP	United Mango Stakeholders of the Philippines
UN SDG	United Nation's Sustainable Development Goal
UPLB-CAFS	University of the Philippines Los Baños College of AgriCulture and Food Science
USDA	United States Department of Agriculture
USD	United States dollar
USM	University of Southern Mindanao
VHT	Vapor Heat Treatment
VSU	Visayas State University

MESSAGE

In the wake of unprecedented events and emerging crises, the Department of Agriculture (DA) launched the Plant, Plant, Plant Program to ensure that all Filipino families would have adequate supply of nutritious, healthy, accessible and affordable food to meet the demands of these challenging times.

As a testament of our firm resolve to triumph over this formidable foe, the DA was re-energized to act as one, but is committed at the same time to delivering results from various projects under the different major programs of the Department.

In light of this, I wish to congratulate all the principal actors who paved the way for the crafting and updating of High Value Crops Development Program (HVCDP) Roadmap. Through the completion and publication of this HVCDP Roadmap, we enshrine the spirit of excellence, collaboration, and resilience as inherent characteristics of our agricultural inheritance and legacy.

The progressive cross-cutting and continuing collaboration among all stakeholders in pursuit of attaining competitive advantage and relevant growth is an output designed into the pages of this roadmap.

I am proud and grateful that such a focused work on this commodity could be undertaken to ensure that a brighter future for the industry can reasonably be expected and attained because this blueprint already exists to assure it.

Marami pong salamat at Mabuhay!

WILLIAM D. DAR, Ph.D.
Secretary
Department of Agriculture

FOREWORD

The Covid-19 pandemic that ravaged life and livelihood in the country for almost 2 years now proved to be an existential threat to our way of life. On the positive side, it elicited generosity and a sense of community in all of us, and became a catalyst of change in many areas of our lives.

It is in these multi-faceted circumstances that the High Value Crops & Rural Credit (HVCRC) of the Department of Agriculture (DA), working collaboratively with various stakeholders and industry experts, undertook the needed updating of this industry roadmap as an integral part of the Secretary of the Department of Agriculture, Dr. William D. Dar's 18 transformative strategies, and formulated in alignment to his **One-DA to Transform Vision** of Philippine Agriculture, in order to achieve a Food Secure and Resilient Philippines, with empowered and prosperous farmers and fisher-folk. While this industry roadmap is the handiwork of many minds and multi-stakeholders, in its core it subscribes to the interdependent and inter-related approaches of **Industrialization, Farm Consolidation, Mechanization, and Professionalization** as pillars of its foundation.

This roadmap is envisioned to serve as a guide to all industry stakeholders for the realization of the targets set in it for 2021 – 2025. It is an embodiment of how the industry will achieve its goals of transformative growth through the value chain approach, as well as increase in quality and sustained yields and incomes. It is with pride and pleasure that I express my heartfelt gratitude to everyone both in the private sector and government, who unselfishly lent their time and talent for this timely and necessary endeavor. More than the lofty legacy and memorable milestone we shall leave behind because of this worthwhile work, it is more the comfort in the knowledge that the entire industry would have a clear pathway to follow in the years ahead to realize its vision that is truly more meaningful to remember us all by. Thank you.

EVELYN G. LAVIÑA
Undersecretary for High Value Crops and Rural Credit
Department of Agriculture

PREFACE

The Mango Roadmap Development Team, composed of representatives from farmer groups, private sector, research institutions, academe, and national government agencies, would like to thank the DA - High Value for facilitating this collaboration to upgrade the national and global status of the mango industry.

Series of on-line consultations with the different sectors of the value chain, data validation citing different sources, and other relevant activities had been conducted to come up with a better and more comprehensive mango roadmap.

For a more effective implementation of this roadmap, we would like to ask support from the Local Government Units (LGUs) of mango-producing areas to craft their respective mango roadmap attune to their industry needs, citing the National Mango Roadmap. It is primarily the task of the LGUs to protect & improve the industry through the formulation of local ordinances. The Agriculture & Fishery Councils (AFCs) can be one of the platforms through crafting resolutions. We would also like to highlight the importance of the other stakeholders of the mango industry. We would also like to enjoin the participation and support of our farmers, SUCs and other research institutions and organizations, government agencies and most of all the private sector. We all need to work hand in hand to make this roadmap happen for our country's national fruit, the Philippine Mango.

Together let's make our mango industry the sweetest in the world!

RAMON P. MARAÑON, Guimaras Mango Growers and Producers Development Cooperative
Team Leader
Mango Industry Roadmap Development Team

EXECUTIVE SUMMARY

The Philippine Mango Industry Roadmap 2021-2025 lays the short-term strategic direction of the mango industry both local and international. It serves as a guide for the Philippine government to make sure that its investment decisions are aligned with the priorities of the industry, with the collective approval of the different stakeholders of the mango industry.

Where are we?

The Philippine mango industry has been on a continuous decline in all indicators of industry performance which includes production volume, productive area, as well as yield per unit area and yield per tree, as summarized in the table below:

Year	Production		Area		Yield per unit area		Yield per tree	
	Metric ton (MT)	Growth Rate	hectare	Growth Rate	In MT/ ha	Growth Rate	Kg/tree	Growth rate
2000-2009	925,247	-0.7%	163,106	3.9%	5.7	-4.5%	No data available	No data available
2010-2020	793,296	-0.93%	187,530	-0.14%	4.2	-0.80%	86.1	-2.1%
2016-2020	747,987	-2.3%	186,630	-0.14%	4.0	-0.94%	78.4	-2.2%

Also, the mango export industry is not performing as well as in the previous decades. Despite this, the industry remains to be the third highly exported fruit crop in the Philippines, recording a gross value added of PhP 35.520 billion and 1.95% contribution to the major industry in 2020.

The challenges of the industry are scattered across the value chain. Product registration has been challenging for input supply due to regulation. Among the most heavily affected are the producers – mango trees are becoming unproductive due to the prevalence of pests such as the cecid fly and diseases such as anthracnose. In addition, production costs have become too high that there have been recorded incidences of farmers shifting

to other crops. Similarly, postharvest players and processors have experienced high postharvest losses as well as few postharvest and processing facilities that can cater to mango products. It was agreed that these challenges experienced by these players result from poor practices due to limited knowledge on proper cultural practices, as well as the low adoption rate of technologies introduced by R&D institutes and state universities and colleges. As for the marketing aspect, the identified challenges include limited access to resources and direct markets, unstable supply and prices, inadequate knowledge on available financial insurance and loan programs, multi-layer marketing, difficulty in accessing export markets, lack of export incentives, and indirect support in lowering costs for processors.

Where do we want to go?

"A sustainable and resilient Philippine Mango industry offering competitive and world-class mangoes through innovation and inclusivity" – this is the identified and agreed mission of the stakeholders who participated in the crafting of this Industry Roadmap 2021-2025.

"Prosperous mango growers and stakeholders" is the envisioned outcome of the Philippine mango industry stakeholders by the end of 2025.

To achieve this, five focus areas were identified and packaged into the following objectives of this Roadmap:

a. Stabilize and increase mango production
b. Improve productivity and efficiency
c. Reduce postharvest losses
d. Expand market access
e. Ease access to information and quality standards

These objectives would aim to achieve the targets specified for 2021-2025 as indicated in the Table below:

Year	Area (ha)			Yield	Projected Production (MT)			Number of Trees Harvested			Ave. Yield per Tree (kg)			Annual Increase (MT)	No. of Trees for Re-habilita-tionc	Total In-vestment at PhP 650 per tree (in '000)
	Carabao	Others	Total		Carabao	Others	Total	Carabao	Others	Total	Carabao	Others	Total	Carabao		
2021	146,634	40,552.07	187,185.76	4.16	609,315.03	168,508.25	777,823.28	7,319,941	2,352,734	9,672,675	83.24	71.62	80.41	13,004.49	88,198	57,328.70
2022	147,142	40,552.07	187,693.76	4.36	641,997.25	176,933.66	818,930.91	7,408,942	2,352,734	9,761,676	86.65	75.20	83.89	32,682.22	89,001	57,850.65
2023	151,557	0,552.07	192,109.49	4.58	694,326.80	185,780.34	880,107.15	7,906,363	2,352,734	10,259,097	87.82	78.96	85.79	52,329.55	497,421	323,323.49
2024	152,998	40,552.07	193,550.15	4.81	735,973.21	195,069.36	931,042.57	8,387,906	2,352,734	10,740,640	87.74	82.91	86.68	41,646.41	481,543	313,003.08
2025	153,717	0,552.07	194,269.28	5.05	776,404.10	204,822.83	981,226.93	8,861,061	2,352,734	11,213,795	87.62	87.06	87.50	40,430.89	473,155	307,550.85

a Based on the 5% target of improving productivity and efficiency
b Based on the mango seedlings planted from 2016-2021
c Based on the 5% of the mango trees harvested in 2014

Specifically, the given areas for expansion and number of trees were the basis of the abovementioned targets:

	Increase in area harvested	No. of trees
2021	387.69	40,549
2022	508.00	56,796
2023	4,415.73	258,733
2024	1,440.66	60,635
2025	719.13	50,339

How do we get there?

This updated Roadmap is an output crafted and owned by the stakeholders of the Philippine Mango Industry. They are the representatives from farmers organizations, agricultural input suppliers, processors, local and export distributors, researchers, academicians, policy makers, and different national government agencies spearheaded by the Department of Agriculture and its bureaus, councils, and research institutes, with active participation from partners like the Department of Science and Technology and the Department of Trade and Industry.

The objectives and key strategies in which the stakeholders agreed include.

1. Stabilize and increase production:
   a. Reduce losses due to Cecid fly and other major pests
   b. Expand production areas
   c. Provide farm input subsidy
   d. Mainstream local weather data and drought forecast in mango orchard management during the off-season

2. Increase productivity and production efficiency comparable to global competitors
   a. Strengthen R4D on varietal development, pest and disease management
   b. Farm clustering and consolidation
   c. Credit support
   d. Strengthening of extension services and information dissemination
   e. Modernization (mechanization) of farming practices
   f. Diversification of income sources
   g. Establishment of policies, standards, and ordinances for quality plantation management, and strict harvesting standards
   h. Strengthening of national mango organizations

3. Reduce postharvest losses

   a. Strengthening of extension services and information dissemination

   b. Strengthening R&D on mango post-harvest

   c. Modernization (mechanization) of pre- and post-harvest handling practices as well as transportation and storage facilities

   d. Increased availability and access to available and functional post-harvest facilities and equipment

   e. Utilization of rejected fruits and by-products

4. Expand market access for mango

   a. Mobilization of partners

   b. Export promotion and development

   c. Food Safety and Product Quality

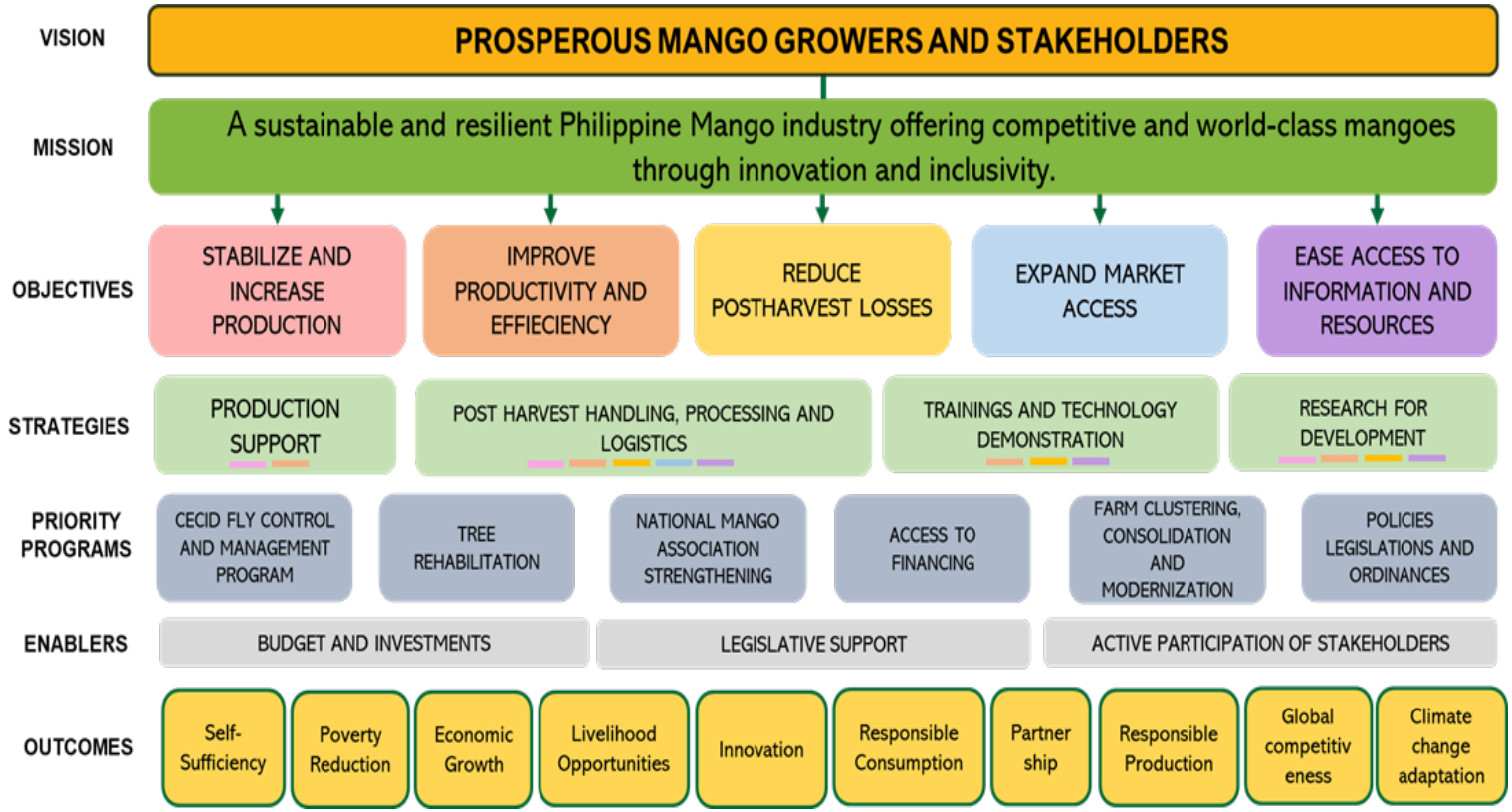
5. Ease access to information and resources

   a. Establishment of Agri-Business Centers

   b. Strategic communication

The group will actively participate, collaborate, and work together to the attainment of short-term goals, while concurrently working towards the realization of the medium-term and long-term goals.

The framework below layouts the strategic direction the Mango Industry Roadmap aims to achieve from 2021-2025.



INTRODUCTION

Rationale

The updating of the Mango Industry Roadmap for the year 2021-2025 complies with the Memorandum Order No. 37, Series of 2021 by the Office of the Secretary of the Department of Agriculture (DA). It is among the ways forward identified during the National Food Security Summit 2021. It stands out among the previous roadmaps as it puts value on the active participation and collaboration of the different stakeholders- both public (i.e. government agencies) and private (i.e. mango farmer organizations, and private businesses) sectors within the mango value chain.

This Mango Industry Roadmap 2021-2025 is anchored to the Philippine Republic Act 8435 – Agriculture and Fisheries Modernization Act of 1997, United Nations' Sustainable Development Goals (UN SDGs) 2030, Ambisyon Natin 2040, and the Philippine Development Plan 2017-2022. Specifically, this updated Roadmap would address the following:

1. at the national level, achieve self-sufficiency while lifting farmers from poverty; and
2. at the global level, enhance global competitiveness while addressing global issues challenges such as those stated in the UN SDGs and the becoming more rigorous food quality standards

Moreover, the Mango Industry Roadmap 2021-2025 would:

1. Engage a wide range of stakeholders in the agriculture value chain and ensure that the stakeholders will have ownership of the processes and outputs;
2. Level up the mango sector through the identified 18 Key Strategies of the Department of Agriculture of the One DA Reform Agenda ; and
3. Anchor in the DA Food Security Framework – with the vision of a food secure and resilient Philippines with empowered and prosperous farmers and fisherfolks and pursue the "OneDA" and the "OneNation" approaches.

Objectives

The general objectives in updating the Mango Industry Roadmap are to ensure the survival of the mango producers; to increase the industry's resiliency to climate change; to provide safe nutritious, affordable, and accessible products to consumers throughout the year; to provide opportunities for all segments in the value chain to modernize; to be globally competitive and strengthening foothold in export markets where the Philippines has a competitive advantage.

The specific objectives were to:

1. Provide a profile, the prospects, and trends in the mango industry including current situation and environment, global and domestic and relevant benchmarks on production technology and costs, competitive measures, and other trends;
2. Analyze the mango supply/value chain;
3. Set goals and objectives which will operationally flesh out the shared vision, quantify targets along a timeline with indicators of production, resource and cost efficiency and competitiveness; the rationale and directions of the proposed strategies and programs; and
4. Recommend strategies, programs, budgetary, and other resource requirements to achieve the set goals, objectives, and targets.

Scope of the Industry Roadmap

Given the short-term timeline 2021-2025, this mango industry roadmap focuses on the enhancement of existing and economically relevant products. Specifically, urgent needs of food products derived from the Carabao Mango variety will be given priority due to its demand in the export market. The export market is also given focus to increase its utilization share in the average gross supply (only 2% as opposed to 96% local consumption). Other aspects of the industry are categorized under medium- and long-term goals and will be highlighted in the succeeding roadmaps.

INDUSTRY SITUATION AND OUTLOOK

Industry Definition

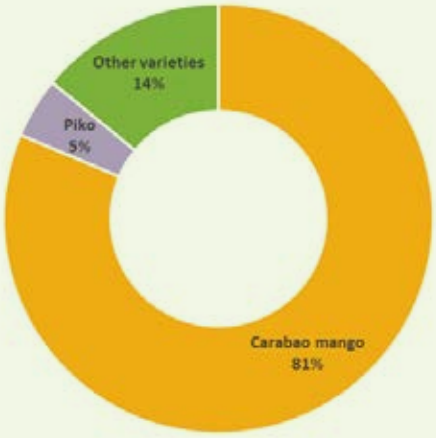
Mango (Mangifera indica, Linn) is a perennial evergreen tree of the family Anarcadiacea. It is native to South Asia and has spread worldwide, becoming one of the most cultivated fruit trees in the tropical region. Its tree is long-lived and can remain productive even at the age of 300 years. It bears a sweet aromatic kidney-shaped drupe fruit that is now a globally prized commodity.

The mango fruit is a highly important commodity in the Philippines. It is claimed to be the country's national fruit and is consumed by many Filipinos in different product forms. Its industry also plays an important role in the country's economy, providing livelihood to around 2.5 million farmers (DOST-PCAARRD, 2011), and being the country's third most exported fruit crop, next to banana and pineapple.

Variety

There are three well-known varieties of mango in the Philippines — Carabao mango, Pico, and Katchamita (also known as Indian Mango). The fruit of Carabao mango is elongated and kidney-shaped, characterized by thin yellow pulp, and has a very tender taste and slight aroma. The fruit of the Pico variety has a distinct beak on the apex and has a fibrous light orange-yellow flesh. Katchamita's fruit, on the other hand, is small and rounded, has green skin and yellowish flesh. Among the three, Carabao mango is the most cultivated – known to be the world's sweetest mango, hence, has high demand both in the domestic and global market (Figure 1). Other widely grown varieties include Apple mango, Pahutan, Paho, and Señorita. Meanwhile, the varieties Cambodiana and Hawaii are exclusively grown in Batangas and Pangasinan, while Duldul, Florida, Spanish, Mestiza, and Zambales are only grown in Davao City and Davao del Sur.

FIGURE 1. PERCENT VOLUME OF PRODUCTION PER MANGO VARIETY, 2010-2020



Source: PSA, 2020

Nutritional Value

The mango fruit is a highly nutritious food of low-calorific content (70 calories per 124 grams serving size) (USDA, 2016). A ripe mango fruit provides a high level of Vitamin A while the unripe form provides Vitamin C. It also provides more carotenoids than most other fruits while giving low-calorie content. Its high fiber content also makes it a good aid for digestion.

Mango Industry Players

The supply chain of the mango industry consists of (1) the input supplier of planting materials, agricultural inputs, and post-harvest supplies; (2) the producer who includes the growers, spray contractor, and spotters; (3) the consolidator/trader; (4) the processor; (5) the exporter; and (6) the retailer (Table 1). Among these players, the spray contractor is identified as unique in the mango industry. They are responsible for the actual mango production – from flower induction, crop protection, harvesting, and marketing.

The mango industry players have already organized themselves into producers and/or trade associations, located in different areas in the country. It is estimated that around 60% of mango producers is a member of a farmers' organization, be it exclusive for mango or assorted crops.

TABLE 1. SUPPLY CHAIN KEY PLAYERS OF THE PHILIPPINE MANGO INDUSTRY

Key Players	Description
Input Suppliers	
Planting materials	These include accredited nurseries which supply certified grafted seedlings of NSIC-registered varieties
Agricultural inputs	These include manufacturers and/or traders of tools, equipment, fertilizers, paper bags, pesticides, and others
Post-harvest supply	This includes manufacturers and traders of plastic crates, bamboo baskets, etc.
Producers	
Growers	These are the farmers or orchard owners who plant and take care of the mango trees
Spray Contractor	These are people who enter into a contract agreement with the mango growers based on an agreed sharing scheme. Contract sprayers may themselves "buy" the share of orchard owners.
Spotters	Usually, under the employment of spray contractors, the spotters are responsible for identifying potential mango farms for spray contracting. They look for bearing-age trees that are ready for flower induction and fruiting.
Consolidator/ Wholesalers/Traders	
These are multi-commodity traders who source mango fruits from several farms, spray contractors, and fellow traders and sell the fruits to big bulk buyers like processors and exporters. They may also be engaged in the trading of other commodities like vegetables and other fruits.	
Processors	
These are food manufacturers which process the mango fruits into purees, dried mangoes, candies, preserves, and other products both for local and export markets.	
Exporters	
These are traders or companies who buy exportable-quality fresh mangoes that meet the requirements and comply with the quality standards of importing markets in Japan, Hong Kong, the USA, and other countries.	
Retailers	
These include supermarkets, fruit vendors, public markets, and chained retailers	

Product Forms

The mango industry is producing a variety of product forms. The majority of it is utilized as food, be it a fresh fruit – both in ripe and unripe forms or as a processed product. In its fresh form, aside from eating its flesh directly, it is also used as the main ingredient in confectioneries and other desserts like juice and shake. Meanwhile, most of the processed products for domestic consumption come from fruits which failed to pass the quality and visual standards of the market. They act as substitutes, particularly during mango off-season. It is important to note that these food products are mainly of Carabao mango variety, as it is the most cultivated, and has the distinct flavor and aroma necessary for processed food.

As for export, around half of the exported mango food products are fresh mango. The remaining half is processed which includes dried mango, mango puree, frozen mango, and other prepared and/or preserved mango products.

Table 2 lists the different food products from mango fruit.

TABLE 2. FRUIT PRODUCTS FROM MANGOES

Fresh Fruit		Processed	
Ripe	Unripe		
•Confectioneries	•Mango juice	•Mango puree/ concentrate	•Mango vinegar
•Mango slice for halo-halo	•Mango shake	•Dried mangoes	•Glazed or crystalized
•Mango scoop for ice cream	•Salad	•Mango bar	•Mango chips
•Mango slice for bakery products	•Mango dessert with shrimp paste	•Mango candy	•Mango butterscotch
•Mango juice		•Mango jam	•Mango empanada
•Mango milkshakes and smoothies		•Mango wine	•Mango otap
		•Mango essence	•Mango hopia
		•Canned mango pulp or slice	•Mango barquillos
		•Mango chutney	•Mango pizza
		•Mango ketchup	•Powdered mango
		•Mangorind	•Dried mango from puree
		•Pickled mangoes	•Chocolate mango
		•Mango cider	

Aside from the fruit flesh, other parts of the mango tree, as well as by-products of the food industry are utilized albeit may not be economically relevant from a national standpoint. These include:

- Mango seeds for nursery planting materials
- Mango seeds and save for fresh
- Mango peel seeds, leaves, branches for organic fertilizer
- Mango wood for lumber and furniture
- Specialized fruit leaves and plant extract for drugs and medicine

Other products are only in their initial stage of development such as pectin for edible coating from mango peels, and starch from mango seeds, among others.

Industry Performance and Outlook

The performance of the Philippine mango industry both locally and globally is measured through the following indicators: production, the area planted/harvested, yield, consumption, trade, and prices.

Overall, the country's mango industry has shown a negative performance, evident in the following industry performance indicators:

- The decreasing volume of production,
- Relatively stagnant area expansion and number of trees harvested
- Declining yield per hectare and stagnant yield per bearing trees
- Low planting density of mango trees
- Declining mango exports
- Increasing farm gate price, and wholesale price

Specifically, the past 5 years (period 2016-2020) were the lowest performance of the Philippine mango industry in the last 2 decades (Table 3). Among major reasons for this trend is the persisting problem of cecid fly, high production costs, farmers shifting to other economic crops for livelihood, and high postharvest losses, among others.

TABLE 3. AVERAGE GROWTH RATES OF PRODUCTION, AREA HARVESTED, AND YIELD OF MANGO, 2000-2020.

Year	Production		Area		Yield per unit area		Yield per tree	
	MT	Growth Rate	hectare	Growth Rate	In MT/ ha	Growth Rate	kg/tree	Growth rate
2000-2009	925,247	-0.7%	163,106	3.9%	5.7	-4.5%	No PSA data**	No PSA data
2010-2020	793,296	-0.93%	187,530	-0.14%	4.2	-0.80%	86.1	-2.1%
2016-2020*	747,987	-2.3%	186,630	-0.14%	4.0	-0.94%	78.4	-2.2%

Source: PSA 2020
*Performance of the industry in the past 5 years
**NO PSA data was published. Available data from BAS is 2002-2008 (Lantican et al., 2013): average yield per tree: 0.14 tons/tree; average annual growth rate: -4%

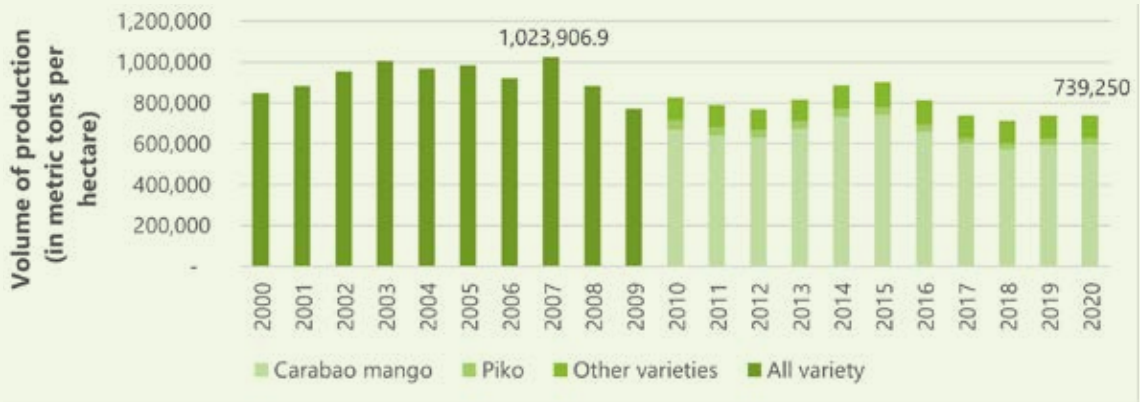
Production

The Philippine mango industry has been facing the challenge of unstable fruit production since 2008 and has continued to decline even at present times (Figure 2). Specifically, the overall average growth rate of mango production is negative, recording -0.93% from 2010-2020.

In particular, the last 5-years (2016-2020) is the country's lowest performance in the last 2 decades. On average, the country was only able to produce an annual average of 747,987.2 MT of mango from 2016 to 2020. This is 19% lower than what the country produced during the early 2000s (2000-2009).

Around eighty percent (80%) of the country's total mango production is Carabao mango; hence is the main driver of the volume trend. Meanwhile, the Piko variety is produced at only 5%, and the remaining 14% is comprised of other varieties such as Katchamita (Indian mango), Apple mango, Florida mango, Keit, Valencia, and others.

FIGURE 2. VOLUME OF PRODUCTION OF THE PHILIPPINE MANGO INDUSTRY, 2010-2020



Source: PSA, 2020
Note: Disaggregation data of mango variety is not available 2000-2009

Top-producing regions

From 2010-2020. The mango production in the country is dominated by the Ilocos Region, comprising 29% of the country's total volume of production from 2010-2020 (Table 4). However, despite its significant share in production, its growth rate has declined by an average of 4.5% in the last 10 years. The next top producing regions include Zamboanga Peninsula (11%), Central Visayas (9%), Central Luzon (7%), and SOCCSKSARGEN (7%). There are very few recordings of average growth rates in these Regions (except for Central Luzon) in the past 10 years, recording only less than 2%. Central Luzon, on the other hand, experienced a negative average growth rate of 2.65%.

TABLE 4. AVERAGE REGIONAL VOLUME PRODUCTION OF MANGO FROM 2010-2020.

Region	Average volume of production, all varieties, 2010-2020 (MT)	Average growth rate, 2010-2020
CAR	3,191	-4.02%
Ilocos Region	231,977 (1st)	-4.49%
Cagayan Valley	49,469	0.19%
Central Luzon	58,192 (4th)	-2.65%
CALABARZON	50,136	-0.03%
MIMAROPA	13,194	6.73%
Bicol Region	1,751	2.49%

Region	Average volume of production, all varieties, 2010-2020 (MT)	Average growth rate, 2010-2020
Western Visayas	49,045	0.48%
Central Visayas	72,656 (3rd)	1.02%
Eastern Visayas	639	-4.87%
Zamboanga Peninsula	89,259 (2nd)	0.68%
Northern Mindanao	46,264	3.77%
Davao Region	44,319	5.36%
SOCCSKSARGEN	55,214 (5th)	1.89%
Caraga	16,492	3.04%
BARMM	11,499	3.85%
PHILIPPINES	793,296	-0.93%

Source: PSA, 2020

From 2016-2020. The period 2016-2020 is the lowest performance of the Philippine mango industry in terms of mango production in the past 20 years. The Ilocos Region remains to be the top producer of mango, followed by the Zamboanga Peninsula, Central Visayas, SOCCSKSARGEN, and Northern Mindanao. Among these top-producing regions, only Central Visayas and SOCCSKSARGEN have a steady increase from 2016 to 2020. Central Luzon, a known-top producing region fell to the 9th spot and was surpassed by Western Visayas. Table 5 shows the regional volume of production in the past 5 years.

TABLE 5. REGIONAL VOLUME OF PRODUCTION, 2016-2020.

Region	VOLUME OF PRODUCTION (MT)				
	2016	2017	2018	2019	2020
CAR	3,102	2,878	2,718	2,896	2,399
Ilocos Region	209,375	194,042	167,594	178,540	178,244
Cagayan Valley	60,855	48,625	47,507	45,110	50,109
Central Luzon	61,998	48,957	44,166	41,900	46,525
CALABARZON	50,465	41,195	40,754	46,846	40,678
MIMAROPA	14,939	15,399	15,725	17,181	18,086

Region	VOLUME OF PRODUCTION (MT)				
	2016	2017	2018	2019	2020
Bicol Region	1,888	1,879	2,347	2,106	1,840
Western Visayas	50,062	48,852	49,057	54,015	51,421
Central Visayas	66,539	68,219	73,545	80,149	74,164
Eastern Visayas	504	485	484	514	498
Zamboanga Peninsula	114,910	86,425	78,275	77,008	73,738
Northern Mindanao	50,753	49,548	50,705	52,571	53,449
Davao Region	52,765	52,337	53,355	45,197	48,243
SOCCSKSARGEN	46,902	47,797	52,480	59,994	64,824
Caraga	17,121	18,195	18,533	18,980	19,806
BARMM	11,879	12,198	14,416	14,932	15,227
PHILIPPINES	814,055	737,032	711,660	737,938	739,250

Source: PSA, 2020

Top-producing provinces

In terms of provinces, Pangasinan of the Ilocos Region produces the highest volume of mango from 2010-2020, with an average of 130,982 MT. This amount is 56% of the Ilocos Region's total production, and 16% of the country's total production. It was then followed by Zamboanga del Norte in the Zamboanga Peninsula and Cebu in Central Visayas at 50,315 MT and 39,099 MT, respectively. These three provinces remain to be the country's top-producing countries even within the current year 2020. Table 6 shows the top mango-producing provinces in the country.

TABLE 6. PRODUCTION RANKING OF TOP MANGO-PRODUCING PROVINCES, 2010-2020

Rank	Province	Average production, 2010-2020, in MT
1	Pangasinan	130,982
2	Zamboanga del Norte	50,315
3	Cebu	39,099
4	Davao del Sur	32,502
5	Batangas	30,684
6	Ilocos Norte	26,981

Rank	Province	Average production, 2010-2020, in MT
7	Cotabato	26,526
8	Iloilo	22,058
9	Misamis Occidental	21,058
10	Negros Oriental	17,542

Source: PSA, 2020

Production Seasonality

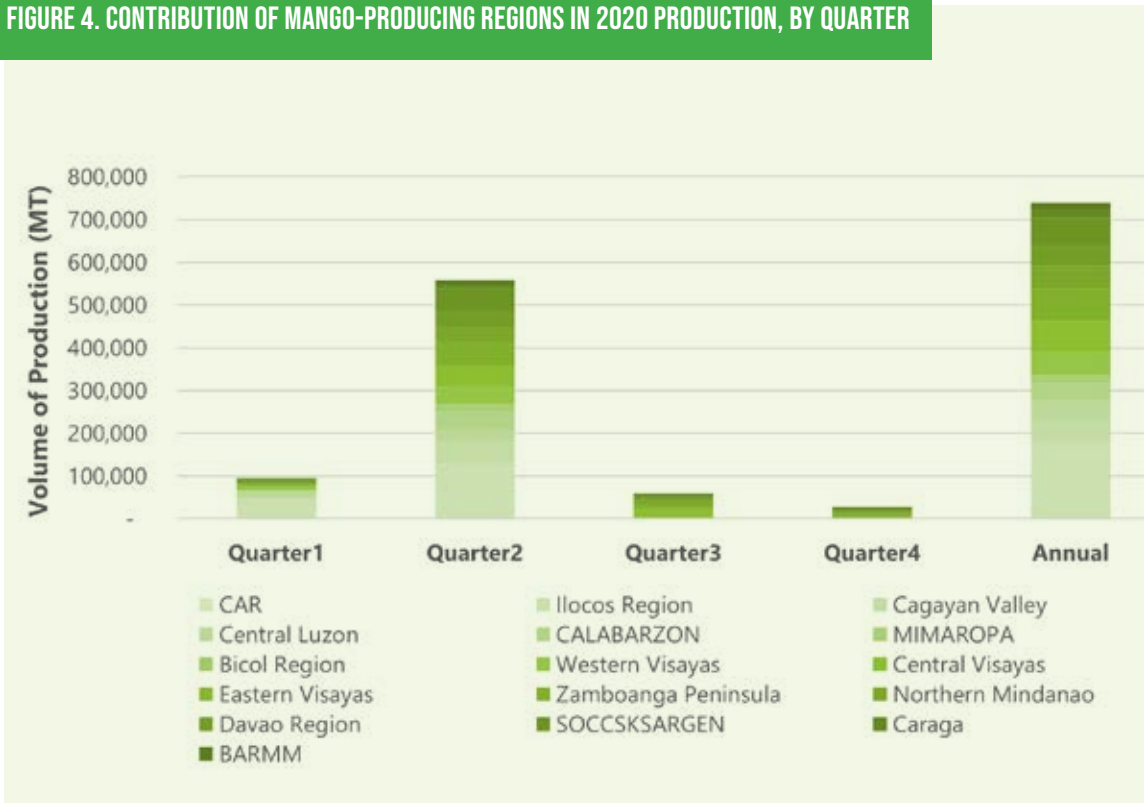
The volume of production in the Philippines is affected by its seasonality. The normal season for the Philippines is during Quarter 2; hence, around 70% of the country's total annual production happens during this quarter (Figure 3). The seasonality of mango production affects the pricing of mango – it is lowest during Quarter 2, with a ripple effect until July. Prices are highest during the off-season months of August to December.

In 2020, the Luzon Region had the highest share of production for Quarters 1 and 2 at

FIGURE 3. THE PHILIPPINE VOLUME OF PRODUCTION PER QUARTR, FROM 2010-2020

52% and 23%, respectively. Central Visayas supplied 35% of the country's production in Quarter 3 while Caraga supplied 25% in Quarter 4. Figure 4 shows the percentage share of each Region per Quarter.

FIGURE 4. CONTRIBUTION OF MANGO-PRODUCING REGIONS IN 2020 PRODUCTION, BY QUARTER



Causes of production decline

The declining production of mango is caused by several inter-related factors.

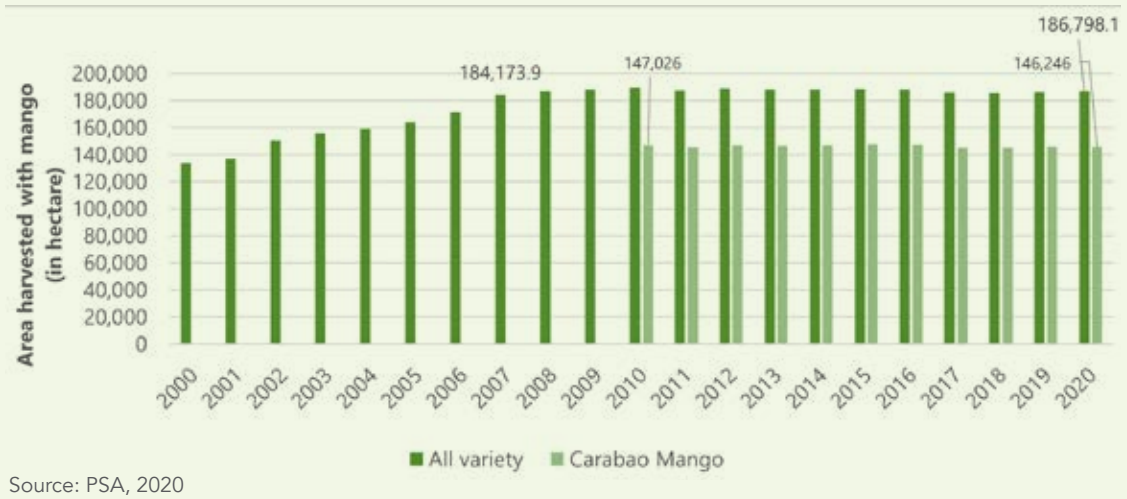
1. Cecid fly infestation and accompanying impacts. As identified by many stakeholders, the worsening cecid fly infestation (i.e. Kurikong disease) particularly in Luzon has been the root cause of many problems. The lack of identified long-term solutions and lack of cost-efficient management methods resulted in additional production costs such as increased use of insecticides, and the necessity to hire skilled baggers from other provinces. This resulted in decreasing number of contract sprayers, attributing it to a lack of capital. As stated by production players in Luzon, around 70% of mango trees in Luzon are not productive anymore (MIRDT, 2021a).

2. High Postharvest Losses. High postharvest losses is another factor that causes a decline in production. According to PhilMech (2012), the total system loss can range from 26.26% to 30.4% when no technology intervention is applied (MIRDT, 2021a). Among the reasons for postharvest losses include poor harvesting practices causing cracking and droppings, poor handling causing cracking, and compression during loading, piling, and transport. Postharvest diseases such as anthracnose and stem-end rot have also considerable impacts. Several recommendations such as improved cultural practices and postharvest technologies developed through rigorous research and development (R&D) have already been introduced to mango farmers. Among these is the use of hot water treatment (HWT) technology which reduces anthracnose incidence by 48-57%. However, despite the existence of these technologies, there is a very low adoption rate among farmers resulting in still high postharvest losses.

Area harvested

The area allotted for mango plantation in the country is relatively in plateau from 2007-2020, with a recorded average decline of 0.14% decline from 2010-2020 (Figure 5). The same trend was observed with the widely cultivated Carabao Mango. Currently, Central Luzon has the highest area harvested with mango at 33,566 has followed by the Ilocos Region at 22,469 has, and Davao Region at 18,768 has (Table 7).

FIGURE 5. AREA OF PRODUCTION OF THE PHILIPPINE MANGO INDUSTRY, 2000-2020



Source: PSA, 2020

TABLE 7. AREA HARVESTED WITH MANGO IN DIFFERENT REGIONS OF THE PHILIPPINES, 2016-2020

Region	AREA HARVESTED (hectare)				
	2016	2017	2018	2019	2020
CAR	791	789	783	776	776
Ilocos Region	21,855	21,487	21,475	22,478	22,469
Cagayan Valley	10,419	10,250	10,243	10,237	10,304
Central Luzon	33,576	33,571	33,500	33,649	33,566
CALABARZON	13,950	13,783	13,782	13,582	13,583
MIMAROPA	3,573	3,556	3,554	3,502	3,469
Bicol Region	2,836	2,837	2,837	2,841	2,810
Western Visayas	10,105	10,273	10,283	10,538	10,537
Central Visayas	11,978	11,977	11,976	11,978	11,979
Eastern Visayas	717	715	705	753	760
Zamboanga Peninsula	16,905	15,343	15,338	14,950	14,956
Northern Mindanao	8,720	8,719	8,722	8,730	8,827
Davao Region	18,315	18,639	18,572	18,563	18,768
SOCCSKSARGEN	17,143	17,146	17,125	17,079	17,024
Caraga	2,625	2,625	2,623	2,623	2,626
BARMM	14,328	14,330	14,341	14,344	14,345
PHILIPPINES	187,834	186,038	185,858	186,621	186,798

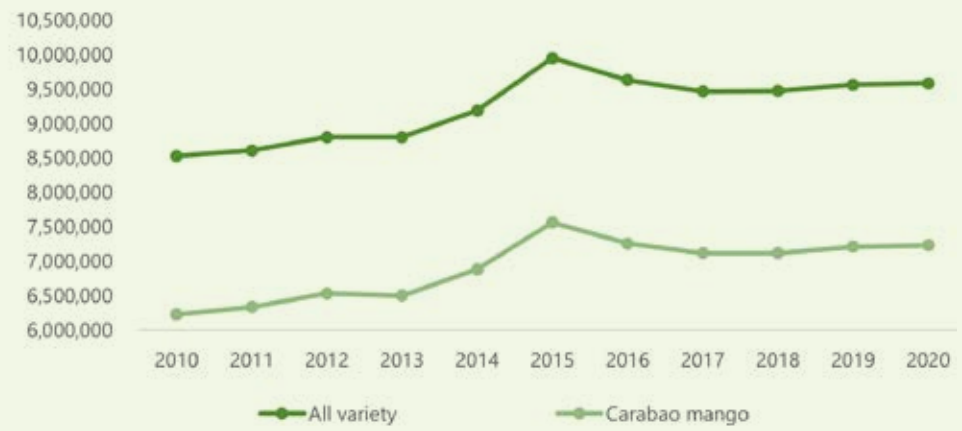
Source: PSA, 2020

Number of trees harvested

From the land area devoted to mango plantations in 2020, almost 9.6 million planted mango trees were considered productive. Seventy-five percent of these (7.3 million trees) are of carabao mango variety (Figure 4).

There is a steady increase in the number of bearing trees from 2010-2014 until a sharp increase in tree productivity happened in 2015 (9.9 million trees). However, the industry failed to maintain the value in the following years, resulting in only 9.6 million by 2017. A slow steady increase of 1% was again experienced from 2018 to 2020 (Figure 6, Table 8).

FIGURE 6. NUMBER OF TREES HARVESTED WITH MANGO, 2010-2020



Source: PSA, 2020

Regions with a high number of trees

Central Luzon possesses the highest number of trees among all regions in the country, with around 1.86 million productive trees. Other regions with a high number of productive trees are SOCCSKSARGEN (987 thousand) and Cagayan Valley (945 thousand). Meanwhile, the top producing Ilocos Region has an average of 771 thousand harvested trees.

Tree to Area Ratio

According to the 2010-2020 mango data, each hectare of mango plantation has an average of 49 productive trees, with a range of 45 to 53 trees. For carabao mango, there is an average of 47 trees per hectare, with a range of 42-51 trees. These figures are 50% lower than the common planting distance practiced by mango growers (10 x 10m) and 30% lower than the recommendation of the Code of Good Agricultural Practices (GAP) for mango (12 x 12m). This indicates that the areas dedicated to mango plantations are not meeting their full potential in terms of planting density and production.

TABLE 8. AREA HARVESTED WITH MANGO IN DIFFERENT REGIONS, 2016-2020

Region	NUMBER OF TREES HARVESTED				
	2016	2017	2018	2019	2020
CAR	35,932	36,582	35,647	33,300	32,920
Ilocos Region	794,506	772,450	758,002	757,193	783,097
Cagayan Valley	968,283	963,869	940,055	940,126	938,561
Central Luzon	1,858,952	1,859,574	1,859,265	1,856,930	1,858,757
CALABARZON	985,204	983,367	928,509	906,909	908,349
MIMAROPA	208,320	198,877	198,156	198,006	197,457
Bicol Region	64,039	64,211	64,618	64,764	66,084
Western Visayas	410,576	411,281	431,036	431,868	434,751
Central Visayas	572,115	573,243	573,563	573,148	573,174
Eastern Visayas	18,492	18,774	18,843	18,571	18,854
Zamboanga Peninsula	1,006,835	1,009,739	897,962	904,342	954,565
Northern Mindanao	468,596	472,851	473,830	485,077	495,838
Davao Region	720,298	455,241	456,084	457,351	457,328
SOCCSKSARGEN	1,002,266	974,594	989,453	993,743	989,292
Caraga	203,365	204,125	204,449	204,254	204,257
BARMM	630,636	632,086	633,631	646,840	646,964
PHILIPPINES	9,948,415	9,630,864	9,463,103	9,472,422	9,560,248

Source: PSA, 2020

Causes of Low Area Expansion

Low area expansion for mango production is related to cecid fly infestation and the high cost of agricultural inputs. With the increasing production costs of mango, many farmers have found themselves in debt, resulting in shifting in annual crops. There are also incidences of farmers cutting their mango trees and replacing them with vegetables (MIRDT, 2021b).

Yield

Volume per unit area harvested

Starting from 2016 up to the current year 2020, the mango industry has continued to experience a decline in yield equivalent to a country average of -0.94% (Figure 7). This trend has been observed despite unchanging land area devoted to mango production (Figure 5), and a slow steady increase in the number of trees harvested (Figure 6).

From 2010-2020. The average yield of mango in the country per area harvested is 4.2 MT/ha from 2010-2020. The highest annual yield was experienced in 2015 at 4.8 MT/ha, while the lowest annual yield was experienced in 2018 at 3.8 MT/ha. These data are significantly lower as compared to the yield experienced in the previous decade (2000-2009) (Figure 7). Among the provinces, it is the Ilocos Region which has the highest average yield per hectare of 10.6 MT/ha. However, for the current year 2020, the said Region yielded only 7.9 MT/ha. The next high-yielding regions include Central Visayas and Caraga, at 6 MT/ha (Table 9).

FIGURE 7. YIELD OF MANGO BASED ON THE VOLUME OF PRODUCTION PER UNIT AREA, 2000-2020

Source: PSA, 2020

From 2016-2020. Looking closely in the past 5 years, a continuous decline in yield has been observed for the majority of the Regions (Table 10). The traditional top-producing regions such as Ilocos, Central Luzon, and the Zamboanga Peninsula experienced a more than 15% decline in yield. On the other hand, the top-producing regions of Central Visayas and SOCCSKSARGEN have experienced a steady increase in yield, with the latter

experiencing a 39% increase from its 2016 baseline. The regions of MIMAROPA and Caraga are opposing the downward trend, showing a steady increase in yield albeit not among the top-producing regions.

TABLE 9. REGIONAL AVERAGE YIELD PER HECTARE, 2010-2020

Region	Average yield for all variety, 2010-2020 (MT/ha)	Average growth rate, 2010-2020	Average yield for Carabao Mango, 2010-2020 (MT/ha)	Average growth rate, 2010-2020
CAR	4.1	-3.85%	4.48	-4.07%
Ilocos Region	10.6	-5.13%	11.28	-5.97%
Cagayan Valley	4.8	0.13%	5.37	0.92%
Central Luzon	1.7	-2.59%	1.77	-2.95%
CALABARZON	3.6	0.80%	3.02	0.49%
MIMAROPA	3.6	7.98%	4.57	8.88%
Bicol Region	0.6	2.71%	0.25	-0.04%
Western Visayas	4.8	1.25%	4.88	1.03%
Central Visayas	6.0	1.53%	6.64	1.77%
Eastern Visayas	0.8	-4.06%	0.59	-3.65%
Zamboanga Peninsula	5.5	1.55%	5.41	1.53%
Northern Mindanao	5.3	4.60%	5.74	4.83%
Davao Region	2.4	4.61%	2.42	5.99%
SOCCSKSARGEN	3.2	1.71%	2.87	2.15%
Caraga	6.0	6.62%	7.89	11.56%
BARMM	0.8	2.51%	0.45	104.93%
PHILIPPINES	4.2	-0.80%	4.4	-0.93%

Source: PSA, 2020

TABLE 10. REGIONAL YIELD PER HECTARE OF MANGOES, 2016-2020

Region	YIELD (MT/ha)				
	2016	2017	2018	2019	2020
CAR	3.9	3.6	3.5	3.7	3.1
Ilocos Region	9.6	9.0	7.8	7.9	7.9
Cagayan Valley	5.8	4.7	4.6	4.4	4.9
Central Luzon	1.8	1.5	1.3	1.2	1.4
CALABARZON	3.6	3.0	3.0	3.4	3.0
MIMAROPA	4.2	4.3	4.4	4.9	5.2
Bicol Region	0.7	0.7	0.8	0.7	0.7
Western Visayas	5.0	4.8	4.8	5.1	4.9
Central Visayas	5.6	5.7	6.1	6.7	6.2
Eastern Visayas	0.7	0.7	0.7	0.7	0.7
Zamboanga Peninsula	6.8	5.6	5.1	5.2	4.9
Northern Mindanao	5.8	5.7	5.8	6.0	6.1
Davao Region	2.9	2.8	2.9	2.4	2.6
SOCCSKSARGEN	2.7	2.8	3.1	3.5	3.8
Caraga	6.5	6.9	7.1	7.2	7.5
BARMM	0.8	0.9	1.0	1.0	1.1

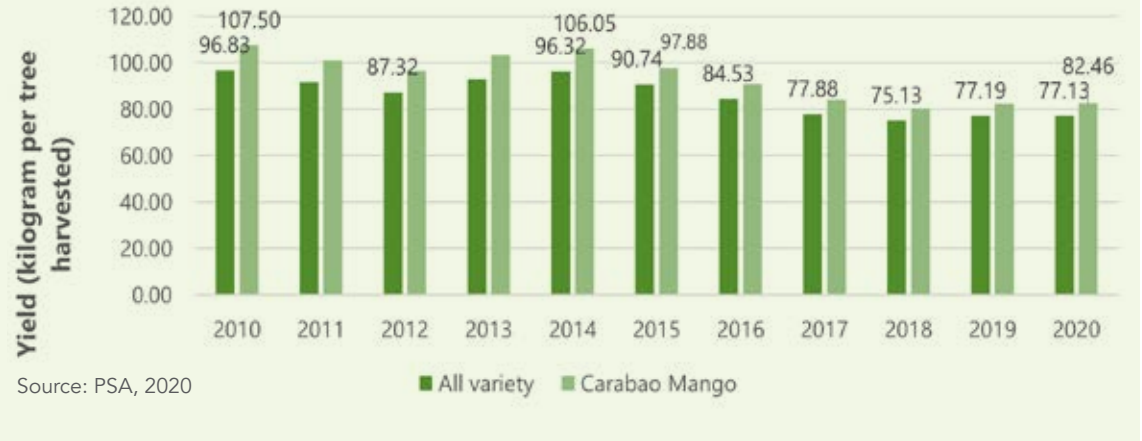
Source: PSA, 2020

Volume per tree harvested

The average yield of mango in the country per tree harvested is 85.8 kg/tree. There is a noticeable continuous decline in yield per tree for all varieties in 2015 until 2018 but 2% gains in the following years (Figure 8).

The yield per tree greatly varies across regions (Table 11). For example, the top producing Ilocos Region can yield as much as 296.7 kg/tree. On the contrary, Central Luzon, the region with the highest number of productive trees can yield only 32.1 kg per tree. Other regions with high yield per tree include Central Visayas (126.8 kg/tree), Western Visayas (112 kg/tree), and Davao Region (105 kg/tree).

FIGURE 8. YIELD OF MANGO BASED ON THE VOLUME OF PRODUCTION PER TREE HARVESTED, 2010-2020



Source: PSA, 2020

TABLE 11. REGIONAL YIELD PER TREE HARVESTED OF PHILIPPINE MANGO, 2010-2020

Region	Average yield for all variety, 2010-2020 (kg/tree)	Average yield for Carabao mango, 2010-2020 (kg/tree)
CAR	91.5	105.0
Ilocos Region	296.7	357.3
Cagayan Valley	52.2	66.2
Central Luzon	32.1	34.0
CALABARZON	55.1	43.9
MIMAROPA	64.9	87.4
Bicol Region	27.0	32.3
Western Visayas	112.1	114.5
Central Visayas	126.8	140.3
Eastern Visayas	31.2	29.2
Zamboanga Peninsula	94.9	94.2
Northern Mindanao	99.9	106.9
Davao Region	105.0	114.1
SOCCSKSARGEN	56.9	53.3
Caraga	97.0	128.3
BARMM	29.2	15.1

Source: PSA, 2020

On Carabao mango. It is important to note that the Carabao mango has a relatively good performance, as compared to other varieties as indicated by its higher yield when analyzed separately. The 2010-2020 average yield of Carabao mango is 4.4 MT/ha and 93.8 kg/tree (Tables 9 & 11). However, the yield of Carabao mango in both categories has also started to decline in 2015 and was only to have small gains in 2019. The Ilocos Region remains to be the top-yielding region for carabao mango (11.28 MT/ha; 357kg/tree), even higher than the country average. Other top-yielding regions for carabao mango include Caraga (7.9 MT/ha; 129.3 kg/tree), Central Visayas (6.64 MT/ha; 140.3kg/tree), and Western Visayas (4.88 MT/ha; 114.5 kg/tree).

Causes of Yield Decline

The average yield of the country is highly affected by various reasons:

1. Unsuitable regions for mango. As for the country's average yield, the overall value is pulled down by the presence of low-yielding regions and/or regions not suitable for mango cultivation. Biophysical characteristics of the plantation play a key role in the productivity of the land and the tree. For example, there is a significant gap between the Ilocos Region's (suitable area) 10.6 MT/ha and 296.7kg/tree yield and Bicol Region's (unsuitable area) 0.7 MT/ha yield and 27kg/tree yield.
2. Low tree density. Each hectare of mango plantation has an average of 49 productive trees, with a range of 45 to 53, 30% lower than the recommendation of PNS/BAFPS 25:2009 (12 x 12m). This indicates that the areas dedicated to mango plantations are not meeting their full potential in terms of planting density and production.
3. Cutting down of trees. Some farm owners also opt to cut down their century-old trees due to difficulty in harvest, low yield, and price fluctuation.

Other factors include an increasing proportion of young trees, damage of insect pests and diseases, the ill practice of excessive flower induction of older trees, and failure to adopt appropriate cultural practices (i.e. fertilization, pruning, bagging).

Consumption

An average Filipino consumes 7.35kg of locally produced mangoes per year, both fresh produce and processed. This is to equivalent 735,746 MT – 92% of the average gross supply of the country. However, there is a noticeable drop in per capita consumption in the past 10 years – from 8.13 kg/year in 2010 to 6.34 kg/year in 2019 (Table 12).

Meanwhile, an average of 46,963 MT of mangoes is either wasted or utilized as feeds. This accounts for 6% of the total mango production and is 194% higher than the average volume of mango exported.

On the other hand, only 2% of the average gross supply is utilized for export (Figure 9).

FIGURE 9.

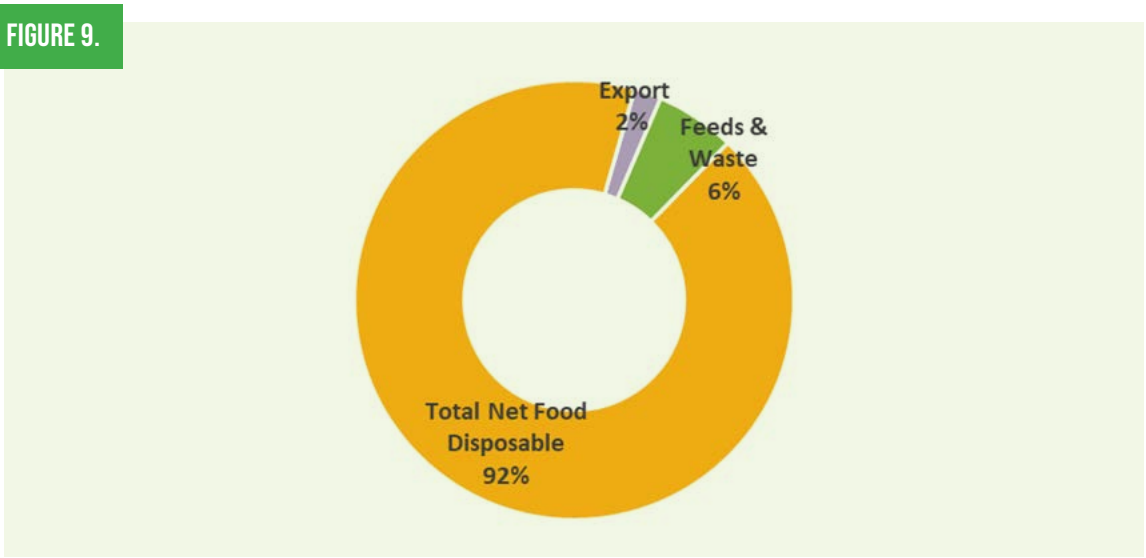


TABLE 12. UTILIZATION OF MANGO IN THE PHILIPPINES FROM 2010-2019

Year	Exports (MT)	Feeds and Waste (MT)	Total Net Food Disposable (MT)	UT Per Capita (kg/yr)
2010	20,115	48,334	757,227	8.13
2011	21,151	46,015	720,908	7.6
2012	18,440	44,998	704,972	7.3
2013	7,886	48,510	759,982	7.74
2014	21,112	51,836	812,090	8.13
2015	12,981	53,385	836,373	8.24
2016	14,343	47,983	751,730	7.28

Year	Exports (MT)	Feeds and Waste (MT)	Total Net Food Disposable (MT)	UT Per Capita (kg/yr)
2017	16,116	43,255	677,661	6.51
2018	13,562	41,886	656,212	6.21
2019	14,212	43,424	680,303	6.34
Average	15,992	46,963	735,746	7.35

Source: PSA, 2020

Table 13 shows the detailed supply and utilization data for mango from 2017-2019. In this period, mango production inched up by an average of 0.13 percent per year (PSA, 2020). In 2017, production was recorded at 737.0 thousand MT but it was reduced to 711.7 thousand MT in 2018. The following year, it recovered at 737.9 thousand MT resulting in an average of 728.9 thousand MT for the 3 years.

During the reference years, there was no importation of mango. from 2017 to 2019. In terms of export volume, 2017 had the highest recorded at 16.1 thousand MT while the lowest in 2018 at 13.6 thousand MT. Exports settled at 14.2 thousand MT in 2019 resulting in an average of 14.6 thousand MT from 2017-2019.

The volume of mango available for food averaged 671.4 thousand MT. From 677.7 thousand MT in 2017, it slid to 656.2 thousand MT in 2018 then reached its highest level in 2019 at 680.3 thousand MT or equivalent to 6.34 kg per person. Annual per capita net food disposable averaged 6.35kg for the past 3 years.

TABLE 13. MANGO SUPPLY UTILIZATION ACCOUNTS, PHILIPPINES 2017-2019

Year	Supply			Utilization						
	Production	Imports	Gross Supply	Exports	Seeds	Feeds & Waste	Processing	Net Food Disposable		
								Total	Per Capita	
									Kg/Yr	Gram/Day
Level in metric tons										
2017	737,032	0	737,032	16,116	0	42,255	0	677,661	6.51	17.82
2018	711,938	0	711,938	13,562	0	41,886	0	656,212	6.21	17.00
2019	737,938	0	737,938	14,212	0	43,424	0	680,303	6.34	17.37
Average	728,877	0	728,877	14,832	0	42,855	0	671,392	6.35	17.40
Growth rate (in percent)										
17-18	-3.44		-3.44	-15.85		-3.17		-3.17	-4.62	-4.62
18-19	3.69		3.69	4.79		3.67		3.67	2.19	2.19
Average	0.13		0.13	-5.53		0.25		0.25	-1.21	-1.21

Source: PSA, 2020

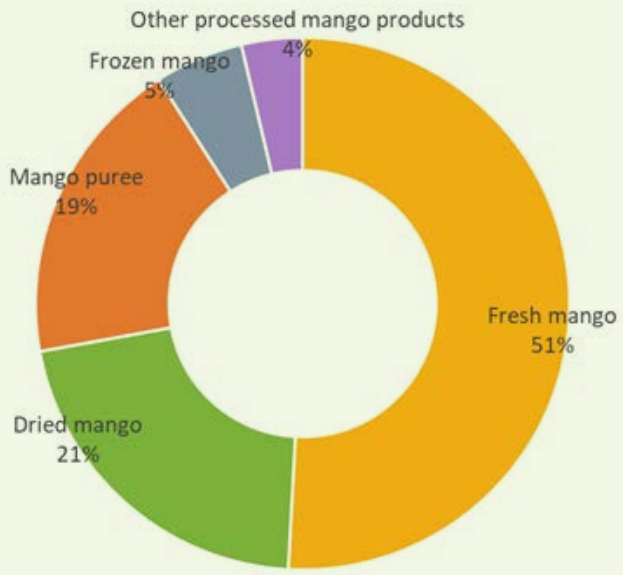
Trade

Export

The country's mango export has been generally declining based on 2016 to 2020 data (Figure 11, Table 14). The average decline rate of export volume is 6%. It momentarily increased in 2017 but returned to its declining state in the following year. Within the same period, the country was able to export an annual average of 27,518 MT which values an average amount of 83 million USD. However, it is important to note that the 2020 exportation was affected by the Covid19 pandemic, hence, can justify the lower in the year 2020.

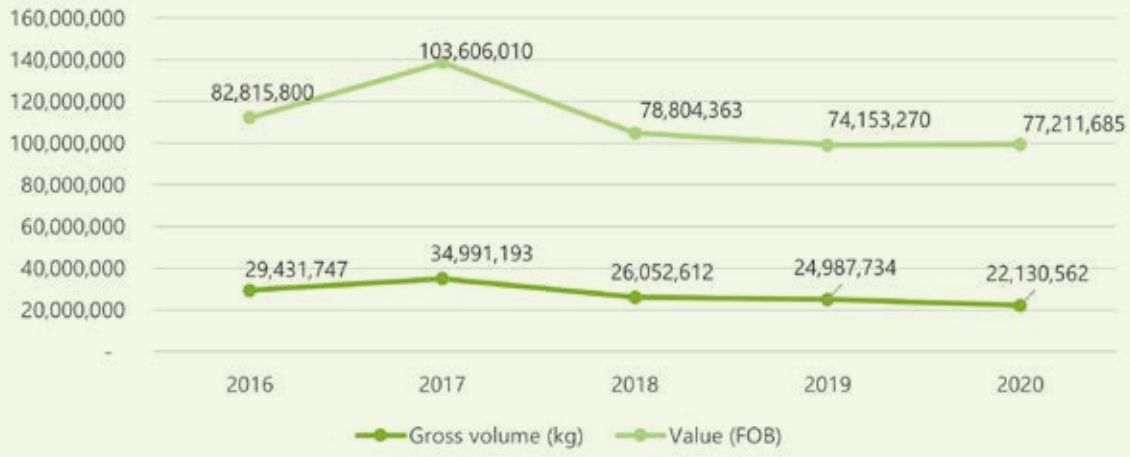
In terms of export volume, fresh mango comprises around 50% of all exported products. For the other products, dried mango comprises 21%, mango puree shares 19%, and the remaining are other processed mango products (Figure 10, Table 14).

FIGURE 10. PERCENT OF MANGO PRDUCTS EXPORTED BY THE PHILIPPINES, 2016-2020



Source: PSA, 2020

FIGURE 11. EXPORT OF MANGO BY VOLUME AND VALUE, 2016-2020



Source: PSA, 2020

Within the 5 years, the country was able to export mango products to 60 countries, of which 23 countries are regular importers. Among these countries, Hong Kong, China is importing at an average of 48% (13,220 MT) of the country's total gross export, in which almost 80% is fresh mango. Other countries with a significant amount of import include the United States of America (USA) (3,732 MT), Republic of Korea (3,507 MT), Japan (2,102 MT), People's Republic of China (1,505 MT), and Canada (971 MT) (Table 15). Despite the high volume of importation of Hong Kong, it is the USA that has the highest average export value (21.2 million USD). It is then followed by Hong Kong (19.7 million USD), Japan (12.2 million USD), the Republic of Korea (7.7 million USD), and Canada (7.1 million USD), among others (Table 16).

Reasons for the declining rate of export

The rise of aggressive competitors in the last decade resulted in the decline of Philippine carabao mango export and premium pricing. Its traditional export markets such as Japan and South Korea shifted their interest to other countries such as India, Mexico, Thailand, and Vietnam. For example, Weambard International Traders, Inc. used to be the top exporter of mango puree in key markets in Japan and Korea until the arrival of other mango-exporting countries. To illustrate, the aggressive marketing strategy of India's Alphonso mango puree resulted in a 63% and 77% drop in Weambard's Carabao mango puree sales in Japan and Korea, respectively. In contrast, India's Alphonso mango puree enjoyed a sale increase of 750% and 900%, respective of mentioned countries.

According to a Korean importer, the market share of the Philippines to the mango requirement of Korea in 2015 is about 60-65% but in 2016 the market share of the Philippines decreased to about 50%. In 2017, Thailand dominated the Korean market with an outstanding 70% market share compared to the Philippines with only 20%. It is also important to note that in 2017, only 10 Korean importers have exported mangoes from the Philippines, a more than 50% decrease from its 22-24 importers in the previous years. Among the problems the importer identified in the importation of mangoes are:

1. The sustainability of the supply of Philippine mangoes. In 2016, the volume of his importation accounted for about 4,000 boxes per week but right now, the volume was only 2,000 boxes per week.
2. Supply sustainability may be attributed to mango infestation and climate change or extended cold weather in Northern Luzon (almost 40 days) which is not good for the Philippine mango.
3. The Philippine government is prohibiting the use of "Endosulfan", a chemical pesticide from Malaysia, to address the mango infestation problem. The said pesticide is allowed in Korea

The Philippines can also learn from India's experience in marketing its Alphonso mango. It is reported that the strengthened Indian government support to aggressively market their products lead to its successful penetration to the Japanese and Korean markets. Among the supports provided include consistent marketing budget resulting in price advantage and export incentives to their mango stakeholders. Through this, Alphonso mango took over Japan's and Korea's mango markets in just 5 years (2010-2015).

TABLE 14. EXPORT BY VOLUME AND VALUE OF PHILIPPINE MANGOES, 2016-2020

Product type	2016		2017		2018		2019	
	Gross kilo	Value (USD)	Gross kilo	Value (USD)	Gross kilo	Value (USD)	Gross kilo	Value (USD)
Fresh mango	14,351,158.00	13,318,957.00	17,397,267.35	23,161,076.00	13,562,169.22	18,818,340.00	14,211,792.85	19,648,548.00
Dried mango	6,854,250.00	55,889,580.00	4,209,870.55	29,507,893.00	6,283,524.10	47,959,098.00	5,063,527.91	41,840,852.00
Uncooked or cooked by steaming or boiling in water, frozen, whether or not containing added sugar or other sweetening matter)	779,038.00	2,004,873.00	2,940,941.10	7,636,785.00	1,109,011.35	3,826,373.00	1,501,833.82	5,447,629.00
Prepared or preserved by vinegar or acetic acid)	-	-	521,100.00	548,791.00	3,089.20	8,016.00	-	-
Preserved by sugar-drained, glace or crystallised)	-	-	-	-			-	-
Mango puree	7,435,338.00	11,573,567.00	6,027,954.66	8,197,189.00	4,962,334.65	7,684,180.00	4,181,441.01	7,134,772.00
Otherwise prepared or preserved, whether or not containing added sugar or other sweetening matter or spirit, not elsewhere specified or included	100.00	340.00	3,894,059.14	34,554,276.00	132,483.95	508,356.00	29,138.72	81,469.00
Provisionally preserved (Ex. sulphur dioxide gas, in brine, in sulphur water or in other preservative solutions), but unsuitable in that state for immediate consumption	311.00	638.00	-	-	-	-	-	-
In airtight containers- otherwise prepared or preserved, containing added sugar or other sweetening matter or spirits	11,552.00	27,845.00	-	-	-	-		
Total	29,431,747.00	82,815,800.00	34,991,192.80	103,606,010.00	26,052,612.47	78,804,363.00	24,987,734.31	74,153,270.00

Source: PSA, 2020

TABLE 15. TOP DESTINATION OF PHILIPPINE MANGOES IN TERMS OF GROSS EXPORT VOLUME, 2016-2020

No	Region	GROSS EXPORT VOLUME (kg)					Average
		2016	2017	2018	2019	2020	
1	Hong Kong, China	14,059,488	16,044,609	13,110,933	13,355,541	10,080,838	13,330,282
2	United States of America	4,312,711	4,530,259	3,106,790	2,587,112	4,122,284	3,731,831
3	Republic of Korea	3,773,312	4,499,861	3,655,257	3,305,388	2,301,716	3,507,107
4	Japan	2,293,114	2,797,755	1,838,736	1,733,675	1,848,974	2,102,451
5	People's Republic of China	1,761,266	2,097,403	1,307,745	1,187,163	1,172,371	1,505,190
6	Canada	894,801	1,546,258	753,258	696,120	963,917	970,871
7	Germany	189,663	549,175	465,681	443,547	380,415	405,696
8	France		804,382		163,442	224,928	397,584
9	Malaysia	385,865	409,044	448,780	386,170	90,426	344,057
10	Singapore	327,117	88,288	181,617	279,576	98,779	195,075

Source: PSA, 2020

TABLE 16. TOP DESTINATION OF PHILIPPINE MANGOES IN TERMS OF VALUE, 2016-2020

No	Region	GROSS EXPORT VOLUME (FOB)					Average
		2016	2017	2018	2019	2020	
1	United States of America	26,597,998	25,310,209	13,544,587	14,438,794	26,314,301	21,241,178
2	Hong Kong, China	17,524,856	20,756,615	22,128,572	23,215,093	14,852,513	19,695,530
3	Japan	12,296,941	18,480,936	11,874,754	10,847,929	12,606,916	13,221,495
4	Republic of Korea	7,725,425	9,839,697	8,447,665	6,997,454	5,534,076	7,708,863
5	Canada	4,202,446	13,630,395	5,154,785	5,226,950	7,692,947	7,181,505
6	People's Republic of China	4,983,426	4,370,056	4,411,071	3,756,702	3,077,685	4,119,788

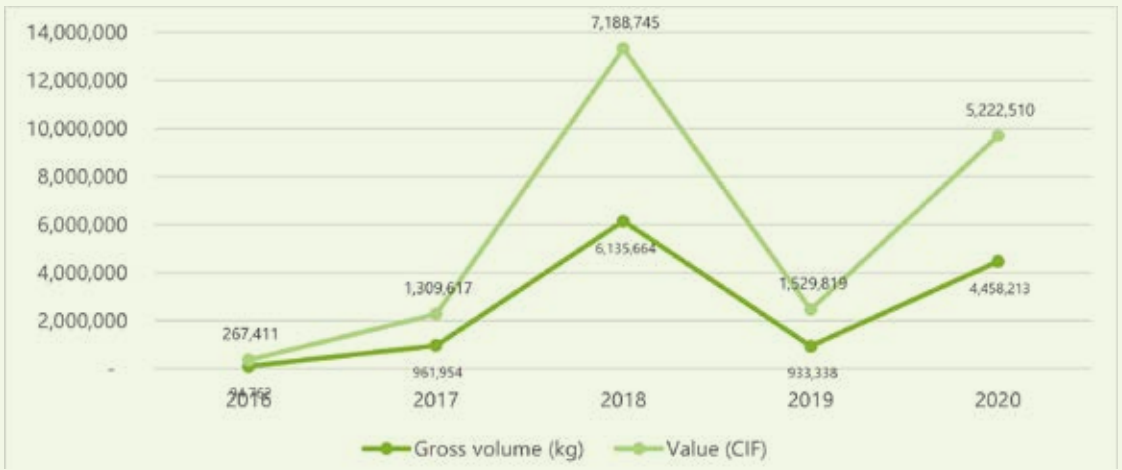
No	Region	GROSS EXPORT VOLUME (FOB)					Average
		2016	2017	2018	2019	2020	
7	UK of Great Britain, N. Ireland	935,377	2,090,418	3,381,692	788,306	798,500	1,598,859
8	Germany	533,402	1,920,693	1,894,639	1,562,755	1,325,672	1,447,432
9	Ireland	2,469,852	1,544,257	1,577,834	622,868	900,508	1,423,064
10	Singapore	1,263,957	336,123	1,331,705	1,695,700	520,721	1,029,641

Source: PSA, 2020

Import

From 2016-2020, the country has had a fluctuating trend in its importation of mango from abroad (Figure 12). For example, the country imported only 94.76 MT of mangoes in 2016 while it suddenly peaked at 6,136 MT in 2018. There is also a drastic decrease to 933.34 MT in the following year. The most imported mango product of the country is preserved mango from Cambodia (Table 17). Other products imported are mango dice, and slice/dehydrated mango from Cambodia, Vietnam, and Thailand.

FIGURE 12. IMPORTATION OF MANGO BY VOLUME, 2016-2020



Source: PSA, 2020

TABLE 17. MANGO IMPORTATION OF THE PHILIPPINES, 2017-2020

Year	Kind	Origin	Volume (MT)
2017	Mango Dice	Vietnam	35.25
2018	Mango Dice	Vietnam	31.517
	Mango (Preserved)	Cambodia	3,168.978
	Mango (Preserved)	Thailand	1,634.2
2019	Mango (Sliced/Dehydrated)	Cambodia	20
	Mango Dice	Vietnam	9.070
	Mango (Preserved)	Cambodia	682.803
2020 (as of May)	Mango Dice	Vietnam	11.560
	Mango (Preserved)	Cambodia	1,005.907
	Mango (Sliced/Dehydrated)	Cambodia	62.200

Source: BPI-NPQSD sent via email last June 18, 2020

Prices

Farmgate Prices

From 2010 to 2020, the annual average farmgate price of green carabao mango at the national level increased by 6.82%. For the top 10 producing provinces, Davao Del Sur registered with the highest average growth in price increase per year at 9.49%. The succeeding higher growth in terms of price increases include: Pangasinan (8.74%), Negros Oriental (8.60%), Batangas (7.68%), Iloilo 7.62%), Ilocos Norte (7.07%), Cebu (6.76%), Zamboanga del Norte (6.42%), Cotabato (2.93%) and Misamis Oriental (2.2%) (Table 18).

As of July 2021, Negros Oriental has the highest average price at PhP 71.67 per kilo while the lowest among the top 10 producing provinces was recorded at PhP 30.12 per kilo for Cotabato.

For 2020 over 2019 price, among the top producing provinces, Cotabato increased by 34.02% while Batangas decreased by 12.01%.

TABLE 18. TOP PRODUCING PROVINCE AND THE FARMGATE PRICE IN PESO PER KILOGRAM OF MANGO, 2010 TO 2021

Rank	Province	AGR (2010-2020)	2019	2020	2021*	(2020/2019) % +/-
1	Pangasinan	8.74	51.75	58.39	69.24	12.83
2	Zamboanga del Norte	6.42	40.11	42.08	53.89	4.91
3	Cebu	6.76	41.68	49.73	48.52	19.31
4	Cotabato	2.93	26.07	34.94	30.12	34.02
5	Davao del Sur	9.49	45.55	51.29	46.31	12.60
6	Batangas	7.68	45.56	40.09	60.54	-12.01
7	Ilocos Norte	7.07	41.47	48.80	41.76	17.68
8	Misamis Occidental	2.20	31.77	37.35	42.64	17.56
9	Iloilo	7.62	63.01	74.30	67.84	17.92
10	Negros Oriental	8.60	65.34	74.19	71.67	13.54

Source: PSA, 2020
*2021 price is as the average from January to July 2021
AGR –average growth rate per year in percent (%)

Wholesale Prices

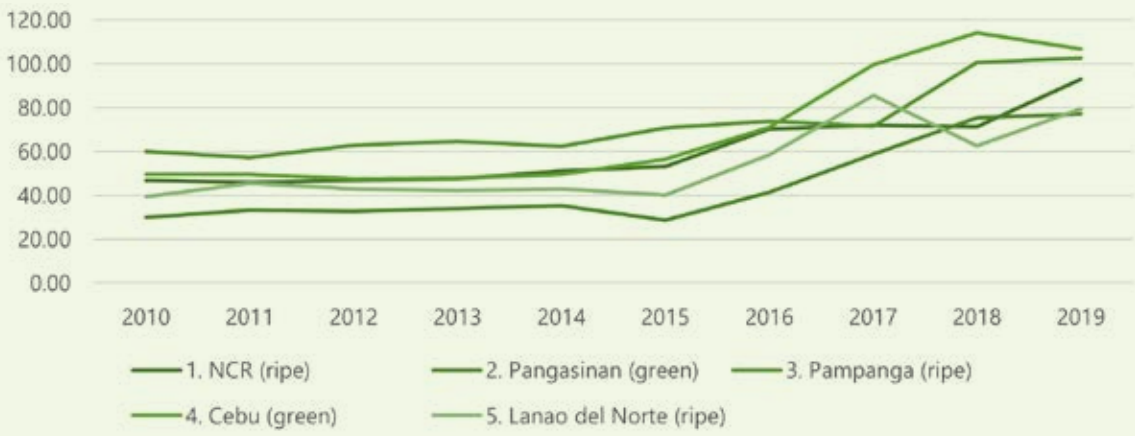
In terms of available green and ripe mango prices in selected areas in the Philippines, for NCR ripe mango, it increased from PhP 46.80 per kg in 2010 to PhP 92.96 per kg in 2019. Using an imputation of PhP 71.15 per kg for 2018, the average growth of prices per year is at 7.92%. For Pangasinan ripe mango, for the imputation of price for 2011 at PhP 33.38, the average growth of prices per year is at 11.21%. For Pampanga ripe mango, the average growth per year from 2011 to 2019 is recorded at 7.10%. For green mango in Cebu and Lanao del Norte, the average growth per year of wholesale prices is 11.37% and 8.13%, respectively. Table 19 shows the prices of ripe and green mango in selected areas in the Philippines from 2010 to 2019. Figure 13 shows the trend of wholesale prices from 2010-2019.

TABLE 19. WHOLESALE PRICE OF RIPE AND GREEN MANGO IN SELECTED AREA IN THE PHILIPPINES FROM 2010 TO 2019

Selected Areas	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NCR (ripe)	46.80	46.14	46.83	47.61	51.06	53.28	70.19	72.10	N/A	92.96
Pangasinan (green)	29.99	N/A	32.78	33.97	35.41	28.77	41.46	58.86	75.40	77.19
Pampanga (ripe)	N/A	57.28	62.94	64.67	62.22	70.74	73.72	71.62	100.52	102.69
Cebu (green)	49.47	49.54	47.60	47.81	49.68	56.41	71.01	99.67	114.00	106.84
Lanao del Norte (ripe)	39.43	45.60	42.85	42.10	42.86	40.25	58.56	85.48	62.53	79.44

Source: PSA, 2020

FIGURE 13. WHOLESALE PRICE OF MANGO FOR SELECTED AREAS IN THE PHILIPPINES (PHP PER KG)



Note: Imputation of prices were made for no available price, particularly for NCR (2018=PhP 71.15), Pangasinan (2011=PhP 33.38), and Pampanga (2010=PhP 60.11)

Retail Prices

The average growth rate per year of the retail prices of ripe carabao mango in the top producing mango provinces in the Philippines increased by 11.21% in Batangas; 9.02% in Cebu; 8.95% in Misamis Occidental; 8.77% in Negros Oriental; 7.69% in Iloilo; 7.73% in Davao del Sur; 6.36% in Pangasinan; and 5.47% in Zamboanga del Norte (Table 20).

For January to July 2021, the average price of ripe carabao mango for the top ten producing provinces include: Negros Oriental had the higher price at PhP144.94 per kg. The succeeding average retail prices of carabao ripe mango for the other top ten provinces include: Pangasinan and Ilocos Norte shared the price of PhP134.20 per kg (regional level price, as the available data), Cebu, PhP133.52; Iloilo, PhP123.21; Cotabato, PhP118.71; Davao del Sur, PhP114.02; Batangas, PhP110.54; Misamis Occidental, PhP110.36; and Zamboanga del Norte, PhP106.61.

Comparing the average price of 2020 over 2019 retail price of carabao ripe mango, the following provinces had increased their prices such as Cebu, 24.71%; Ilocos Norte, 18.27%; Batangas, 11.14%; Iloilo, 10.57%; and Misamis Occidental 0.83%. These were also some of the top ten provinces that decreases their average prices which include: Zamboanga del Norte, 14.9%; Cotabato, 3.94%, Pangasinan, 2.39%, Negros Oriental, 1.06% and Davao del Sur, 0.35%. This could probably be because of the delayed movement of agricultural products brought about by the Covid-19 pandemic.

TABLE 20. AVERAGE GROWTH RATE PER YEAR OF THE RETAIL PRICE OF RIPE CARABAO MANGO IN TOP PRODUCING MANGO PROVINCES IN THE PHILIPPINES 2010-2021

Rank	Province	AGR (2010-2020)	2019	2020	2021*	(2020/2019) % +/-
1	Pangasinan	6.36	91.40	89.22	134.20	-2.39
2	Zamboanga del Norte	5.47	84.76	72.08	106.61	-14.96
3	Cebu	9.02	107.50	134.06	133.52	24.71
4	Cotabato	7.55	95.36	91.60	118.71	-3.94
5	Davao del Sur	7.73	85.94	85.64	114.02	-0.35
6	Batangas	11.21	146.39	162.70	110.54	11.14

Rank	Province	AGR (2010-2020)	2019	2020	2021*	(2020/2019) % +/-
7	Ilocos Norte	6.76	78.04	92.30	134.20	18.27
8	Misamis Occidental	8.95	102.21	103.06	110.36	0.83
9	Iloilo	7.69	119.33	131.94	123.21	10.57
10	Negros Oriental	8.77	128.75	127.38	144.94	-1.06

Source: PSA, 2020
Note: *Average of January to July 2021

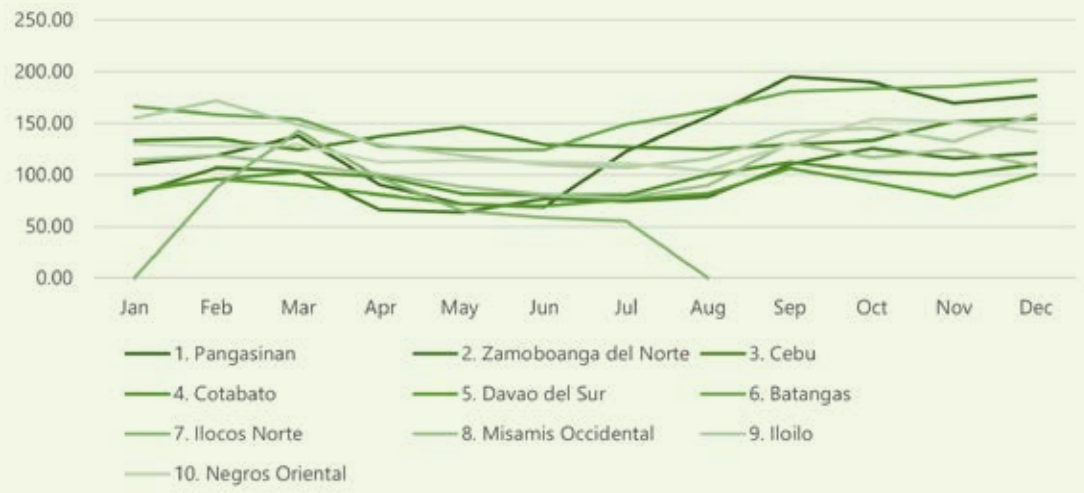
In terms of the monthly average retail prices per kg of ripe carabao mango in the top ten producing provinces in 2020, the highest price was recorded in September 2021 at PhP 195.07 for the province of Pangasinan while the lowest price was recorded at Ilocos Norte in July 2020 at PhP55.00. In terms of average yearly prices per kg, Batangas had the highest price at PhP159.07; followed by Iloilo, PhP 136.12; Cebu, PhP135.53; Pangasinan, PhP133.99; and Negros Oriental at PhP126.4. The lowest price among the top ten provinces is recorded in Ilocos Norte at PhP 84.22 (Table 21 and Figure 14).

TABLE 21. AVERAGE MONTHLY RETAIL PRICES OF RIPE CARABAO MANGO IN THE TOP TEN PRODUCING PROVINCES, PHILIPPINES, 2020

Rank	Provinces	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
1	Pangasinan	110.00	118.63	137.59	90.04	71.81	69.03	123.03	156.67	195.07	189.90	169.46	176.63	133.99
2	Zamboanga del Norte	81.77	106.96	103.95	66.00	63.55	76.76	74.31	78.67	109.94	125.71	115.83	121.00	93.70
3	Cebu	133.43	135.20	124.48	136.90	146.16	129.67	127.38	124.56	129.33	133.25	152.00	154.00	135.53
4	Cotabato	84.00	95.37	103.14	98.29	81.54	70.00	80.00	100.00	111.96	103.27	100.00	110.17	95.65
5	Davao del Sur	85.54	95.83	90.15	80.46	71.83	80.00	76.36	81.67	106.15	92.62	78.25	100.73	85.80
6	Batangas	166.25	158.64	154.00	127.60	124.38	124.37	149.19	162.05	180.90	183.74	185.97	191.69	159.07
7	Ilocos Norte	N/A	87.62	142.27	96.96	65.20	58.26	55.00			N/A			84.22
8	Misamis Occidental	114.13	118.49	110.15	100.83	88.15	80.63	77.79	89.76	130.73	116.56	124.08	108.00	104.94
9	Iloilo	155.00	171.67	148.46	129.67	118.68	109.38	107.14	115.33	141.29	145.26	132.50	159.00	136.12
10	Negros Oriental	130.00	127.75	129.11	112.00	114.00	112.00	111.11	104.00	130.00	154.00	151.75	141.40	126.43

Source: PSA, 2020
Note: Pangasinan is a regional-level data in the absence of a provincial data
N/A- no available data

FIGURE 14. AVERAGE MONTHLY RETAIL PRICES OF RIPE CARABAO MANGO FOR THE TOP TEN PRODUCING PROVINCES, PHILIPPINES, 2020



Source: PSA, 2020

Exported Price of Carabao Fresh Mango

The average exported FOB price of carabao fresh mango from 2011 to 2119 showed that Switzerland had the highest price in 2019 at USD3.20 per kg while the lowest price was the FOB price for Malaysia at USD0.53. On average from 2011 to 2019, Japan market had the higher FOB price at USD2.10 while the lowest FOB price was also Malaysia at USD 0.77 per kg for the said nine-year period (Table 22, Figure 15).

For the past nine years, Switzerland recorded the highest growth of price per year at an average of 22.78%, followed by Hongkong, 13.28%, and Saudi Arabia by 5.99%.

Other countries decreased the FOB price of mango per year, particularly for Singapore and Malaysia at 2.33% and 6.41% per year due to efficiency in the production and proximity of these two countries to the Philippines, as fellow ASEAN-member countries.

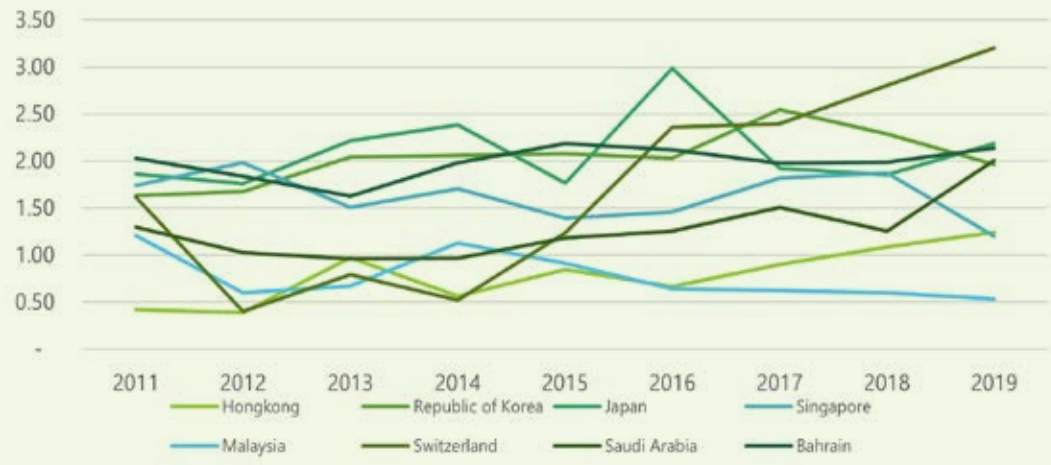
TABLE 22. AVERAGE FOB PRICE OF EXPORTED FRESH MANGO IN SELECTED COUNTRIES, 2011-2019

Country of Destination	2011	2012	2013	2014	2015	2016	2017	2018	2019	AGR (2011-2019)	Average Price (USD) Per Year
Hongkong	0.42	0.39	0.97	0.56	0.85	0.67	0.90	1.09	1.24	13.28	0.79
Republic of Korea	1.63	1.68	2.04	2.06	2.08	2.03	2.54	2.29	1.96	3.56	2.03
Japan	1.86	1.76	2.22	2.38	1.77	2.98	1.92	1.86	2.19	1.24	2.10
Singapore	1.74	1.98	1.50	1.70	1.39	1.46	1.82	1.88	1.20	-2.33	1.63
Malaysia	1.21	0.60	0.67	1.13	0.91	0.64	0.62	0.60	0.53	-6.41	0.77
Switzerland	1.61	0.40	0.79	0.52	1.23	2.36	2.40	2.81	3.20	22.78	1.70
Saudi Arabia	1.30	1.03	0.96	0.97	1.18	1.25	1.51	1.26	2.00	5.99	1.27
Bahrain	2.03	1.84	1.63	1.98	2.19	2.12	1.98	1.99	2.14	1.49	1.99

Source: PSA, 2020

Note: Included countries are those with continuous exports from 2011-2019

FIGURE 15. AVERAGE EXPORTED FOB PRICE PER KILO OF FRESH CARABAO MANGO OF SELECTED COUNTRY, 2011 TO 2019



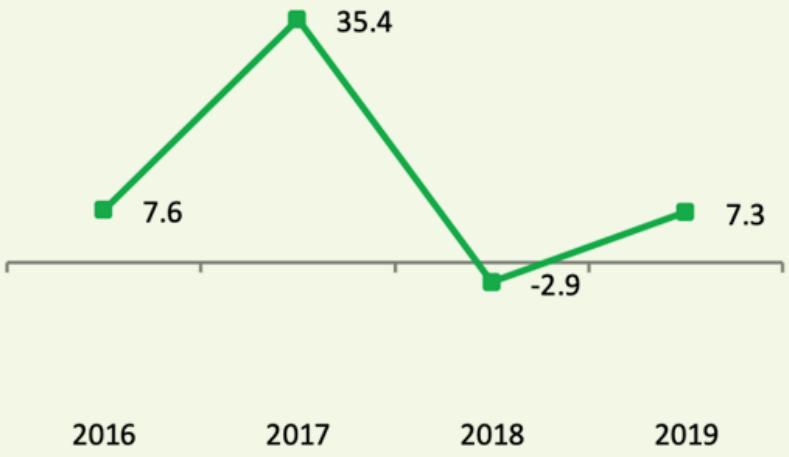
Source of Basic Data: Summarized FOB Price per kilo PSA Openstat

Agricultural Exports

In 2019, the country's export earnings from agricultural products reached PhP 345.77 billion, indicating an increase of 7.3% from the previous year's record. This was an improvement from the decline recorded in 2018. The contribution of agricultural exports to the total export earnings in 2019 went up to 9.4%. Banana remained the leading agricultural export commodity in 2019. Its export volume of 4.40 million MT posted a 40.9% increment with the corresponding value at PhP 101.18 billion expanded by 39%.

The 2019 share of banana to the total agricultural export earnings went up to 29.3%. The value of mangoes produced in the Philippines amounted to around PhP 24.1 billion in 2019. The production volume of mangoes in the country was about 737.9 thousand MT in the same year.

FIGURE 16. GROWTH RATES OF THE VALUE OF ALL AGRICULTURAL EXPORTS, PHILIPPINES, 2016-29 (IN PERCENT)



Source: PSA, 2020

In the world export market, the Philippines recorded a bigger share in the export earnings from coconut products such as cake (copra), coconuts (desiccated), and oil (coconut-copra) in 2018. Aside from coconut, other commodities that have a share in total exports include banana, pineapple, rubber, sugar, and tobacco, which excludes mango from the list.

FIGURE 17. SHARE OF AGRICULTURE IN TOTAL EXPORTS, PHILIPPINES, 2016-2019 (IN PERCENT)

Source: PSA, 2020

Tables 23 and 24 show the volume, value, and percentage share of selected commodities of the country's total agricultural exports from 2015-2019. Banana remains to be the country's top exported commodity. The volume, value, and percentage share of mango still pales in comparison with banana. It can be noted that with the increase in volume from 2016-17, there was a sudden drop in 2018 and it showed that it was just starting to pick up again in 2019.

TABLE 23. VOLUME, VALUE, AND PERCENTAGE SHARE OF SELECTED COMMODITIES IN THE TOTAL AGRICULTURAL EXPORTS, PHILIPPINES, 2015-2017

Commodity	2015			2016			2017		
	Volume (in MT)	Value		Volume (in MT)	Value		Volume (in MT)	Value	
		PhP (000)	% Share		PhP (000)	% Share		PhP (000)	% Share
Banana	1,795,199.30	29,931,743.5	13.153	1,733,836.3	34,683,497.2	14.166	2,855,635.1	56,880,259.3	17.153
Mango	12,981.3	731,866.8	0.322	14,343.0	632,490.5	0.258	16,116.1	1,167,315.9	0.352
All agricultural exports	227,571,132			244,830,255			331,606,385		

Source: PSA, 2020

TABLE 24. VOLUME, VALUE, AND PERCENTAGE SHARE OF SELECTED COMMODITIES IN THE TOTAL AGRICULTURAL EXPORTS, PHILIPPINES, 2018-2019

Commodity	2018			2019		
	Volume (in MT)	Value		Volume (in MT)	Value	
		PhP (000)	% Share		PhP (000)	% Share
Banana	3,126,203.3	72,779,319.4	22.591	4,403,496.3	101,177,609.3	29.262
Mango	13,562.2	990,941.7	0.308	14,211.8	1,017,482.3	0.294
All agricultural exports	322,155,278			345,765,466		

Source: PSA, 2020

Table 25 shows mango's volume growth rate 2015-2019 (in percent) which also reflects the country's mango exports in the previous tables. Still, 2018-19 presents a low growth rate as compared to 2015-16 and 2016-17. There is still a lot to be done to catch up with what mango was able to achieve in recent years.

TABLE 25. GROWTH RATES OF VOLUME OF SELECTED AGRICULTURAL EXPORTS, PHILIPPINES, 2015-2019 (IN PERCENT)

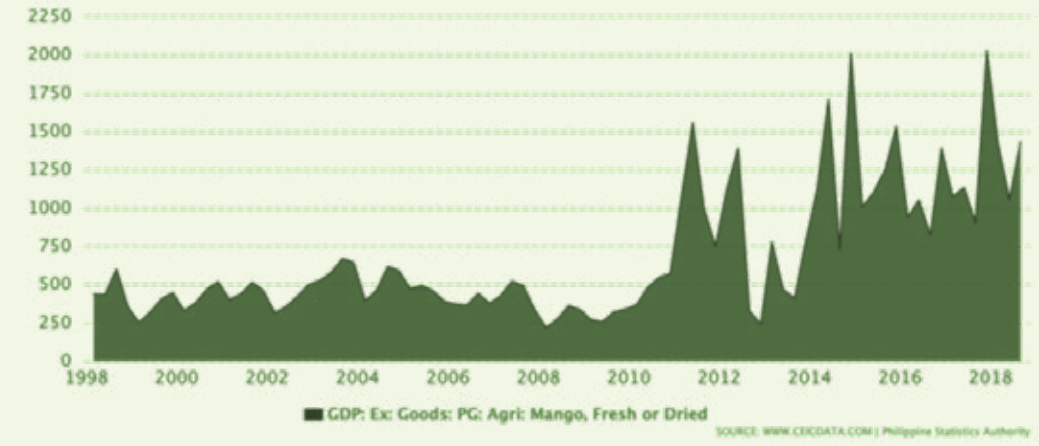
Commodity	2015-16	2016-17	2017-18	2018-19
Mango	10.5	12.4	-15.8	4.8

CEIC Data (2019) shows the Philippines Gross Domestic Product (GDP) Goods & Services: Exports: Current Price for Mango, Fresh or Dried, which is reported at PhP 1,433.416 million in September 2018 as given in Figure 18. This records an increase from the

previous number of PhP 1,057.031 million for Jun 2018. Philippines GDP: Ex: Goods: PG: Agri: Mango, Fresh or Dried data is updated quarterly, averaging Php 492.707 million from Mar 1998 to Sep 2018. The data reached an all-time high of PhP 2,030.000 million in Dec 2017 and a record low of PhP 217.156 million in Mar 2008.

Statista reported that the value of mangoes produced in the Philippines amounted to around 24.1 billion Philippine pesos in 2019 (Figure 19). The production volume of mangoes in the country was about 737.9 thousand MT in the same year.

FIGURE 18. PHILIPPINES GROSS DOMESTIC PRODUCT (GDP) GOODS & SERVICES: EXPORTS: CURRENT PRICE FOR MANGO, FRESH OR DRIED FROM MAR 1998 TO MAR 2018



Source: CEIC Data, 2019

FIGURE 19. PRODUCTION VALUE OF MANGOES IN THE PHILIPPINE FROM 2011 TO 2019 (VALUES AT CURRENT PRICES)

Source: Statistica 2020

Gross Value Added of Mango to the Major Industry

The Philippine mangoes remain to be the third most important fruit crop in the Philippines, after banana and pineapple, with gross value added (GVA) pf PhP 35.520 billion and 1.95% contribution to the major industry in 2020 (Table 26). However, it must be noted that its GVA has been in decline in the past 2 decades through a noticeable slow general recovery has been observed from 2012 (Figure 20). The GVA is highest during Quarter 2, the Philippines' normal season, while it is lowest is in Q4, the country's off-season (Table 26).

TABLE 26. GROSS VALUE ADDED AND PERCENT SHARE OF THE MANGO TO THE MAJOR INDUSTRY PER QUARTER AT CURRENT PRICES, 2010-2020

Year	Q1	Q2	Q3	Q4	Average percent share	GVA in million pesos
2010	1.2	3.8	0.5	0.2	1.43	17,489.00
2011	1.3	3.3	0.4	0.2	1.30	18,189.00
2012	1.2	3.8	0.4	1.6	1.75	25,073.00
2013	1.1	3.7	0.4	1.6	1.70	25,318.00
2014	1.0	3.3	0.5	1.6	1.60	26,104.00
2015	1.2	3.7	0.5	1.7	1.78	27,111.00

Year	Q1	Q2	Q3	Q4	Average percent share	GVA in million pesos
2016	1.2	4.4	0.5	1.9	2.00	30,400.00
2017	1.1	5.2	0.6	1.7	2.15	36,231.00
2018	1.3	4.4	0.6	1.4	1.93	33,050.00
2019	1.1	4.0	0.6	1.7	1.85	31,973.00
2020	1.2	4.3	0.6	1.7	1.95	35,520.00

Source: PSA, 2020

FIGURE 20. AVERAGE GROSS VALUE ADDED OF MANGO, PERCENT SHARE TO THE MAJOR INDUSTRY AT CURRENT PRICES, 2000-2020.

Source: PSA, 2020

ANALYSIS OF THE MANGO INDUSTRY

Linking the industry performance and commodity industry analyses, the following challenges across the value chain were identified:

1. Input Supply:
   - Regulatory problems on product registration
2. Production
   - Unproductive mango trees

•Prevalence of insect infestation (cecid fly) and diseases (anthracnose)

   - Limited access to information and technologies
   - High cost of inputs and production costs
   - Lack of economies of scale
   - Production seasonality
   - Improper farm practices such as excessive use of chemicals
3. Postharvest and Processing
   - High postharvest losses
   - Inadequate or limited postharvest and processing facilities
4. Marketing and other related concerns
   - Limited access to resources and direct markets
   - Unstable supply and prices
   - Inadequate knowledge of available financial insurance and loan programs
   - Multi-layer marketing
   - Difficulty in accessing export markets
   - Lack of export incentives
   - Indirect support in lowering costs for processors
5. Cross-cutting (Input Supply, Production and Postharvest and Processing

•The low adoption rate of existing technologies

Value Chain Map (Structural Analysis)

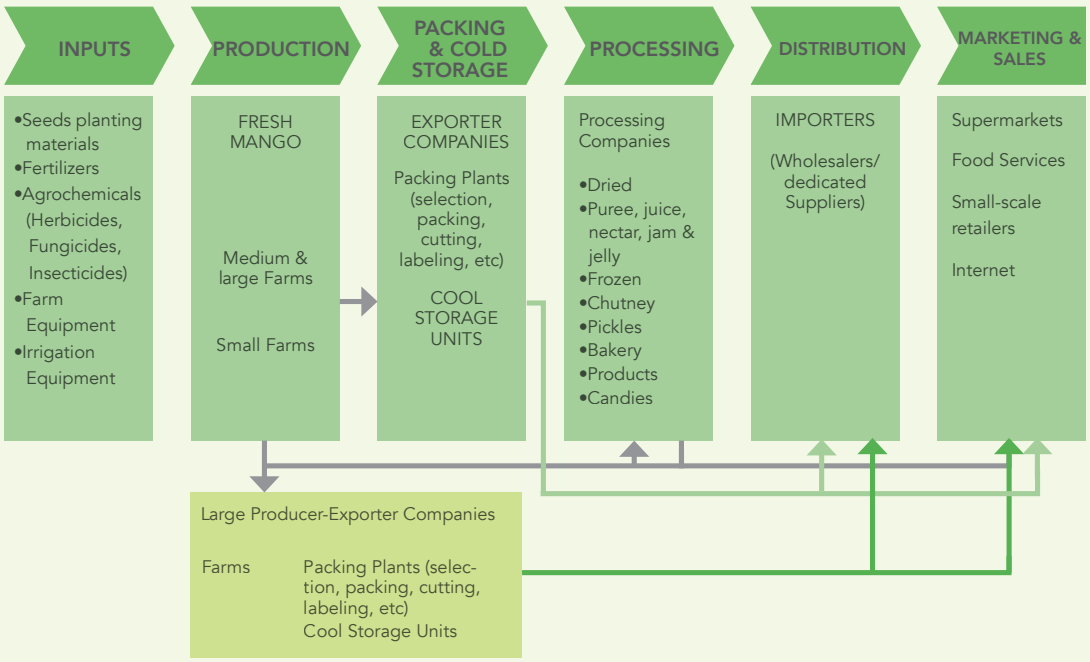
In the mango Global Value Chain (GVC), the Philippines holds a relatively significant position as it has been an important player in the global market since 1980, with exports taking off in the 1990s Fernandez-Stark, Couto, and Gereffi (2017). In terms of exports of fresh and dried mango, the Philippines ranked seventh with USD 91 million for a 4% share of the global market that accounts for an average of 10% of world fresh and dried mango exports in 2015. In the same year, leading processors have been steadily gaining access to regional and global markets, particularly to major export destinations like the US (24%), Hong Kong (17%), Republic of Korea (13%), and Japan (12%).

In the mango GVC, the Philippines is primarily present in the production and processing stages. Constraints in fresh mango exports are attributed to poor performance in cold chain management, packaging, and pre-export SPS treatments, thereby serving as barriers from complying with standards required by key export markets.

As with many major fruits, the mango global value chain, as indicated by Figure 21 can be divided into the following main segments: Production, Packaging & Cold Storage, Processing, Distribution, and Marketing and Sales. Unlike many other commercial fruits, the production of mango for exports has not yet been consolidated and continues to be undertaken by a range of small, medium, and large farms. Small farmers are usually grouped in cooperatives to achieve economies of scale, or they are linked to a contractor that usually provides technical assistance and financial support. Medium and large farms that use modern agricultural techniques are usually common in Mexico, Peru, Brazil, India, and Thailand.

The Packing and Cold Storage chain involves the preparation of fresh mango for shipping and sale. Packing is typically undertaken by export firms with large packhouses that aggregate the production from numerous different producers, and most likely also export a range of other tropical fruits. These exporters may also have some degree of production. They may sell to regional distributors or directly to large retail stores.

FIGURE 21. PHILIPPINE MANGO GLOBAL VALUE CHAIN



Adapted from: Fernandez-Stark, Couto, and Gereffi (2017)

The processing stage consists primarily of manufacturing activities, converting fresh mango into a range of processed products. The most popular processed mango products are dried, puree and Individual Quick Frozen (IQF) mangoes. Capital remains to be the main component needed to acquire the necessary equipment and infrastructure.

The distribution segment incorporates all activities corresponding to the reception of the mangos in the end market and delivery to sales outlets. Many exporters sell directly to end clients, but in other cases, brokers, or intermediaries for destination countries as market entry modes although direct buying and eliminating intermediaries have increasingly become the focus as a market entry mode. This is also the case for processed mango, wherein the exporter sells directly to large food retailers or food manufacturers. Exporters may also sell their products through distributors.

Marketing and sales activities are performed by several different actors depending on the geographic end-market such as supermarkets, food services, and small-scale retail outlets. Supermarkets increasingly remain to be the important market channel for both fresh and processed (dried and juices) mangoes.

Figures 22 and 23 depict two kinds of value chain maps for the Philippine mango. Figure 22 shows the segments in the Carabao Mango value chain in the country and each of the segment's the respective task/functions, materials, and operators. This salient information provides details on the critical aspects of each of the components that were mapped out. As Philippine Carabao mango remains to be the flagship mango variety for fresh mango export, having a closer look into these details and addressing them is important in further enhancing the Carabao mango's competitiveness in the global market.

Figure 23, on the other hand, showcases the several value chain across mango-producing provinces and regions in the Philippines. These include Guimaras, Palawan, Romblon, and North Luzon, CALABRZON and Mindanao. The mango products/byproducts, stakeholder network, and enablers across these consolidated value chains as mapped out indicate how all these elements interact. It can also be noted with the color-coded texts and lines that some value chain actors may not be evident in other value chains while also showing which actors are prominent in all these chains.

Table 27 shows the Mango Value Chain Workshop Output. The gaps/challenges as well as the recommended courses of action throughout the value chain have been identified. One of the pressing issues is the lack of skilled manpower which is evident in the production, postharvest, and assembly/trading chains. Another is the increased postharvest losses which is encountered from the postharvest stage until it reaches the distribution/marketing stage. Moreover, unfair trading practices is experienced by actors under the assembly/trading and distribution/marketing chains. Finally, utilization of mango and mango by-products was raised because of missed opportunities in further processing and value addition from such products.

FIGURE 22. PHILIPPINE MANGO VALUE CHAIN MAP

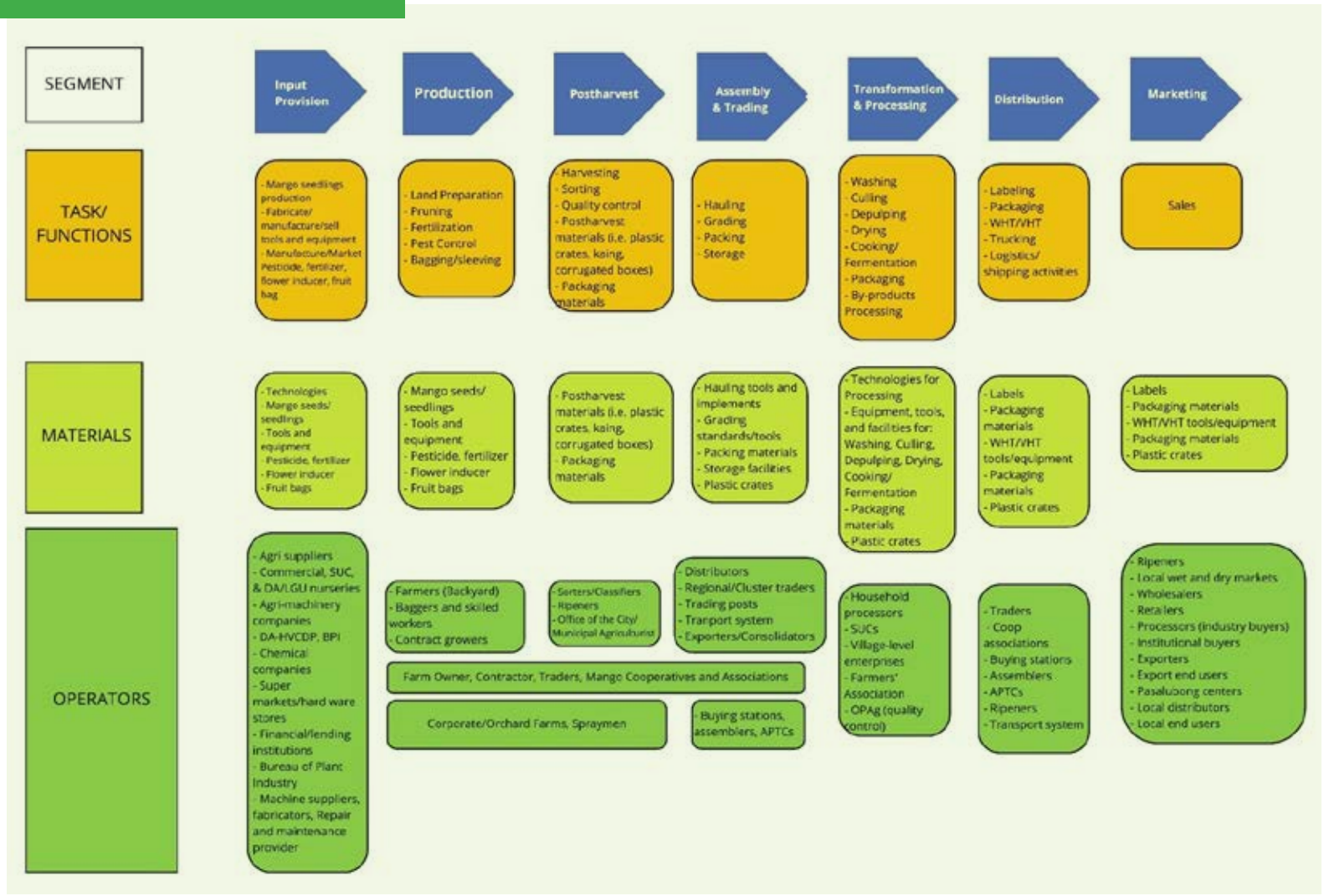


FIGURE 23. MANGO VALUE CHAIN PRODUCTS/BY-PRODUCTS, STAKEHOLDERS NETWORK AND ENABLERS ACROSS MANGO-PRODUCING REGIONS IN THE PHILIPPINES

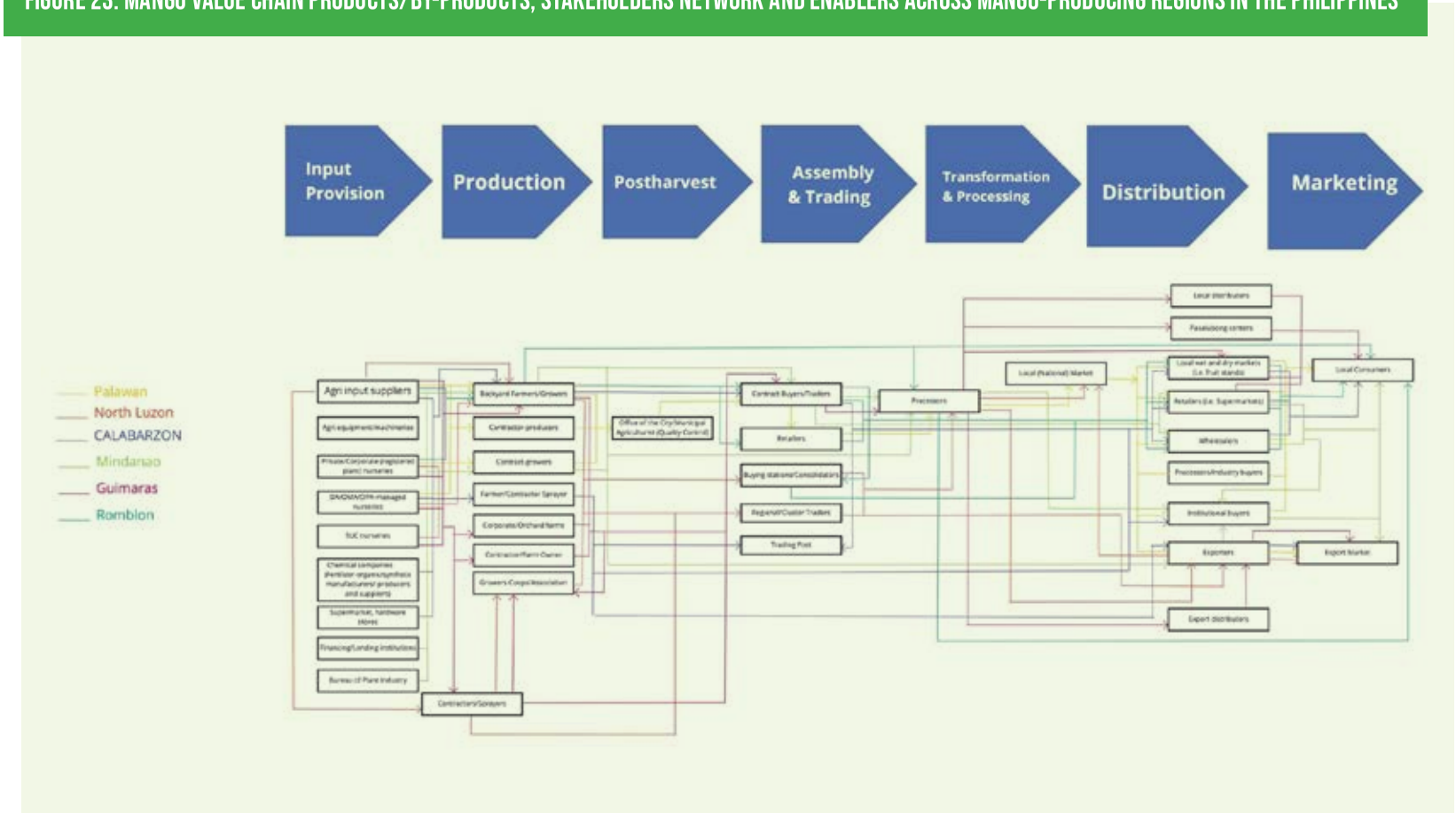


TABLE 27. MANGO VALUE CHAIN WORKSHOP OUTPUT

Inputs	Gaps and Challenges	Recommendation	Discussion
Input Provision			
Fruit bag suppliers (PLDT) Imported bags from Pakistan etc. Junkshop (recycled papers) Locally assembled	Limited source of materials (fruit bag supplier, kaing)	Create livelihood opportunities to produce bagging materials R&D on different materials for fruit bags in collaboration with the private sector Shift to use of plastic crates Others: The yellow pages used in the directory of PLDT are superior in quality; hence, it was suggested to ask PLDT their paper supplier.	The materials used for fruit bags used by mango growers are either sourced locally or abroad. Locally sourced bags are made from newspaper and yellow pages of the PLDT directory sourced from recycling centers and junkshops. Those coming from abroad are from Pakistan and other areas. Region 1 sourced their paper from Ramgo. Region III – Nueva Ecija organized a fruit bag-production group (The size of the team or the company was not specified). Old newspapers are sourced directly from newspaper companies. Women's organizations may be trained in fruit bag making There is an ongoing R&D on identifying appropriate bagging materials for mango. It is already in its pilot stage in Guimaras To compensate for the low-quality material of the locally produced newspapers, some growers are doubling the number of paper sheets per bag. However, it has consequences such as its heavyweight and additional expenses DuPont and Divex have already circulated paper bags in the market. However, they are too expensive for the farmers

Inputs	Gaps and Challenges	Recommendation	Discussion
Equipment and Machines suppliers and fabricators, Repair and Maintenance Provider			This includes sellers of equipment such as power sprayer, nozzle,
Kaing and corrugated boxes makers		Include the use of plastic crates in the whole value chain.	This Includes makers of kaing, and manufacturers of corrugated boxes, repair, and maintenance
	The proliferation of fake expired, and unauthorized products	FPA regional offices to conduct regular monitoring of products sold in the market and impose sanctions based on guidelines Database of registered products and improve the accessibility of information (like product stewardship program of chemical companies)	
	Declining effectiveness due to resistance (agricultural chemical supplier)	Database of registered products and improve the accessibility of information (like product stewardship program of chemical companies)	Chemical companies need to identify effective products that can meet the MRL and food safety standards of importing countries like Japan, South Korea, and China Mango farmers need to have enhanced access to information as they tend to misuse a chemical by applying it to a pest/crop that is not appropriate.
	Meeting the standards of food safety (MRLs set by importing countries)	Adoption of GAP	
	High cost of inputs		
	A limited number of Mode of Action (MOA) to implement Insecticide Resistance Management	Others not included in final output: Give incentives to the private sector to encourage them to register new MOAs. Example of possible incentive: ease the application process for Experimental Use Permit (EUP)	

Inputs	Gaps and Challenges	Recommendation	Discussion
Production			
Service Provider (Baggers and Skilled Workers)	Lack of skilled laborers (baggers)	Skills development for workers in the field Mechanization or use of mango lifting machines"	Most baggers come from Zambales and Mindanao. Since their number is limited, there is a low supply of skilled baggers to accommodate the farmers of Luzon. Former rate of baggers: PhP 350 per 1000 pcs.; Current rate of baggers PhP 500 per 1000pcs. There is an additional expense in sourcing out baggers from other provinces since the growers need to shoulder their transportation costs. When asked on preference, mechanization through lifting machine vs skilled laborers, Mang Carding mentioned that the mango growers prefer skilled baggers There is a high laborforce who can perform bagging in Northern Luzon; however, the problem lies in their bagging skills ATI has been conducting blended-approach training on proper bagging
	Cross-boarding of workers	Compliance with the IATF and LGU requirements and guidelines, Sourcing of workers within the area, Prioritize farmworkers in vaccinations against Covid19	The strict guideline of IATF on cross-boarding has cost mango growers additional expenses. These expenses include (1) Covid19 test, (2) limit in the number of allowed passengers in a vehicle (Example: a 10-wheeler truck can only accommodate 4 laborers); and (3) 14-day quarantine of cross-boarding laborers

Inputs	Gaps and Challenges	Recommendation	Discussion
	Limited local Manufacturers for Agri-Machinery (both production and postharvest)	Modernization of farming practices	
	Low productivity (low yield, pests, and diseases, poor care of trees) The low number of GAP-certified farms	Adoption of GAP Incentivizing	Only 3 GAP farms in the Philippines
	Profitability (high input cost, unstable price)	Farm clustering and consolidation approach	
	Lack of capital		
	Very little knowledge of the market	Establishment of a central business hub and digitize information	
	Sustainability: Degradation of the natural resource base	Mango rehabilitation	

Inputs	Gaps and Challenges	Recommendation	Discussion
Postharvest			
Fabricators* – for postharvest machinery and equipment Hot Water Tank Makers/ Processors	Access to suitable/ appropriate machinery and equipment for mango postharvest activities Awareness and adoption of suitable/appropriate machinery and equipment for mango postharvest activities	Commercialization of Mechanical lifters which are also intended for fruit bagging and flower induction (spraying) Better harvesting tools to ensure high quality of mango produce, particularly for export Better and wide-scale dissemination of useful and simple technologies/ post-harvest techniques (observe correct maturity stage, HWT, careful handling to avoid fruit drop)	Efficient and effective machinery/ equipment and tools
Farmer Traders Consolidators Cooperatives/ Associations	High pesticide residue in mango produce Awareness and adoption of suitable/appropriate machinery and equipment for mango postharvest activities	Conduct pesticide residue analysis in major mango-producing areas Better and wide-scale dissemination of useful and simple technologies/ post-harvest techniques (observe correct maturity stage, HWT, careful handling to avoid fruit drop)	This would increase the competitiveness of mango whether in local or export markets

Inputs	Gaps and Challenges	Recommendation	Discussion
	Low quality of mango fruits due to sap/latex	Observe careful harvesting and handling of mango fruits to prevent latex overflow	This would increase the competitiveness of mango whether in local or export markets
	Awareness and adoption of suitable/appropriate machinery and equipment for mango postharvest activities	Use of plastic crates throughout the whole chain (cost-effectiveness vs losses)	
		Streamlining of PNS for mango quality and other issuances from DA	
		Formulation of a Mango Quality Manual for Carabao Mango for promulgation to value chain players (cross-cutting)	
		Better and wide-scale dissemination of useful and simple technologies/ post-harvest techniques (observe correct maturity stage, HWT, careful handling to avoid fruit drop)	
Ripeners	Short shelf-life	Biodegradable bags for fruit mango (may take 2 yrs to be fully developed)	This would increase the competitiveness of mango whether in local or export markets
	Rapid ripening	Ripening agent that is safe, alternative to calcium carbide	
	Awareness and adoption of suitable/appropriate machinery and equipment for mango postharvest activities	Better and wide-scale dissemination of useful and simple technologies/ post-harvest techniques (observe correct maturity stage, HWT, careful handling to avoid fruit drop)	

Inputs	Gaps and Challenges	Recommendation	Discussion
Manual sorters/ Classifiers	Lack of manpower for sorting Contractors are funding the harvests – sorters There is a need to consider not only the size and weight in sorting as there is a lack of standards for grading, making it hard to implement Awareness and adoption of suitable/appropriate machinery and equipment for mango postharvest activities The issue of fruit fly infestation.	Creation of manpower pool for sorting, to be facilitated by associations Commercialization of mango sorters (needs to consider the quality during sorting) Accreditation of sorters by BAFS DOST-Accredited fabricators Better and wide-scale dissemination of useful and simple technologies/ post-harvest techniques (observe correct maturity stage, HWT, careful handling to avoid fruit drop)	This would standardize the practices of manual sorters/ classifiers and at the same time ensure a pool of manpower who are skilled and knowledgeable in applying these standards in their activities. Philmech agrees with the challenge in grading. There is lax monitoring of standards in size. (depending on season and area) Philmech has a sorter programmed to cater to different standards/ requirements which also measures certain parameters (size and quality).
Appropriate packaging materials and post-harvest materials	Increased losses due to mishandling and lack of proper packaging materials	Include the use of plastic crates in the whole value chain.	This would increase the competitiveness of mango whether in local or export markets

Inputs	Gaps and Challenges	Recommendation	Discussion
Assembly and Trading			
Exporters/ Consolidators (harvest and handle a large volume of mango produce)	Integrate harvest in certain provinces and deliver to institutional buyers. Lack of skilled workers	Skills Training on the Operation and Maintenance for Agricultural Machinery for Mango Production (eg proper arrangement of crates, etc) Monitoring of the consistency of quality products from producers/traders Creation of local ordinance to address unethical/malicious practices in trading Educate industry players on standard/prescribed practices for mango trading	The consolidators integrate harvest in certain provinces and deliver it to institutional buyers.
Appropriate packaging materials and post-harvest materials	Increased losses due to mishandling and lack of proper packaging materials	Include the use of plastic crates in the whole value chain.	This would increase the competitiveness of mango whether in local or export markets
Transport system	High losses incurred during transport of produce	Formulation of a Mango Quality Manual for Carabao Mango for promulgation to value chain players Identify stakeholders with major concerns/issues to come up with appropriate interventions Creation of Unified Philippine National Standards for Mango	This would increase the competitiveness of mango whether in local or export markets

Inputs	Gaps and Challenges	Recommendation	Discussion
Traders	Unfair trading practices	Coordinate with concerned government units (DTI/ DILG/LGUs) regarding unfair pricing/trading practices.	This is only an issue in Luzon Issuance of a memorandum/ ordinance Institutionalize and Raise awareness and conduct training on Standardization Systems to avoid issues on malicious trading practices Come up with Mango Quality Manual for Carabao Mango Amend Consumer Act to prevent disingenuous marketing/trading to strengthen penalties for malicious practitioners.
Transformation and Processing			
Village-level processors	High cost/price of processing grade	Use of boiler Consolidation of farmers into associations for bulk purchasing of raw materials or production of their raw material	Assist and capacitate village-level processors to transform mango fruit into more valuable products
High-end product processors	Emerging market opportunities must be tapped as there might be forgone opportunities and trends in the industry	Sugar-free jams Creation of Unified Philippine National Standards for Mango	Players of the industry are already aware of the mainstream markets so emerging and niche markets must be explored
Technologies for processing	Limited access to or availability of appropriate technologies	Utilization of IQF technology. Invest in technologies like blast freezers for processors to extend the shelf life of raw materials	IQF is aimed to be implemented in Cebu next year not only for mangoes but also for other agricultural commodities.

Inputs	Gaps and Challenges	Recommendation	Discussion
By-products processing Sugar-free jams and jellies in consideration of the increasing awareness on health and wellness (applied patent for this); Pectin produced from waste generated in mango peels (wide application from food, cosmetics, to pharmaceutical purposes) Edible coating to extend shelf life; and Flour/oil from mango kernels/ seeds. Utilize peels as fertilizer Mango rejects	Mango fruits, leaves, and tree parts (i.e. leaves, bark) could provide additional income sources if properly utilized A high volume of rejects especially during harvest season.	Utilization of mango wastes into valuable products like pectin, seed flour, oil, pectin-based edible coating Processing of rejects from the market	The utilization of mango by-products could adopt the circular economy value chain Train village-level processors and link them to the market to encourage them to process.

Inputs	Gaps and Challenges	Recommendation	Discussion
Distribution			
Ripeners Online traders Transport system	High losses incurred during transport of produce Unfair trading practices	Improved documentation and traceability system especially for export mangoes (to pre-empt possible concerns on food safety) Promote GAP among mango farmers/GAP Enhancement Program GAP Certification of mango farmers Incentivize mango farmers to apply for/undergo GAP certification Implementation of GAP enforcement programs by the government Strengthening of the Consumer Act to prevent disingenuous marketing/ trading	This would increase the competitiveness of mango whether in local or export markets
Appropriate packaging materials and post-harvest materials	Increased losses due to mishandling and lack of proper packaging materials	Include the use of plastic crates in the whole value chain.	This would increase the competitiveness of mango whether in local or export markets

Inputs	Gaps and Challenges	Recommendation	Discussion
Marketing			
Ripeners	Low quality of mango products/ exports due to pest infestation and/or diseases High demand but low volume of production	Require implementation of proper postharvest and handling practices Production chain to increase production volume of mangoes	Low supply increases the cost as well as low quality that resulting in increased losses thereby decreasing the income of ripeners
Local/small-scale retailers (mango rejects*)	Small players who still peel reject/ remove bruised parts and still sell the good portions to local students, pedestrians, etc.	In Manila, these may be classified as those who sell fresh cut, usually not top quality mangoes, with bagoong to value add (also considered minimally processed mangoes).	This is to maximize the profitability despite losses
Online traders Resellers	Increased promotion	Multi-media promotion of IECs related to mango products to raise awareness on mango quality in the market Strengthening of the Consumer Act to prevent disingenuous marketing/ trading	Promote and highlight our country's national fruit not just locally but even globally
Appropriate packaging materials and post-harvest materials	Increased losses due to mishandling and lack of proper packaging materials	Include the use of plastic crates in the whole value chain.	This would increase the competitiveness of mango whether in local or export markets

Inputs	Gaps and Challenges	Recommendation	Discussion
Support			
TESDA (training/ capacity building)	Need to equip various actors across the value chain	Accreditation of industry actors in terms of knowledge and skills	Tap TESDA in capacity building needs and accreditation of mango workers since the standardization of practices shall be made
Best practices in Guimaras: Reporting After induction,	Limited regulations on a national and local level that would mitigate malpractices and support best practices	Need for policy interventions that could be implemented on a national and local level	With Guimaras as a model farm, other local Mango industries could follow and adopt
	Advocacy on GAP mango farms	Benchmarking activity for this and that the government provide technical and/or financial assistance	Come up with policy recommendations and GAP-enhancement programs/ incentivize mango farmers.
		Integrate into the roadmap the standards for mango for the information and guidance of mango stakeholders and LGUs.	

SWOT Analysis

Strengths	Carabao mango of the Philippines is one of the best varieties in the world. It is also responsive to flower induction. The Philippines has a suitable climate and soil that can support the growth of mango. Grown in most parts of the country Year-round production technologies are available Improved production, postharvest, and processing technologies are available Technological support is provided by the government and other stakeholders Priority fruit crop supported by DA, DOST and DTI The mango private sector is active There is both local and export market
Weaknesses	Thin-skinned; poor handling and transport characteristics. It is also susceptible to major insect pests and diseases High perishability and inadequate post-harvest, and processing facilities Low adoption of improved technologies resulting in decreased productivity Low level of mechanization The predominance of small farms, hence inconsistent supply of high-quality fruits Many mango trees are old and unproductive contributing to low productivity Existing 'Carabao' mango trees are difficult and too risky to manage Archipelagic islands Limited R and D support Limited credit access Limited skilled workers
Opportunities	The substantial surplus that is not optimally used can be developed into marketable value-added products Increasing domestic and export demands for fresh and processed products Possible adoption of controlled atmosphere storage for distant markets Strategic geographical proximity to Asian markets Availability of additional suitable areas for further expansion R and D on canopy management for pest, disease, and other culture technology application
Threats	The adverse effect of climate and weather change Stiff competition from other mango-exporting countries Emerging insect pests and diseases; Unscrupulous exporters using prohibited chemicals Increasing costs of labor and production inputs Unabated cutting of mango trees for crop conversion

Source: NFSS workshop, May 2021

Industry Analysis

Production

Number of Accredited Nurseries

There are 24 nurseries accredited by the Bureau of Plant Industry – National Seed Quality Control Services (BPI-NSQCS) as of June 8, 2021. These nurseries are in Regions I, II, III, IV-A, IV-B, X, XI, and XII aside from the nurseries that are being maintained by Regional Field Offices (RFOs) and BPI Centers nationwide. These nurseries are accredited as to the National Seed Industry Council (NSIC) approved mango varieties available on their scion groves for propagation that will be qualified for tagging as certified quality planting materials by the designated Plant Nursery Evaluators (PNEs) and Plant Material Inspectors (PMIs). Appendix 1 list the accredited nurseries.

NSIC Approved Mango Varieties

Based on the NSIC Registered Crop Varieties Catalogue (2021), there are 5 Philippine Seed Board (PSB) and 17 NSIC approved mango varieties. Parent trees of these varieties exhibited outstanding characters that passed the evaluation of the NSIC Fruit Crop Technical Working Group, Technical Secretariat, and Council members.

The approved varieties are composed of 17 'Carabao', 3 big and 1 small red-colored, and 1 'Pico' parental lines. Among these varieties, Guimaras Super (Galila) has the highest total soluble solids recorded (22.3° Brix).

Plant Breeding activities

Due to the experienced decline in mango productivity, the development and breeding of improved and new varieties with traits that will improve productivity are recognized to be long-term solutions but needs to be commenced at once.

Among government institutions, active breeding for improved traits is carried out at the Institute of Plant Breeding (IPB), at the University of the Philippines Los Baños. Large mango germplasm collections where desired genes can be sourced from are also

maintained at IPB and the DA-BPI National Mango Research and Development Center in Guimaras. There are a few other institutes with smaller mango germplasm collections such as the Rizal Memorial Technological Institute in Zambales, and the University of Southern Mindanao in Cotabato.

Currently, in projects that are supported by DOST-PCAARRD, IPB mango breeders have collaborated with other DA institutes and SUCs in developing crosses for traits such as fruitfly resistance and red-blushed peel in Carabao mangoes. However, the breeding activities are still in their infancy stage, with parentals and hybrid seedlings maintained at IPB. Potential hybrids and varietal improvement traits of interest are resistance to cecid fly (resulting in kurikong), fruitfly resistance, delayed ripening, thick peel, anthracnose resistance, fruit nutrient content improvement.

Efforts to control disease and insect infestation may be short-term as the causative organisms can develop resistance to control measures, hence breeding resistant varieties should be an alternative. The same sense of urgency is also necessary for other traits to improve productivity. The use of molecular techniques and genetic information will help facilitate and hasten the breeding process since at the early growth stage, hybrid seedlings carrying the desired trait can be selected. Molecular markers developed from mango genomic data have been used to identify parental lines and true hybrids, and if these hybrids carry the marker for the trait of interest. The Institute of Plant Breeding and the Institute of Crop Science have obtained genomic data that can be mined for genetic markers that can be used in selecting genotypes with superior traits. The data can also be used to identify or barcode the endemic mango species. More specific gene information will become available once the whole genome sequencing data analysis for Carabao mango, and 2 other Philippine species become s available.

Other proposed areas for breeding research:

1. Improvement of pollination techniques for higher fertilization rates
2. Development of embryo culture/rescue from successfully fertilized flowers (high fruit drop results in a very low number of hybrid seedlings)
3. Studies on coordinated flowering for breeding purposes/ hybrid and varietal development

4. Rootstock breeding for rootstock varieties/lines that are slow growing yet stress and disease resistance
5. Development of dwarf phenotypes through proper spacing and pruning or through selection and breeding
6. Breeding for high nutraceutical content in fruits
7. Collaboration among government and private institutions in the development of new hybrids and varieties
8. Validation of genetic markers for screening and marker-assisted-selection

Recommended Practice vs Current Practices

Table 28 presents a comparison of recommended practices based on Good Agricultural Practices (GAP) against the current/traditional practices in the country's mango industry. The parameters include planting materials, cultural management, harvesting, postharvest, marketing and credit.

TABLE 28. COMPARISON OF RECOMMENDED AND CURRENT PRACTICES

Parameters	Recommended based on GAP	Current/Traditional
Planting Materials		
Source and quality	Certified grafted seedlings from BPI-accredited nurseries, DA-RFO ROS and BPI Centers	Seedlings or grafted seedlings purchased from any source
Cultural Management		
Land Preparation	Land clearing, staking, and digging of bigger holes for the addition of compost fertilizer	Land clearing, staking, and digging of holes
Planting distance	12x12 m (based on GAP recommendation)	10x10 m apart
Type	Intercropping, multiple cropping	Monocropping
Fertilization	Based on crop removal or a result of soil analysis:	No fertilization or undetermined amount of organic or inorganic fertilizers applied directly at the base of the trees.

Parameters	Recommended based on GAP	Current/Traditional
Insect pests and diseases control	Need-based spraying based on recommended Insecticide and Fungicide Resistance Management and MOA of pesticides. Adopting the pre-production, production, and post-production practices (Integrated Cultural Management for Mango) If cecid fly is not a problem: 55 to 60 days from flower induction (DAFI) If cecid fly is prevalent: early bagging at 35 to 40 DAFI and re-bagging at 50 to 55 DAFI to bag the fruits that developed late. Done to reduce the frequency of pesticide spray	Pest management relies heavily on the use of synthetic pesticides
Bagging of fruits	If cecid fly is not a problem: 55 to 60 DAFI If cecid fly is prevalent: early bagging at 35 to 40 DAFI and re-bagging at 50 to 55 DAFI to bag the fruits that developed late. Done to reduce the frequency of pesticide spray	Not a common practice among mango growers in Luzon.
Harvesting		
Fruit Maturity	Mangoes should be picked only when they reached full maturity using the recommended indices. 120 to 130 days from flower induction (during early induction months of Oct, Nov., and Dec); 105 to 115 days during late induction months of January, February, and March. Local ordinance to harvest fruits at the right maturity should be passed and imposed by the LGUs.	Harvesting time is not considered critical; Picking of mangoes is done by hand and/or with the use of a picking pole. With tall trees, harvesters have to climb the tree and use a rope to lower down the basket filled with fruits
Fruit sampling and testing	Varies with age and health of trees; 4,213 kg/ha.	'Pakyaw' system based on the mercy of contractors and 'biyaheros'.

Parameters	Recommended based on GAP	Current/Traditional
Time and method	Harvesting of mango should be done between 9 AM and 3 PM to minimize latex staining and latex burns which are major causes of rejection. Picking of mangoes is done by hand and/or with the use of a picking pole. With tall trees, harvesters have to climb the tree and use a rope to lower down the basket filled with fruits.	Harvesting time is not considered critical; Picking of mangoes is done by hand and/or with the use of a picking pole. With tall trees, harvesters have to climb the tree and use a rope to lower down the basket filled with fruits
Estimated and yield	Varies with age and health of trees; 4,213 kg/ha.	'Pakyaw' system based on the mercy of contractors and 'biyaheros'.
Postharvest		
Sorting and grading	In the packinghouse, fruits are sorted on tables padded with foam based on marketable quality (no defects) and non-marketable (with defects) and classified according to sizes (small, medium, and large) following the PNS for mango	Fruit sorting is usually done in the field without following the Philippine National Standards (PNS) for mango.
Ripening	If accelerated ripening is desired, simply subject the fruits to hot water treatment (HWT) without hydro cooling. Place liners, such as newsprint, inside the container to help conserve some of the heat and trap ethylene which can accelerate ripening.	Calcium carbide is placed inside the container together with the fruits to accelerate the ripening of fruits.
Hot water treatment	To minimize problems with anthracnose and stem-end rot, mangoes should be subjected to HWT. This consists of dipping newly harvested fruits in water at 52° to 55° C for ten minutes, followed by hydro cooling with tap water, then air drying	Generally, not practiced by typical mango growers
Packaging	Plastic crates are used; Fiber board cartons are used for fruits intended for export.	Bamboo basket ("Kaing"), is commonly used
Marketing		
Practices	The supply chain of the mango industry has been characterized by production-marketing arrangements between growers and contract sprayers who also act as traders. These growers and traders sell to wholesale markets and exporters.	Sell to contract buyers.
Credit		
Financing	Special lending programs from the government	Self-financed

Crop Suitability

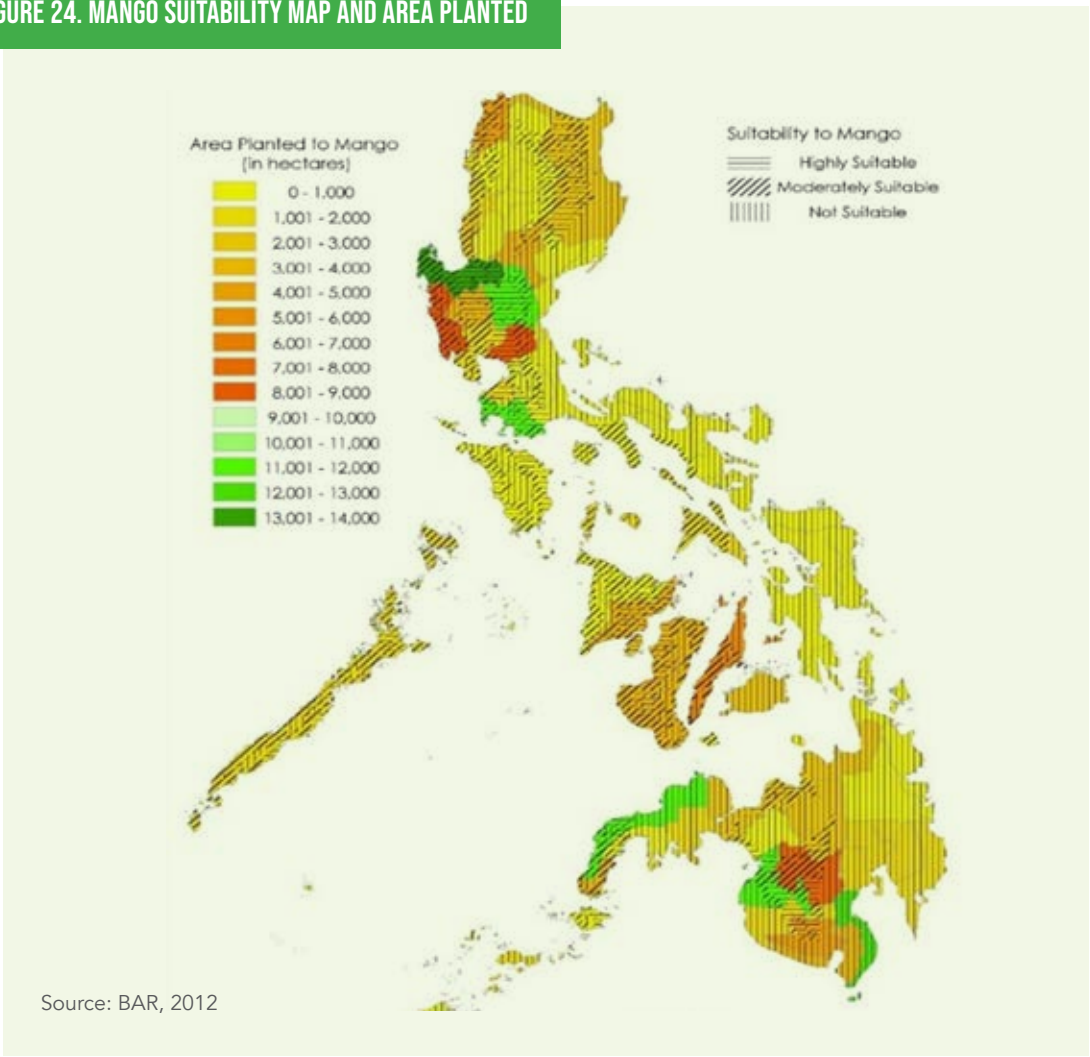
Being a tropical country, the Philippines has distinct wet and dry seasons that can support the growth of mango trees. During its productive years, the mango tree must be exposed to a dry period for around 3 to 5 months to induce stress. The stress is necessary for the trees to accumulate reserved food thereby, enhancing the maturation of leaves in preparation for flowering. On the other hand, areas with continuous rainfall induce vegetative growth, hence, the tendency for difficult flower induction. Table 29 shows the other biophysical requirement for mango cultivation.

TABLE 29. BIOPHYSICAL REQUIREMENT FOR MANGO CULTIVATION (SOURCE: PNS/BAFPS 45:2009)

Parameter	Description
Climatic condition	With distinct wet and dry season; with four (4) months dry period
Temperature	22°C - 34°C, mean temperature: 28°C
Soil characteristic	Well-drained soil; pH of 5.5 to 7.5
Elevation	The area should not be higher than 600 meters above sea level
Topography	Flat to slightly rolling

According to the DA-Bureau of Agricultural Research (DA-BAR), the following provinces are ideal for growing mangoes: Abra, Antique, Bataan, Batangas, Bulacan, Cavite, Cebu, Cotabato, (South), Davao (North and Southern), Guimaras, Ilocos Norte, Ilocos Sur, Iloilo (South and Western), Laguna (Western), La Union, Negros Occidental (Western), Negros Oriental, Nueva Ecija, Mindoro Oriental, Palawan, Pampanga, Pangasinan, Rizal, Tarlac and Zambales. Figure 24 illustrates the mango suitability map and area planted with mango in 2012.

FIGURE 24. MANGO SUITABILITY MAP AND AREA PLANTED



Source: BAR, 2012

Mango Pest and Diseases

The industry faces declining yield and quality attributed to pests and diseases (Table 30). This particularly limits the performance of the Philippine mango in the international market as it requires higher quality standards as compared to the domestic market.

Currently, the major problem of mango growers is cecid fly infestation during the production stage and anthracnose disease in postharvest. With the occurrence of destructive pests and diseases in mango like the cecid fly, the Department of Agriculture coordinated with SUC's and experts regarding the conduct of a research study on the management and control of major mango pests and diseases.

Cecid Fly

Cecid fly also known as "kurikong or nora nora" is a very small and delicate fly with long legs and antennae, and hairy transparent wings. Two types of cecid fly are present in mango: one attacks the fruits (Procontarinia frugivora Gagne) and the other on leaves (Procontarinia pustulata). Cecid fly on newly infested fruits is hard to recognize because the damage appears as pin pricks with slight discoloration and/or moderate galling and becomes more distinct and darker as the fruit grows and matures. Infestation starts as early as 32 DAFI and could recur up to 75 DAFI.

Management: Prune crowded branches and infested leaves, particularly flushes. Remove weeds, underbrush shrubs, and small trees under the mango canopy. Collect and dispose of the infested fruits properly. Monitor damage as early as 32 DAFI and spray insecticide when necessary. Practice Insecticide Resistance Management (IRM) by alternating insecticides with different MOAs. Dispose of fallen fruits by burning or digging into a minimum of 50 cm. deep.

Prevention: Bag fruits at 40 DAFI or marble size or spray registered insecticides up to 55 days after flower induction. Bag fruits one to three days after insecticide application.

Anthracnose

Anthracnose is a major postharvest problem of mango fruits and is the most serious fungal disease of mangoes in the Philippines. It causes irregular brown spots on young leaves while mature leaves get distorted with "shotholes" in various shapes and sizes. It also blackens and withers the flowers and produces "blossom blight" while causing brown to black sunken spots on the fruits. Other damage caused by anthracnose: reduced tree vigor; unproductive terminal branches; withering of flowers; failure to set and retain fruits; rotting of fruits and total crop failure

Field Management – Maintain good light penetration and air circulation in each mango tree. Collect and burn trash to reduce sources of disease. Bag fruits using appropriate bagging materials to reduce further field infestation. Fertilize and irrigate trees to improve tree vigor. When flushing occurs on rainy days, protect emerging flushes from leaf spots by spraying registered contact fungicides. Apply protectants/ systemic fungicides to protect inflorescence against blossom blight and fruit rot infection on developing fruits.

Post-harvest Management- Subject newly harvested fruits in hot water treatment.

Other Pests and Diseases of Mango

TABLE 30. COMMON PESTS AND DISEASES ON MANGO

Part of Mango Plant	Pests	Disease
Flowers	Mango leafhopper	Anthracnose
	Mango tip/twig borer	Sooty mold
	Mealy bugs	
	Scale insect	
	Mango thrips	
Fruits	Fruits flies	Anthracnose
	Mango seed borer	Scab
	Mango Pulp weevil	Sooty mold
	Mango thrips	Diplodia stem-end rot
	Mealy bugs	
	Scale insect	
	Capsid bug	
	Cecid fly	
	Ants	

Source: PNS/BAFPS 2045-2009

Postharvest Handling and Processing

A good quality mango is mature, well-formed, clean, free from physical damage, blemishes, insect damage, and sap injury. Fruit bagging in the field along with the use of spray decision tools resulted in better visual quality and shelf life (Bayogan et al., 2012). Likewise, bagging was found to also delay the onset of stem-end rot and improve shelf life (Secretaria et al., 2020).

Harvesting

Harvesting of 'Carabao' mango is done from 105 to 125 DAFI. Fruit harvested from 115 to 125 are however heavier, sweeter, juicier, less sour than fruit harvested at 105 to 110

DAFI. The indicators of maturity are as follows: the presence of bloom, flattening of mango fruit shoulder. Another way of ascertaining fruit maturity is through flotation with the use of 1% salt solution. Fruits that sink are mature while immature fruit float in 1% salt solution (10 g/10L water or roughly 2 tsp salt in 10 L water). About 15 fruits are randomly picked from the various parts of the tree and placed in a pail with 1 % salt solution. If 80% (12 of 15 fruit) sinks, then the fruits may be harvested. To minimize bruising, use picking tools and place fruit in plastic crates. There are harvesting tools that minimize physical injury and latex injury. Produce should be immediately placed in a shaded area.

Careful harvesting and handling of mangoes where fruits are not dropped nor tossed increase the quantity of high-quality fruit due to lesser cracks and bumps. Blemishes due to latex flow on fruit can be controlled by harvested in the afternoon (12:00 PM onwards) in which latex production is lower compared to harvesting in the morning (Secretaria et al., 2021). Re-cut pedicel at the abscission or base and subsequently keep fruit upside down to drain latex using a latex draining tray. Fruit can also be harvested with a longer pedicel that can be re-cut later to minimize exudation of sap on the fruit. Wash the fruit with water to remove the latex.

Causes of Rejection

Causes of rejection at the farm level and postharvest include the following: scab, mechanical injury or bumps, insect damage (fruit fly, cecid fly, ants, thrips), cracks, undersized, misshapen fruit, lenticel spotting, discoloration, and sooty mold.

Sorting

Fruits are sorted according to size and quality. Diseased or defective fruit should be discarded. Sorting should be done in a shaded area.

Packing and Transport

If bamboo baskets are used, the inside part should be lined with newspaper sheets. Whenever possible, use carton boxes and plastic crates for packing. Packing should be done in a shaded area.

Transport losses can be minimized by transporting mango during the coolest part of the day. Delivery trucks should be covered with white instead of dark-colored canvas material. People should not step or sit on the mango containers.

Postharvest Treatments

Mango, a climacteric fruit undergoes ripening after harvest. Ripening converts it into one that is edible and acceptable. A common ripening agent still in use in the Philippines is calcium carbide. To reduce the adverse effect of high temperature when using calcium carbide, ripen fruit for 48 hours instead of 72 hours. Likewise, concentration can be reduced from 10 to 12.5 g/kg to 7.5g/kg of fruit. Chemicals should be tightly wrapped in paper, packed in the middle of the fruit pile inside the bamboo basket. Bamboo baskets should be placed in the shade.

Ethephon can also be used at 1,000 ppm for two minutes instead of calcium carbide (Lacap et al., 2019).

HWT at 52 to 550°C for ten minutes followed by cooling in water and air drying effectively controlled stem-end rot and anthracnose. HWT is a very effective physical method to maintain quality longer and control diseases. It can also wash latex, pesticide residues, and dirt adhering to fruit. It is not however widely practiced by farmers. Reasons can be due to the cost of the unit, duration of treatment, and no real advantage in price in the local market.

When disease pressure in the field is low, a rapid hot water treatment (69 to 600°C for 35 to 60 min) can be done (Pasilan et al., 2020).

Storage

Mangoes can be stored in a low-temperature room (120°C) to maintain quality. Chilling injury in Carabao mango fruit following prolonged storage at 70°C is alleviated when fruits are conditioned for three days at 100°C (Rodeo and Esguerra, 2013).

A lower temperature of 100°C may be used if the fruit were Carabao mango fruit packed in five kg polyethylene bags (0.38mm, with 50 pinholes using 26-gauge needles) and held in 12.50°C were at a half-ripe and slightly firm stage of ripening with minimal development of disease after four weeks (Yaptenco, et al., 2010).

In the market, mangoes should be displayed away from the heat of the sun. If poor quality fruit is also sold, these should be displayed separately from good quality fruit. Poor quality and diseased fruit give off ethylene which would hasten the deterioration of produce particularly the green and firm fruit. Containers and shelves to display fruit should be clean.

Farm Income/Costs and Returns Analysis

More than 50% of the total costs in the production of mango are attributed to cash costs. In particular, agricultural inputs such as fertilizers and pesticides as well as hired labor constitutes more than 80% of the cash costs and approximately 40% of the overall costs.

Cost and Return Analysis

Nationwide data generated in Table 31 for the country's overall cost and return analysis for mango production. the profitability picture is much better. It can be noted that all costs such as cash costs, non-cash costs, and imputed costs have gradually increased from 2015-2019. In 5 years that more than 50% of the total costs in the production of mango are attributed to cash costs. In particular, agricultural inputs such as fertilizers and pesticides as well as hired labor constitutes more than 80% of the cash costs and approximately 40% of the overall costs. In the same way, gross returns, returns above cash costs, returns above cash & non-cash costs, and net returns have increased by 20%, 24%, 23%, and 15%, respectively. With the simultaneous increase in cost per kg as well as the farmgate price per kg, the profit margins do not significantly increase nor decrease over the 5-year period.

TABLE 31. COST AND RETURN ANALYSIS OF MANGO PRODUCTION, 2015-2019

ITEM	2015	2016	2017	2018	2019
CASH COSTS	43,813.00	43,828.00	44,102.00	46,234.00	49,224.00
Fertilizer	14,606.00	13,806.00	13,412.00	14,011.00	14,842.00
Pesticides	7,220.00	7,253.00	7,092.00	6,815.00	7,914.00
Hired labor	12,635.00	13,040.00	13,245.00	14,469.00	15,201.00
Land tax	823.00	831.00	840.00	848.00	856.00
Rentals	2,026.00	2,264.00	2,528.00	2,634.00	2,639.00
Water/electric bills	280.00	268.00	283.00	303.00	305.00
Fuel and oil	1,753.00	1,679.00	1,771.00	1,894.00	1,909.00
Interest payment on crop loan	1,659.00	1,825.00	2,007.00	2,208.00	2,429.00
Food expense	1,347.00	1,370.00	1,414.00	1,507.00	1,534.00
Repairs	1,464.00	1,491.00	1,510.00	1,545.00	1,594.00
NON-CASH COSTS	4,924.00	5,845.00	6,941.00	6,946.00	6,726.00
Hired labor paid in kind	794.00	818.00	831.00	908.00	954.00
Rentals paid in kind	148.00	152.00	155.00	169.00	178.00
Landlord's share paid in kind	3,228.00	4,024.00	4,991.00	4,946.00	4,690.00
Harvester's share	754.00	850.00	964.00	923.00	904.00
IMPUTED COSTS	26,143.00	28,464.00	30,951.00	33,685.00	36,471.00
Operator and family labor	6,291.00	6,482.00	6,584.00	7,193.00	7,557.00
Depreciation	15,631.00	17,194.00	18,914.00	20,805.00	22,885.00
Interest on operating capital	1,923.00	1,923.00	1,900.00	2,167.00	2,690.00
Rental value of owned land	2,298.00	2,865.00	3,553.00	3,521.00	3,339.00
ALL COSTS	74,880.00	78,137.00	81,994.00	86,865.00	92,421.00
GROSS RETURNS	130,363.00	147,009.00	166,676.00	159,630.00	156,336.00
RETURNS ABOVE CASH COSTS	86,550.00	103,181.00	122,574.00	113,396.00	107,112.00
RETURNS ABOVE CASH & NON-CASH COSTS	81,626.00	97,337.00	115,633.00	106,450.00	100,386.00
NET RETURNS	55,483.00	68,872.00	84,682.00	72,765.00	63,915.00
NET PROFIT- COST RATIO	0.74	0.88	1.03	0.84	0.69
Cost per kilogram (pesos)	15.63	18.03	20.70	22.69	23.37
Yield per hectare (kg)	4,791.00	4,334.00	3,962.00	3,829.00	3,954.00
Farmgate price (pesos/kg)	27.21	33.92	42.07	41.69	39.54

Source: Countrystat-PSA, 2019

The succeeding tables show the production costs data for Luzon, Visayas, and Mindanao regions as provided by the Mango farmers associations. Table 32 shows the production cost of mango in Luzon for one season at 15 years old and up fruit trees in one hectare of 50 mango trees, which is the region's average. Fertilization costs cover fertilizer costs, irrigation fees, pruning and flushing induction activities, treatment for young leaves, and labor/manpower costs plus food allowance. For flower production, these include flower inducer, insecticide, manpower, and allowance costs. In cases where there is an incidence of rain at nighttime, potassium nitrate is introduced after 4-5 days to improve flower production. Spraying is done from October to February.

For Insect and pest control, costs include insecticides, fungicides, spraying expenses, and labor. These costs are employed in three batches of shots for 7-10 days, 14-17 days, and 20-30 days while half shower application is done optionally. This is followed by washing and maintenance of insects and pest control. Developing fruits may be treated with foliar fertilizer and protective sprays. Fruit bagging expenses such as fruits bags, bagger fees, fuel, and allowance are also included in this cost item.

As indicated, the total cost is at PhP134,804.00 in the assumption that low to an extreme infestation of cecid fly and other pests and diseases incidence did not occur. The total costs vary based on the harvest costs incurred depending on the incidence of cecid fly and other pests and diseases. These harvest costs cover manpower, food, trucking & other costs. With low infestation of cecid fly that manifest as cracks or sooty molds in mango fruits, the volume of mango harvest only reaches up to 3,600 kg or 200 kaing which is 66% of total harvest with no pest and disease infestation while for extreme cases where fruit drops and rejects such as scab are evident only yield 1,800 kg of mango fruits which is only 33% of total harvest with no infestation. Harvest schedule is employed at 115 DAFI.

The average harvest for one season is 5,400 kg (or 300 kaing) at a farmgate price of PhP 30 per kg. The farm gate price varies per region which depends on the mango's seasonality. This generates a gross income of PhP 162,000.00 with a return on investment (ROI) at PhP 27,196.00 and PhP 24.96 production cost per kg.

TABLE 32. PRODUCTION COST AND RETURN FOR MANGO (LUZON) FOR 1 SEASON AT 15 YEARS OLD AND UP FRUIT TREES IN 1 HA. (50 TREES)

PARTICULARS	AMOUNT (in PhP)	
Farm Sanitation		1,500.00
Fertilization		5,000.00
Flower Production	5,408.00	23,712.00
Optional: Potassium nitrate + labor*		
Insect and Pest Control		34,328.00
Shower (optional – half only*)	6,972.00	
Washing		11,444.00
Maintenance Insect and Pest Control		15,320.00
Treatment of Developing Fruits		30,000.00
Harvest Cost		13,500.00
TOTAL COSTS		134,804.00
Harvest in kg (or 300 kaing)		5,400
Farm Gate Price per kilogram		30
GROSS INCOME		162,000.00
ROI		27,196.00
Production cost per 1 ha. / 50 trees		134,804.00
Production cost per kilo		24.96

Source: United Luzon Mango Stakeholders Association Inc. (ULMSAI), 2021.

In the case of the Visayas Region, the production costs and returns of mango are given by Table 33 for one season at 15-year-old and up fruit trees in one hectare of 80 grafted mango trees, specifically for Guimaras. The region does not spend on costs farm sanitation and fertilization costs unlike that of Luzon's.

For flower induction, these include first and second (dressing) induction and power sprayer expenses such as fuel, labor, and water. Insect and pest control, costs include foliar fertilizer, insecticides, fungicides, spraying expenses such as fuel and labor. These costs are employed in four spraying batches for 10-20 days, 16-17 DAFI, and 20-30 days while half shower application is done optionally. This is followed by washing and maintenance of insects and pest control that fifth till the 8th batches of spraying.

Developing fruits may be treated with foliar fertilizer and protective sprays. Spraying is done from December to March. Fruit bagging expenses such as fruits bags, bagger fees, fuel, and allowance being spent on three batches of bagging at 46-up DAFI, 60 DAFI, and 80 DAFI, on 28 trees only wherein typically, 70% of 80% that responded will bear fruits. Harvesting is done at 115 days DAFI with costs covering recycled boxes, transportation allowance, labor, and sorters. Overall, these costs sum up at PhP 355,342.11.

The average harvest for one season is 16,000 kg (or 200 kg per tree at 80 trees/ha) at a farmgate price of PhP 65 per kg. The farm gate price may vary depending on the market This generates a gross income of PhP 1,040,000.00 with a net cash income of PhP 684,657.89 and PhP 22.21 production cost per kg.

TABLE 33. PRODUCTION COST AND RETURN FOR MANGO (VISAYAS: GUIMARAS) FOR 1 SEASON AT 15 YEARS OLD AND UP FRUIT TREES IN 1 HA. (80 TREES)

PARTICULARS	AMOUNT (in PhP)
Flower induction	36,640.00
Insect and Pest Control	144,905.00
Washing	25,396.50
Maintenance Insect and Diisease Control	81,357.81
Treatment of Developing Fruits	48,479.50
Harvest Cost	18,563.31
TOTAL COSTS	355,342.11
Harvest (300 kg/tree)	6,000
Farm Gate Price per kilogram	65
GROSS INCOME	1,040,000.00
Net Cash Income	684,657.89
Production cost per 1 ha. / 80 trees	4,441.78
Production cost per kilo	P22.21

For Mindanao, Table 34 showcases the production costs and returns of mango for one season at 15 years old and up fruit trees in one hectare of 50 mango trees, which is the region's average. Fertilization costs cover fertilizer costs, irrigation fees, pruning and flushing induction activities, treatment for young leaves, and also labor/manpower costs plus food allowance. Spraying is done from October to February. For flower production, these include flower inducer, manpower, transport, fuel, and water costs.

For Insect and pest control, costs include insecticides, foliar, spraying expenses, labor, fuel, and food. These costs are employed in three batches of control with the 3rd control employing a cocktail insecticide. This is followed by washing with the 1st shot being applied for 32-40 days and another with 'Yugyog' washing for 32-35 DAFI. The expenses incurred include insecticides, fungicides, food, fuel, manpower/labor for the 1st shot while the 'Yugyog' expenses cover cocktail insecticide, food, fuel, and labor/manpower costs for performing the 'yugyog'. and Maintenance of insects and pest control is being done in five batches at 37-40 DAFI. Treatment of developing fruits may be treated with foliar fertilizer and protective sprays. Fruit bagging expenses such as fruits bags, bagger fees, fuel, and allowance are also included in this cost item.

As indicated, the total cost is at PhP 488,237.50 without incidence of cecid fly and other pests and diseases. Harvest costs differ with the incidence of cecid fly and other pests and diseases recorded at PhP 10,850.00. These harvest costs cover manpower, food, trucking & other costs. Mango production with the incidence of cecid fly and other pests and diseases can only harvest half (8,000 kg) of what can be produced without infestation. Harvest schedule is employed at 115 DAFI. Additional production costs incurred which are not reflected in the Luzon and Visayas Regions are farm owner share 30% and farm regular staff commission @1.50/kg x 4 person at PhP 216,000.00 and PhP 96,000.00, respectively.

The average harvest for one season is 16,000 kg at a farmgate price of PhP 45 per kg. The farm gate price varies per region which depends on the mango's seasonality. This generates a gross income of PhP 720,000.00 with a net cash income of PhP 231,762.50 and PhP 30.51 production cost per kg.

TABLE 34. PRODUCTION COST AND RETURN FOR MANGO (MINDANAO) FOR 1 SEASON AT 15-YEAR-OLD AND UP FRUIT TREES IN 1 HA. (50 TREES)

PARTICULARS	AMOUNT (in PhP)
Farm Sanitation	1,600.00
Fertilization	12,050.00
Flower Production	5,650.00
Insect and Pest Control	25,735.00
Washing	22,732.50
Maintenance Insect and Diisease Control	34,050.00
Treatment of Developing Fruits	54,820.00
Operating Costs	156,637.50
Harvest Cost	19,600.00
Farm owner share 30%	216,000.00
Farm Regular staff commission @1.50/kg x 4 person	96,000.00
TOTAL COSTS	488,237.50
Harvest (kg)	16,000
Farm Gate Price per kilogram	45
GROSS INCOME	720,000.00
Net Cash Income	231,762.50
Production cost per 1 ha. / 50 trees	9,764.75
Production cost per kilo	30.51

The cost and profit of 1kg fresh mangoes across mango-producing provinces/regions in the Philippines is given in Table 35. This information was generated from the VCA reports of North Luzon, CALABARZON, Palawan, Romblon, Guimaras and Mindanao. It can be noted that only North Luzon has export data for Mango, wherein profit margin is highest at the production chain. Similarly, North Luzon (local market), CALABARZON, and Guimaras have the highest profit margin at the Production level. Only CALABARZON can provide the wholesale and retail data in the Distribution/Marketing chain.

TABLE 35. COST AND PROFIT OF 1KG FRESH MANGOES ACROSS MANGO-PRODUCING PROVINCES/REGIONS, PHILIPPINES

Region	Production		Assembly/ Trading		Processing/ Exporting	Distribution/ Marketing	
North Luzon							
Selling Price (PhP)	Local	Export	Local	Export		Local	Export
Cost of material	18.00	18.00	27.00	30.00		32.00	35.00
Other cost							
Profit	9.00	12.00	5.00	5.00		3.00	10.00
Profit Margin	33.33%	40.00%	15.62%	14.29%		8.57%	22.22%
CALABARZON*	*peak season no contract arrangement					Whosale	Retail
Selling Price (Php)	17.02		50.00			65.00	70.00
Cost of material	5.15		17.02			32.00	35.00
Other cost	0.60		5.00			5.00	1.00
Profit	11.28		27.98			10.00	4.00
Profit Margin	66.27%		55.96%			15.38%	5.71%
Palawan							
Selling Price (PhP)	16.00		50.00			75.00	
Cost of material	7.92		16.00			50.00	
Other cost	3.27		8.61			2.22	
Profit	4.81		25.39			22.78	
Profit Margin	30.00%		40.00%			43.00%	
Romblon							
Selling Price (PhP)	30.00		50.00			60.00	
Cost of material	8.44		30.00			50.00	
Other cost	4.88		2.00			3.00	
Profit	16.68		18.00			7.00	
Profit Margin	40.02%		43.19%			16.79%	
Guimaras							
Selling Price (PhP)	35.00		40.00			47.00	
Cost of material			35.00			40.00	
Other cost	19.37		2.12			3.00	
Profit	15.63		2.88			4.00	
Profit Margin	44.66%		7.22%			8.51%	
Mindanao							

Region	Production	Assembly/ Trading	Processing/ Exporting	Distribution/ Marketing
Selling Price (PhP)	25.48	60.00	177.94	
Cost of material	15.95	25.48	60.00	
Other cost	-	10.76	Not available	
Profit	9.53	23.76		
Profit Margin	37.40%	39.60%		

Benchmark Analysis

The benchmark analysis explored the different mango varieties and cultural practices employed by neighboring countries Thailand, Vietnam, and Australia, and tight export competitors India and Mango, and compared it with what the Philippines have (Table 36). Notable findings include the following:

- All mango popular exports are of sweet to very sweet juicy flavor and have no to very little fiber. Carabao mango's advantage is its good blend of sweetness and sourness. It is important to highlight that Thailand's Nam Dok Mai has already established export markets in China, South Korea, and Russia. On the other hand, Keitt and Kent varieties are the most popular in Western markets (EU and USA). India's Alphonso mango has an increasing following in the Japanese and Korean markets
- Following PhilGAP's recommended planting distance, the Philippines is planting less densely as compared to the benchmarked countries. Recently, some Filipino scientists are exploring a smaller planting distance of 2 x 2m, which can accommodate around 2,500 trees per hectare.
- Mexico has an all-year-round production of mango. However, among Asia Pacific countries compared, the Philippines and India have the longest normal season of production, equivalent to eight months. The country's normal season coincides with Thailand (May to Jul), India (Feb to Aug), Mexico (Feb-Sep). Meanwhile, Vietnam and Australia's productive seasons are during the Philippines' offseason.
- Soil analysis is not a standard practice in the Philippines and India.
- Manual irrigation, drip, and sprinkler irrigation is common practice.

- There is no significant difference in terms of fertilization. Commercial fertilizers are widely used among benchmarked countries. However, Mexico differs by applying fertilizers through fertigation
- Pruning is a common practice. However, pruning is too late to apply to existing mango orchards in the Philippines and India
- The Philippines and India are intensive users of chemical pesticides. On the other hand, Thailand and Vietnam have regulated their use of agrochemicals.
- Only the Philippines has prevailing cecid fly infestation
- Flower induction by potassium nitrate, calcium nitrate, and/or in-tandem with paclobutrazol is a common practice. India, on the other hand, follows normal flowering and discourages flower induction
- Bagging is a common practice in the Philippines, Thailand, and Vietnam. Meanwhile, it is not practiced in Mexico and India.
- In the Philippines, sorting usually happens at the farm, right after harvest. Other countries do it on the packing house
- Hot water treatment/hot water spray is a common practice except for Mexico, in which they use a prototype pasteurization machine.

TABLE 36. CULTURAL MANAGEMENT PRACTICES IN OTHER COUNTRIES

Philippines	Thailand	India	Vietnam	Mexico	Australia
Variety					
Carabao mango – most popular and known internationally Others: Pico Indian mango (Katchamita) Apple mango Florida mango Keitt Valencia Guimaras Super Galila (carabao mango) is the sweetest in the Philippines, recording 22.3 °Bx	Nam Dok Mai – most popular and known internationally Nam Dok Mai Si Thong Maha Chanok Chok Anan Khiao Sawoei Others: Khieo Sawoei Sampran Ok Rhong Damnoen Raed Paet Tong Dam Mamuang sook	Alphonso - most popular and known internationally Kesar Chausa Langra Totapuri Banganpalli Khirsapati Lakshmanbhog Zardalu Fazli Amrapali Dusshheri/ Dasheri	Cat Hou Loc (Hoa Loc) – most popular and known internationally Buoi Cat Chu Cat Bo Xiem Num Yen Chau Canh Nong	Haden Tommy Atkins Keitt Kent Ataulfo	Kensington Pride - highly cultivated and most consumed locally Calypso R2E2 - popular in export market due to size and color (high blush) Honey Gold Others Keitt Brooks Palmers Kent Pearl

Philippines	Thailand	India	Vietnam	Mexico	Australia
Planting Density					
Common spacing practice: 10 by 10m (100 trees per hectare) PNS/BAFPS 25:2009 recommendation - 12m x 12m (69 trees per hectare) to 20 x 20m (25 trees per hectare) 51 trees to 70 trees per hectare	Upland spacing: 4 by 6m (416 trees per hectare); Lowland spacing-6 to 8 meters wide and water ditches 1.0-1.5 m	100 trees per hectare	High-density planting 5 meters by 8 meters (250 trees per hectare)	100 trees per hectare For experimental planting density, there is a higher density of 1,000 to 2,200 trees per hectare	200 to 250 trees per hectare
Harvest Season					
Luzon-February to April Visayas- July to September Mindanao- May to September Other months not mentioned are off-season. However, little off-season production may happen to some areas	Normal season- May to July Little production- April. Late harvest- August Thailand is also capable of producing mangoes during the off-season from September to March.	The whole country- January to August the State of Andhra Pradesh- April to July	Hoa Loc mangoes- harvest once a year. Production starts in November, peak months- March and April. Off-season- June to October (there is still production during off-season)	Normal period of availability- February to September (September-peak period) There is year-round availability of mangoes depending on the variety and the location.	New South Wales and Victoria - Jan (low) to Feb (medium) Queensland - Nov to Jan (high); Feb (medium); Mar (low) Western Australia - Oct to Dec (medium); Jan to Feb (low) Northern Territory - Aug to Sep (low); Oct to Dec (high) South Australia - Nov to Jan (low)
Soil testing and analysis					
Uncertain- not done at all or frequently done	Frequently done	Uncertain- not done at all or frequently done	Frequently done	Frequently done	Frequently done

Philippines	Thailand	India	Vietnam	Mexico	Australia
Fertilization					
Commercial/inorganic fertilizers like complete fertilizers, urea, and muriate of potash by the side pocket method Organic and manure fertilizers/manual fertilization through basal and foliar application a few days after flower induction to promote flower stalk elongation and enhance fruit retention and size	Manual fertilization through basal and foliar application	Not widespread in the mango farms of India but practiced as a demonstration in the Fruit Research Station (FRS) in the State of Andhra Pradesh.	Manual fertilization through basal and foliar application	Through irrigation (fertigation)	Commercial fertilizer (ex. Complete)
Irrigation					
Manual watering is a common practice at the establishment or young stage however other big orchards use drip or sprinkler For older trees, rainfed is a common practice. Meanwhile, well-managed orchards use a motor pump or flooding Irrigation of trees happen at flowering and fruiting stages to enhance faster development of flowers, minimize fruit drop and increase fruit size	Novel irrigation systems: using water from the river systems, by building ditches and canals proximate to the mango orchards These cuts cost on labor associated with manual irrigation.	Irrigation (manual watering) The country offers subsidies for the installation of drip or sprinkler irrigation, encouraging growers by offering Rs 50,000 (PhP 36,030.00) systems with 10% equity.	Novel irrigation systems, using water from the river systems, by building ditches and canals proximate to the mango orchards, These cuts cost on labor associated with manual irrigation.	Drip irrigation system	No required supplementary irrigation in northern NSW, although watering of young trees during their establishment phase can be beneficial. CSIRO developed a low-cost irrigation scheduling tool known as Full Stop. It is a simple device buried in the ground in the rooting zone, which will tell the irrigators when to switch off irrigation. Application method: drip and sprinkler

Philippines	Thailand	India	Vietnam	Mexico	Australia
Pruning					
Growers prune either before flushing or after harvesting. Use of chainsaw to prune the center and sides of its trees to open up the canopy and to remove overlapping branches. Three to five trees are center, or side pruned per day and about twice as many for sanitary pruning. When necessary, trees are pruned slightly before flower induction to remove water sprouts and crowded branches to improve the efficiency of chemical application. Pruning is too late to apply since the country has existing orchards with fruit-bearing trees. Pruning is done mainly for canopy management, allowing sunlight to cover as much area as possible and to get rid of diseased and dead branches. Corrective pruning Formative pruning (open-center)	Pruning and fruit thinning. All the farms visited in Thailand deliberately implement scheduled pruning of trees to limit branches and height of trees. Grafting is likewise universally practiced by the farmers. With proper pruning, the number of fruits per tree is limited but of better size and weight giving better marketability, especially for exports. Pruning increases the yield	Pruning is too late to apply since the country has existing orchards with fruit-bearing trees. Pruning is done mainly for canopy management, allowing sunlight to cover as much area as possible and to get rid of diseased and dead branches. Fourth-order pruning resulted in increases in yield	Pruning may also be practiced as well because the country has stock replacement plans and high-density planting too.	Systematic or geometric progression (1 main branching into 4 branches) pruning, even during the early stages (young trees) of orchard establishment, to manage tree height, branching and canopy spread so that in later years, less pruning will be done. This means that the growers manage plant growth in a similar way that growers manage “bonsai” plants. Apart from the suitability of cultivars, this is one of the most important factors in high-density planting.; mechanical pruning is used in some orchards or plantations.	Aim to produce an open centered tree with about 8 main supporting limbs to a height of 3 to 4 meters. The preferred time to prune mangoes in NSW is in winter before flowering, not following fruit harvesting as is done in Queensland. Prunes a little every year to maintain the balance between vegetative and reproductive growth.

Philippines	Thailand	India	Vietnam	Mexico	Australia
Pest and Diseases Control Management					
Intensive use of agro-chemicals especially during flowering, fruit set, and fruit growth. This explains the dominant role of sprayer-contractors during harvesting especially engaged by most backyard and small holders, who cannot afford the cost of agro-chemicals or who find the cost-prohibitive. Commercial growers can well afford to have their own spraying operations. Oftentimes, they double up as sprayer-contractors. Use of calendar-based spraying, 8 to 11 pesticide applications. Mindanao has less use of pesticides due to differences in climate For Cotabato, spraying can occur 12-15; For Davao: 10 sprayings. The latter consists of spraying 5 times up to 60 DAFI then once or twice up to 80 DAFI. More spray applications of fungicide during the wet season depending on pest incidence and availability of cash to purchase pesticides. More spray applications of insecticide during the dry season depending on pest incidence and availability of cash to purchase pesticides Use of spray decision tool.	To make mangoes more acceptable to its export markets which is increasing because of FTAs, Thailand regulates the use of agro-chemicals. Agro-chemical application is undertaken by the growers themselves and not outsourced to sprayer contractors. This may be explained by their access to cheaper agro-chemicals. Other practices include eradication of fruit fly, the use of integrated controlling techniques based on ecological data of the fruit fly, coupling with the use of poison bait and repellant.	India has intensive use of agrochemicals. The FRS in the State of Andhra Pradesh reported no occurrence of cecid fly (it would seem the fly can only be found in the Philippines). However, the FRS is conducting research on Integrated Pest Management (IPM) and Integrated Nutrient Management (INM) to reduce agro-chemical application.	The VietGAP requires the regulated use of agrochemicals to meet the chemical residue level standards of importing countries. Cecid fly has not been reported to thrive in Vietnam especially in the Hoa Loc mango areas.	The country has the strictest policy on fruit flies (Anastrephaludens). It imposes a "zero fruit fly policy" prohibiting mango inter-state trade if fruit fly appearance is suspect. It also requires the establishment of "buffer zones" near mango plantations and orchards to fence off fruit fly incidence.	

Philippines	Thailand	India	Vietnam	Mexico	Australia
Flower Inducement					
Growers induce once. However, flower inducement can happen twice for younger trees. Choice of flowering-inducing chemicals depends on the efficacy, cost, and availability. Multi-K is popular because of the perception that leaf burning is low or absent with excessive application, while Bloomex is cheaper but tends to result in leaf burning with improper use. Most mango growers and contract sprayers use potassium nitrate, no matter if it costs higher. However, there is a slow shift to calcium nitrate because of its availability and cheaper price. Off-season production is not as prevalent as it is in Vietnam and Thailand as previously mentioned, so the use of flower inducer may be in the regular season to increase the number of flowers per panicle and the probability of generating more yield per tree. Paclobutrazol is used in Mindanao	The tandem use of paclobutrazol and flower inducer (unknown whether potassium or calcium nitrate) enables the country to produce off-season fruits. This mastery, coupled with a favorable climate and regularity of seasons in some provinces, means that it can respond to market demands.	Most of the mango growers, backyard, and smallholders, follow the phenology and normal flowering. They do not induce flowers, at least according to the materials on cultural management practices; the use of paclobutrazol for off-season production is even more discouraged.	Potassium nitrate is used as a flower inducer. Like Thailand, Vietnam can also produce off-season fruits using paclobutrazol in tandem with potassium nitrate.	Calcium nitrate is used instead of potassium nitrate primarily because of the price difference. Calcium nitrate is much cheaper. Off-season production is also possible in Mexico.	

Philippines	Thailand	India	Vietnam	Mexico	Australia
Fruit (Pea Stage Selection) and Bagging					
Fruit drops are not controlled, and the natural course is followed. Using old telephone directories to control fruit flies, bagging is usually done when the fruit is at native chicken egg size (51-52 DAFI) or around 55-60DAFI-during this stage, natural fruit drop is still high. Bagging of fruit at 70-75 DAFI increased the retention of bagged fruit and further improved by Taiwan bag (based on our results, unpublished-will still conduct another trial). Carabao mango fruit at 55 DAFI was bagged with various bagging materials. Examples include old newspaper), spun-bond high-density polyethylene (SHDPE) (DuPont™ Tyvek® Homewrap), and non-woven spun-bond polypropylene (NSPP) or fleece. Bagging with insecticide-impregnated plastic strips	Few (2-3 fruits) selected pea-sized fruits or buds are selected per panicle or bunch to get quality fruits which are then bagged using specially designed or custom-made pouches. The custom-made paper (even if imported from Taiwan) for bagging is used to prevent fruit flies and achieve the required skin color consistency. There are two types of bags available. One is called "carbon" bag and the other is "white" bag. The "carbon" bag does not allow the light to penetrate the fruit. This provides a suitable environment for the perfect skin color appearance of the ripe fruit. The cost of the specially designed wrapper from Taiwan is about PHP 3.00.	Mango growers follow the natural course. Bagging is not practiced (at least in Andhra Pradesh) because it is laborious and most of the produce goes into local consumption, not exports.	The Hoa Loc practice is similar to Thailand's, but the growers are content with caring for even one fruit per panicle to ensure quality. This fruit bud is then bagged with a specially designed pouch that insects and even rain cannot penetrate. Again, the area productivity concept is given more importance.	There is no deliberate fruit selection. The natural course of fruiting and fruit drops is allowed to take its course. No bagging is necessary and the "zero fruit fly policy" is in effect.	

Philippines	Thailand	India	Vietnam	Mexico	Australia
Harvesting					
Use ladders and harvesting poles. Extra workers are hired during the harvest operation to help in the picking, sorting, packing, and loading of fruits. Sorting is already done at the farm right after harvest based on size and quality. Both commercial farms in Luzon place their harvested fruits in plastic trays to avoid damage during transport to the buyer's facility. Commercial farm operators have their trucks for delivery of their harvest to the buyer's facility and bear all the cost of freight. Harvesting happens late in the morning (9-11 AM) and early in the afternoon (1-4 PM), allowing the latex to drain in a delatexing tray and washing fruit with water or 1% alum can reduce sap or latex damage/injury	Thai mango farmers are aware of the importance of harvesting procedures in producing and maintaining high-quality fruits. Inherent in their farm planning is the inclusion of a harvesting schedule even at the time of planting. They predict the best time that they will harvest their produce to maximize freshness and longer shelf life. The farmers also synchronize their harvesting activities with the schedule and requirements of their buyers. In the case of the two farmer-interviewees, they keep in constant contact with their buyers and determine ahead of time who among their buyers they will deal with even before they harvest the produce. Though the price is an important consideration, other terms are also taken into consideration.	Harvesting time varies with the distance to the market and local consumption. Nevertheless, the factors such as market price, market glut, etc., should also be considered while harvesting mangoes. Postharvest losses in mangoes, which impact productivity, have been estimated in the range of 25-40% from harvesting to consumption stage. Fruits such as mangoes, banana, papaya citrus, and pineapples in the Philippines are estimated to incur post-harvest losses from 15% to 35%. There is a widespread use of chemicals such as calcium carbide in ripening because of the unavailability of fruit ripening chambers, especially in the semi or peri-urban areas. The SAP is encouraging the setting up of more chambers to discourage the use of ripening chemicals.9.	Manual harvesting using a bamboo pole with a net basket at the end and ensuring that no scarring occurs. Maturity is determined by visual means and observance of the calendar for harvest. Growers do not practice water flotation to determine maturity. Produce for sale are assembled, sorted, and graded at the packing house. Washing is done using purified water and drained in tables with specially made holes for mangoes. No vapor heat treatmen (VHT) t or hot water treatment is being done because of the thin skin.; Produce intended for Ha Noi are harvested three days earlier than those intended for Ho Chi Minh or other local markets. Hoa Loc mangoes have typically seven days shelf-life. No ethylene is used for ripening as this is not allowed under VietGAP. The natural course of ripening is preferred. The cold storage is used for a short time while waiting for buyers usually contacted in advance. As much as possible, the use of cold storage is avoided because of its high operating cost.	Mango growers consider harvesting as one of the most important decisions a grower faces to provide superior-quality fruits. Due to the seasonal nature of the harvest, Mexico requires a special focus on the yearly retraining of harvest crews. Training includes harvest maturity indicators, latex removal procedures, good sanitation practices, and workers' safety. Mango growers in Mexico follow the most popular and effective harvest practices as contained in the "Mango Postharvest Best Management Practices Manual" based on the collective experience of the mango industry.	Picking ladders and poles are used on taller trees. Growers with large plantings may use various types of picking platforms. Harvest mangoes with long stems of at least 5 cm to stop fruit spurting sap and minimize the downgrading of otherwise good quality fruit due to sap burn. Harvested fruits are placed in the shade to reduce the build-up of field heat

Philippines	Thailand	India	Vietnam	Mexico	Australia
Postharvest handling					
Ripening agent. Ethephon could be a relatively safer alternative to CaC2 in ripening 'Carabao' mango. Moreover, the benefits of using ethephon over conventional CaC2 include lower cost and higher profit. 'Ripestuff'- an encapsulated form of ethylene- slow release of ethylene. This serves as a safe and cheaper ripening agent alternative to 'Calburo' or calcium carbide which is already banned in many countries because of its toxicity and considered carcinogenic Rapid hot water treatment as an alternative to HWT in controlling postharvest diseases and prolonging the shelf life of 'Carabao' mangoes. It is used when disease pressure in the field is low For fresh export- disinfection HWT, hydrocooling, flotation method for 24 hours that may lead to conditioning, VHT, packing at 20°C, shipment at 10°C Cold rooms and alternative cheaper storage rooms for mango esp. for smallholder farmers as follows: Coolbot, a cheaper option for low storage condition for fresh produce, is "a device that tricks an air conditioner into further reducing temperatures in a well-insulated room"	Postharvest treatments such as 1-Methylcyclopropene, edible coatings, and hot water treatment have shown to be effective in preserving fruit quality. Gaseous ozone, controlled atmosphere (CA), and pulsed electric field (PEF) are some of the emerging technologies with great potential for the mango fruit industry, especially in addressing environmental-friendly postharvest technologies that ensure the safety of consumers. The use of such technologies has been demonstrated to be effective in maintaining the sensory, nutritional, and physicochemical quality of the mango fruit. However, the mode of action of the emerging technologies is not yet understood.	Postharvest treatments such as 1-Methylcyclopropene, edible coatings, and hot water treatment have shown to be effective in preserving fruit quality. Gaseous ozone, CA, and PEF are some of the emerging technologies with great potential for the mango fruit industry, especially in addressing environmental-friendly postharvest technologies that ensure the safety of consumers. The use of such technologies has been demonstrated to be effective in maintaining the sensory, nutritional, and physicochemical quality of the mango fruit. However, the mode of action of the emerging technologies is not yet understood.	Use of a de-sapping tank to prevent sap burn injuries, a brush unit to save water and clean fruit, a hot water spray unit to control post-harvest microbial diseases, and a drying machine. The cooling unit, composed of a forced-air system and cold storage systems were installed in the company to maintain harvested mango flesh and lengthen the shelf life of the mangos. Reduction of post-harvest loss from 27% of its total production to below 5% is achieved, resulting in an increased capacity from 30 tons/day to 50 tons/day and even 60 tons/day during the peak season. Savings on energy expenditure is also achieved through the solar system which provides 40% of the total consumed electricity for the cooling system and 100% of the consumed lighting system.	For mangoes being sold as raw material for processing as puree, nectar, or juice, a prototype pasteurization machine, and procedures manual keep products in excellent condition after harvest. The pasteurizer system preserves food, removing pathogens that could harm consumers. It also prevents oxidation of the mango pulp, as well as a dark color of the pulp, one of the objectives of pasteurization. The technology can pasteurize various mango varieties and maintain their organoleptic pulp, which maintains its physical characteristics, and which is dehydrated without losing its flavor, color, or nutrition.	Before de-stalking, the field lugs are dipped in a water solution with detergent then drained using a mesh sheet Before grading, the fruits are sprayed with a fungicide to control anthracnose Mangoes are patterned packed in trays using plastic inserts with molded caps After packing, pre-cool fruit to 10 to 12°C for no more than 3 days. The best transport temperature for a 1 to a 2-day trip is 12 to 16°C.

Philippines	Thailand	India	Vietnam	Mexico	Australia
Evaporative cooler- a cabinet type using a jute sack, or a brick-walled evaporative cooler (BEC) is a type of simple evaporative cooling system that maintains a low temperature and higher relative humidity as heat is removed from the ambient environment with the evaporation of water Delatexing/desapping- important esp. for mangoes for export since sap or latex injury/burn is among the causes of rejection in an export company upon receiving/delivery of fruit from the farm and during packing of fruit for export Safe food coating- that can control diseases and extend the shelf life of fruit such as chitosan, which is derived from chitin, a major constituent (in quantity) of crustaceans					

Source: International Benchmarking Study on Selected Agricultural Commodities. DAP, May 2015

Competitive Analysis

The Philippines is one of the top ten mango producers in the world and is supplying high-quality mangoes to important markets such as Hongkong, Japan, Singapore, United Kingdom, United States, Switzerland, and Korea, among others (Lapina, et. al., 2020). From 2000-2014, our country is consistently the third-largest producer of mango in ASEAN that accounting for 17% of the yearly production of the region, next to Thailand and Indonesia. From 2001 to 2015, 71% of the Philippine mango exports (in terms of value) went to the ASEAN region, with Singapore as the top importer, followed by Malaysia. Russia and the EU are exploring mangoes from the Philippines that show potential demand, yet market expansion becomes a challenge because of the high-volume demand.

Achieving economies of scale is important in mango production because of the high investment costs needed to raise productivity as well as ensure the quality of mangoes (Briones, 2013a). The USAID funded research was done by Duke University in 2017 (Fernandez-Stark, Couto, and Gereffi (2017) also echoed that the importance of scale economies, but also identified constraints such as lack of modern production and harvest techniques, poor post-harvest management, and lack of effective coordination between stakeholders and the government. This implies that small-scale producers will find it hard to participate in global value chains (GVCs), but medium-sized firms could have a better chance. Thus, it is through regulatory reforms, a reliable database of mango growers, R&D investments, and improvements in the extension system to offer technical assistance and technology transfer that must be done to facilitate entry in GVCs (Briones, 2013a).

For mangoes, the existing fruit-bearing trees that can produce large volumes and good quality fruits and mechanized farming facilities can maximize mango production. However, there are challenges that industry players are facing that might erode the competitive position of the Philippines for these crops. For instance, growers have been subject to rising costs of production, which include the high cost of fertilizers. Lack of infrastructure such as farm-to-market roads makes transportation of the products costly and difficult. In particular, mangoes from the island of Guimaras lack facilities to transport the products elsewhere from the Visayas region; this hinders the maximization of its domestic and global market potential.

Table 37 shows selected indicators relevant for estimating cost competitiveness as well as the calculated domestic resource costs (DRCs) and resource cost ratios (RCRs) for three fruit crops namely banana, mango, and pineapple under an export trade scenario. The costs and returns were secondary data obtained from key informant interviews, research institutions, and the Philippine Statistics Authority.

DRC estimates were 20.80 for banana, 27.76 for mango, and 8.74 for pineapple. Since DRC values were less than the exchange rate of 45.50 (2015 average from Bangko Sentral ng Pilipinas), the domestic production of these fruit crops is cost-competitive in an export trade scenario. This is also evident with the RCRs that were less than one for all these fruit crops. This also conforms to trade data that the Philippines is a major exporter of these commodities. A major challenge is more on meeting the required volumes in export markets as reported by stakeholders during field interviews.

TABLE 37. COST COMPETITIVENESS OF SELECTED FRUIT CROPS IN THE PHILIPPINES, UNDER AN EXPORT TRADE SCENARIO, 2015

Item	Banna	Mango	pineapple
Border Price (USD/mt)	960.00	711.00	1,683.00
Yield (mt/ha)	47.36	4.55	32.89
Exchange Rate (PHP/ USD)	45.50	45.50	45.50
Domestic Resource Cost	20.80	27.76	8.74
Resource Cost Ratio (RCR)	0.46	0.61	0.19

Sources:
Banana: Border price from EU/IMF, yields and costs and returns from DA-PRDP, 2015
Pineapple: Border price from Mexico, yields and costs and returns from PSA, 2015
Mango: Border Price from Mexico, yields and costs and returns from Guimaras, 2015
Exchange rate data from Bangko Sentral ng Pilipinas (BSP), 2015
RCR<1 is competitive, RCR> 1 is uncompetitive, and RCR = 1 is indifferent
Source: Lapiña, et al.,2020

The Industry Strategic Science and Technology Program (ISP) of PCAARRD reports that RCR results showed that mango, banana, and pineapple are quite competitive in the export market (Table 38). For mango, yield levels could fall by 27% and still retain competitiveness. This can be interpreted as giving the local industry sufficient "yield" space while further research on technology and other aspects of post-production (i.e. processing) is done. This is especially important given that is it now well known that from basic research of technology (such as seeds development) to roll-out into various farms takes time (Lapiña, 2020).

PCAARRD's ISP targets are generally supportive of sustaining or improving cost competitiveness. ISP measures for mango target further increasing yields by at least 50% from yield targets in 2015.

TABLE 38. SENSITIVITY ANALYSIS ON COMPETITIVENESS BASED ON YIELDS: ACTUAL, BREAK-EVEN, AND PCAARRD'S INDUSTRY STRATEGIC SCIENCE AND TECHNOLOGY PROGRAM (ISP) TARGETS, 2015

Crop	Actual Yield (mt/ha)	Break-even Yield (mt/ha)				ISP Targets
		Export Trade	% diff	Import Trade	% diff	
Mango	4.79	3.512	-27%	n/a	n/a	Increased yield by 90% (from 5.82 mt/ha to 11.11 mt/ha) by 2015 mt/ha in 2020
Banana	52.617	21.852	-58%	n/a	n/a	Reduced incidence of Fusarium wilt tropical race 4 on Cavendish in Mindanao by 90-95% in 2016
Pineapple	41.118	14.786	-64%	n/a	n/a	≥ 71.5% increase in average yield from 24.7 mt/ha to 42.36 mt/ha

Source: ISP Targets: PCAARRD,

MARKET TRENDS AND PROSPECTS

Key Demand Drivers

A mango global value chain study by Duke University described the globalization of mango production and consumption as a relatively new phenomenon (Fernandez-Stark et al., 2017). According to the study, the trade of mango products has tripled - in 2005 the total exports were just USD 696 million, while in 2015 it had increased to almost USD 2 billion (UNComtrade, 2016). According to the Market Intelligence Team (2020), the global exports of mango (including guava and mangosteen) have been increasing by 3-4% until 2018. From 2021-2026, the Mango Market is expected to flourish in CAGR in terms of revenue (2News, 2021). Specifically, the global processed mango market size, estimated at 16.55 billion in 2018 and is forecasted to have a 6.4% CAGR from 2019-2025.

The following are collated global mango industry trends that may positively affect the local and global demand for mango [Transparency Market Research (2021), Grand View Research (2019), Market Intelligence Team (2020)]:

- There is an increasing global demand for mango due to its nutritional characteristics and health benefits
    - –Ready-to-eat mangoes in individual containers, dried mango, and mango puree in combination with other juices have become snacks and alternatives to sugared snacks (Fernandez-Stark et al., 2017);
    - –Mango is an ingredient in energy bars and biscuits and has become part of home-cooking esp. on healthy exotic cuisines (Fernandez-Stark et al., 2017);
    - –The Covid19 pandemic encourage consumers to increase consumption of fruits rich in vitamins and minerals (Market Intelligence Team, 2020);

  - Orange juice consumers are shifting to processed mango due to its lower acidity content (Grand View Research, 2019)

- Huge food manufacturing companies like Coca-Cola, Nestle, and Pepsi drive the demand for mango pulp, as it is becoming a major flavoring ingredient. This drives the demands for mango pulp and IQF mango (Grand View Research, 2019).
- There is a preference for mango puree over fresh mangoes due to the busy schedules and lack of time of consumers from both developing and developed nations (Transparency Market Research, 2020). However, there is a preference for Alphonso, Tommy Atkins, Kent, and Palmer (Grand View Research, 2019).
- There is a limited number of mango-exporting countries. Many exporting countries, including the Philippines, have difficulties meeting the GAP and the Sanitary and Phytosanitary (SPS) requirements of importing countries like the European Union (EU) and the USA. There is also a lack of logistical and commercial infrastructure in many mango-exporting nations (Fernandez-Stark et al., 2017).
- Climate change is affecting the supply of mango. Higher temperatures, lower rainfall, and higher frequency of natural disasters are expected to affect mango production (Fernandez-Stark et al., 2017)
- Fresh mango is traded only within regions (e.g. Philippine fresh mango's biggest export market is Japan and Korea) while dried mango is traded globally (Fernandez-Stark et al., 2017).
- There is also an observed increased demand for mango among Filipino consumers (hence, the increasing retail prices of ripe carabao mango). It has become a major source of nutritional fruit for the family providing low-calorie high fiber and a great source of vitamins A and C plus other minimal nutrients such as vitamins E, folate, B6, iron, calcium, and zinc.
- The online distribution channel segment is forecasted to witness the fastest CAGR from 2019 to 2025. The growth of digital mediums has encouraged manufacturers and sellers to advertise via websites and social networking sites. Options such as customer feedback and reviews have also helped consumers in their purchase decision (Grand View Research, 2019).

Prospects

There is a high potential for fresh and processed mango products based on the results of the International Trade Fairs attended and market reports. It is important to note that the Thai mangoes are a tight competitor as they already penetrated and established their markets earlier than Philippine carabao mangoes. Countries with a high number of Overseas Filipino Workers (OFWs) must be also given focus. There is a big potential for Philippine mangoes if proper branding and marketing was implemented.

The following countries present export opportunities for Philippine mangoes:

China

There is a big potential for Philippine Mango despite its Thai mango-dominated market. However, the promotion period may take longer as the consumers have already adapted to the Thai mango taste. There is also a need to address price competitiveness to capture the opportunity. Among mango products that are of high interest among Chinese consumers are mango ketchup due to its unique flavor, and mango jam for children and teenagers.

Europe Union

The European Centre for the Promotion of Imports from developing countries (2021) reported that there is rising consumption of mangoes in Europe, in which fiberless varieties such as Kent, Keitt, and alternatively Palmer are preferred. Interestingly, the Philippines is not highlighted among their exporters. Among the Southeast Asian varieties, only Thailand's Nam Dok Mai is mentioned, which is considered a minor commercial variety in the Region. The Philippines can catch the opportunity, but an intensive marketing effort may be necessary.

Japan

Japan has a high demand for fresh mango hence, a very good market for the Philippines. Among processed mango products, frozen mango has constantly grown in terms of volume and popularity. Chocolate mango caramel also gained positive feedback from Japanese consumers due to its unique taste and appealing packaging.

On the other hand, new products such as regular and spicy pickled mango have gained interest from Japanese buyers as a potential side dish to Sake and Curry. Similarly, mango chews albeit not yet known to Japanese consumers may have good mainstream potential. However, these products may take more marketing effort to become popular.

Russia

There is a big potential for fresh Philippine carabao mango in Russia as they are shifting to a healthier diet. However, the buyers are inclined to Thai mangoes as they have adapted to their taste. It is also important to note that the Philippine mango has a shorter shelf-life of only 21 days, a major challenge as mango is generally expensive in Russia hence, only those with enough purchasing power can access them. There is also an opportunity on pickled mango - Russians eat a lot of pickles but not from mango.

Dried pineapples, mangoes, and guyabano are being sold in Perekrestok supermarket under the brand Filipino Sun, a Russian brand of dried fruits that sources some of its supply requirements from Philippine exporter, Profood International Corp.

There must be continuous good marketing/distribution programs and participation to trade fairs to change their culture and preference.

South Korea

Despite supply sustainability issues experienced by Korea by Filipino exporters, there is still a growing demand for Philippine mangoes in South Korea. The sweet and sour taste of the Philippine mangoes is its main advantage as compared to the only sweet taste offered by Thai mangoes. Its yellow color is also more attractive to Koreans, especially to the kids. Philippine mango becomes yellow when it ripens while those from Thailand and Vietnam become brown. The major competitors of the Philippines in South Korea are Thailand, Taiwan, and Pakistan.

United Arab Emirates

There is a demand for Philippine mangoes due to the high population of Overseas Filipino Workers.

TARGET SETTING

Vision

Prosperous mango growers and stakeholders

Mission

A sustainable and resilient Philippine Mango industry offering competitive and world-class mangoes through innovation and inclusivity.

Goals, Objectives, and Targets

The Philippine mango industry roadmap aims to:

a. Stabilize and increase mango production

b. Improve productivity and efficiency by 5% per year

c. Reduce post-harvest losses from 30% to 5% by 2025

d. Expand market access

e. Ease access to information and quality standards

The strategies, activities, key indicators, and responsible agencies to address these roadmap objectives, listed in Table 39, were identified through exhaustive consultation with different mango stakeholders. The strategies and the associated activities identified align with the 18 key strategies of the One DA Reform Agenda, emphasizing the principles of consolidation, modernization, industrialization, and professionalization.

As for the responsible agencies, these include the government through the national government agencies, SUCs, and the LGUs, as well as the private sector, which includes the smallholder farmers, farmer organizations, and private businesses. They need to work together in the implementation of the activities. While the national government agencies would spearhead the creation of national policies, the LGUs would complem them by developing and implementing local ordinances. Meanwhile, the academe would be responsible for the conduct of research, and implementation of capacity-building activities. The private sector, aside from being beneficiaries of the associated, projects would ensure that actual development is happening on the ground- adhering to the implemented policies. The farmers are expected to mainstream the use of newly developed technologies and follow the skills learned from their seminars and training.

The industry targets are also identified through the supply utilization accounts (Table 40). With the projected population of the country, reaching approximately 116.3 million by 2025 from its 109 million baselines in 2020, the total production (accounting export, feed & waste, and net food disposable) that must be met by 2025 is 981 thousand MT from 737 thousand MT 2020 baseline. Consequently, area expansion rate and yield increase rate must also increase annually.

The attainment of the targets would require a PhP 2.378 billion. The physical targets and the required investment plan are provided in Table 41. The table also indicates the One DA strategies being reflected in the mango roadmap with the following strategies given as follows:

- Strategy 1: Bayanihan Agri Clusters;
- Strategy 2: Collective Action/Cooperatives Development;
- Strategy 3: Province-led Agriculture and Fisheries Extension Systems;
- Strategy 4: Mobilization and Empowerment of Farmers;
- Strategy 5: Diversification;
- Strategy 6: Credit Support;
- Strategy 7: Technology and Innovation including Digital Agriculture;
- Strategy 8: Farm Mechanization and Infrastructure Investment;
- Strategy 9: Climate Change Adaptation and Mitigation;
- Strategy 10: Food Safety and Regulations;
- Strategy 11: Agri-industrial Business Corridors;
- Strategy 12: Global Trade, Export Development and Promotion;
- Strategy 13: Postharvest, Processing, Logistics, and Marketing Support;
- Strategy 14: Agriculture Career System;
- Strategy 15: Education and Training: Agribusiness Management;
- Strategy 16: Youth and Women Engagement;
- Strategy 17: Ease of Doing Business and Transparent Procurement; and
- Strategy 18: Strategic Communication

TABLE 39. STRATEGIC DIRECTIONS FOR THE MANGO INDUSTRY

KEY STRATEGIES	ONE DA AGENDA	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY/ GROUP
OBJECTIVE 1: STABILIZE AND INCREASE PRODUCTION				
Reduce losses due to cecid fly and other major pests	Strat 1 Strat 14 Strat 7 Strat 4	Implement The Cecid Fly Control and Management Action Plan IRM Training and Website Fruit Bagging New Mode of Action Technology Demonstration Professionalization of Mango Farming/Spraying Continued R&D Pest monitoring and surveillance	Decrease incidence of infestation and damage	CCMAP-TWG (DA HVCDP, BPI-CPMD, DA-RCPC, FPA, FCAs, ATI, Chemical Companies, SUCs)
Expand production areas	Strat 1	Distribution of quality planting materials, including new and improved varieties	Increased area harvested	DA-HVCDP, BPI, LGU, FCAs
	Strat 3	Support top-producing and with high-potential regions (e.g. Zamboanga Peninsula) to mainstream mango production	Increased volume of production	DA-HVCDP, FCAs, LGU
	Strat 6 Strat 16	Revive dormant/ unproductive mango farms by offering loan programs to young agripreneurs	Increased area harvested	DA-HVCDP, ACPC, FCAs
Farm input subsidy	Strat 1	Distribution of flower inducers	No. of kg/liters distributed No. of trees induced	DA-HVCDP, Agro-Supplies, FCAs

KEY STRATEGIES	ONE DA AGENDA	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY/ GROUP
Mainstream local weather data and drought forecast in mango orchard management	Strat 7 Strat 9	Conduct information and education campaign on climate-smart farming and other related topics	No of seminars conducted No of farmer participants	ATI, PAGASA, DA-AMIA, FCAs
		Use of expanded vulnerability risk assessment maps of PRDP in identifying suitable areas for expansion	Areas identified for expansion	PRDP, LGU
OBJECTIVE 2: INCREASE PRODUCTIVITY AND PRODUCTION EFFICIENCY COMPARABLE TO GLOBAL COMPETITORS				
Strengthen R4D on variety development and disease management	Strat 7	Development of 'Carabao' mango hybrids and other varieties	No. of breeds developed	DOST-PCAARRD IPB-UPLB CAFS-UPLB BPI
		Exploration of other planting varieties (i.e. Alfonso mango)	No. of research conducted	BPI
		Detection kits to identify true to type 'Carabao' mango planting materials (for pilot test and adoption)	No. of developed technologies	SUC (USM, VSU),DOST- PCAARRD
		Apiculture in Mango Farming	No. of farmer adaptors	BPI
		Identification of fruit bagging materials and safety gears or equipment.	No. of developed technologies	PhilMech, SUCs, BPI

KEY STRATEGIES	ONE DA AGENDA	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY/ GROUP
Farm Clustering and Consolidation	Strat 1	Production cluster establishment	No. of clusters developed	Private Sector (FCAs) DA-F2C2P, HVCDP
	Strat 1	Rehabilitation of old/low yielding trees	No. of trees rehabilitated/ rejuvenated	DA-HVCDP, FCAs, ACPC,
	Strat 4 Strat 15	Conduct of trainings and technology demonstration	No. of participants No. of Techno Demo conducted	DA-HVCDP, ATI, BPI, FCAs
	Strat 1 Strat 2 Strat 3 Strat 4 Strat 16	Establishment of community-based fruit bag production, processing/ postharvest facilities	No. of facilities established	DA-HVCDP, FCAs
Credit Support	Strat 6 Strat 17	Streamlining of loan and insurance requirements with lower interest rates Expedite the processing of loan applications/ or availments in loaning conduits of ACPC, and mango farmers are encouraged to join associations/federations for easier access to ACPC programs.	No. of approved loans	DA-RLOFTs, ACPC, PCIC, and FCAs
Strengthening of extension services and information dissemination	Strat 15	Aggressive education of producers to consumers (i.e. Proper timing and application of appropriate agrochemicals)	No. of trainings conducted	ATI, FCAs, LGUs and Chemical Companies
		Training on proper technique on fruit bagging	No. of trainings conducted	ATI, BPI, FCAs

KEY STRATEGIES	ONE DA AGENDA	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY/ GROUP
Modernization (mechanization) of farming practices	Strat 7 Strat 8	Use of drone sprayers, low-volume sprayers, pruning technology, and other new technologies	No. of equipment provided No. of new technologies introduced	PhilMech, BAFE, HVCDP, BAR, BPI
Diversification of income sources	Strat 5	Support for planting other fruit trees and vegetables, small ruminants to diversify income source	No. of farmers adaptors Increase farm income	DA-HVCDP, BAI, ATI
Establish policies, standards, and ordinances for quality plantation management, and strict harvesting standards	Strat 3	Local ordinances to harvest only when fruits are at their right maturity	No. of new policies issued	LGU BAFS PRS BPI
		Establish a guideline on cultural intervention specific to regional growing areas (based on biophysical and socioeconomic conditions)	No. of modules developed	
		Formulate a policy that will require mango contractors to fertilize their contracted area and trees harvested to sustain the productivity of land	Policies adopted	PRS
Strengthening national mango organization(s)	Strat 2 Strat 3 Strat 4	Organizing and reactivating members from the regional, provincial, city/municipality, and municipal mango growers' associations and cooperatives, chemical companies, processing and export companies etc.		United Mango Stakeholders of the Philippines (UMSP), Philippine Mango Industry Foundation, Inc. (PMIFI), Other mango growers associations/ cooperatives, private companies.

KEY STRATEGIES	ONE DA AGENDA	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY/ GROUP
OBJECTIVE 3: REDUCE POST-HARVEST LOSSES				
Strengthening of extension services and information dissemination	Strat 18	Aggressive education of players in the value chain (i.e. proper handling) - from producers to consumers	Decrease in post-harvest losses	ATI, LGU, DA-AFID, PhilMech
	Strat 18 Strat 15	Improved extension support and services in the promulgation of IEC Materials	No. of IEC materials distributed	
Strengthen R&D on mango post-harvest	Strat 7 Strat 8	Alternative to ripening agents (i.e. calcium carbide)	No. of research conducted No. of technologies adopted	BAR, BPI, DOST-PCAARRD, and PhilMech
		R&D to delay ripening of mangoes including breeding for fruits with delayed ripening trait		
		R&D on mechanized handling/processing technologies		
Modernization (mechanization) of pre- and post-harvest handling practices as well as transportation and storage facilities	Strat 8 Strat 13	Establishment of more post-harvest facilities and equipment (e.g. HWT)	No. of equipment/ facilities provided/ established	PhilMech, BAFE, HVCDP, BAR, DOST, DTI
		R&D on mechanized handling/processing technologies; develop simple and easy to use HWT machine		
		Shift to plastic crates, and improved harvesting tools through subsidies		
		Establishment of Mango Processing Facility		

KEY STRATEGIES	ONE DA AGENDA	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY/ GROUP
Increased availability and access to available and functional post-harvest facilities and equipment	Strat 3	Provision of harvesting tools developed by SUCs or local manufacturers (e.g Latex injury-reducing harvesters)	No. of tools distributed	HVCDP, BAFE, and DTI
	Strat 18	Promotion of developed pre- and post-harvest technologies	No. of technologies promoted and adopted	HVCDP, BAFE, and DTI
Utilization of reject fruits and by-products	Strat 15 Strat 16	Capacitate farmers to process their mango rejects or excess harvests	No. of trainings conducted	HVCDP, DTI, BPI, PhilMech and BAR
	Strat 7	R&D of innovative products utilizing reject fruits and byproducts	No. of research conducted	DOST, DA-BAR and PhilMech
		Studies on the nutraceutical properties of by-products of processing		
OBJECTIVE 4: EXPAND MARKET ACCESS FOR MANGO				
Mobilization of partners	Strat 11	Market matching	Number of farmers matched	DA-AMAS, DTI
		Conduct of Mango Week	Conduct of activity Number of farmer participants	HVCDP, DA-AMAS, FCAs
Export Promotion and Development	Strat 12	Explore/provide policy support on export incentives (e.g. during emergencies like the pandemic)	Policy developed	DA PRS, DTI
		Participation in trade fairs and outbound business missions	No. of participants No of closed deals	AMAS, DTI-EMB
		Trade negotiations	No. of countries with a successful partnership	DA-PRS, IAD, DTI
		Conduct of market analysis and product competitiveness	No. of studies conducted	AMAS

KEY STRATEGIES	ONE DA AGENDA	SPECIFIC ACTIVITIES	KEY PERFORMANCE INDICATOR	RESPONSIBLE AGENCY/ GROUP
Food Safety and Product Quality	Strat 4 Strat 5 Strat 10	Training on compliance to the existing standards (GAP, GMP, HACCP)	No. of trainings conducted No. of GAP certified mango farms	ATI, BPI, BAFS, DTI
	Strat 10	Impose regulations/ policies to maintain product quality Explore "seal" of good quality, Geographical Indicators, and traceability	No. of LGUs issuing policies	P/MLGU DA-PRS, DTI
OBJECTIVE 5: EASE ACCESS TO INFORMATION AND RESOURCES				
Establishment of Agri-Business Centers	Strat 11	Establish a one-stop-shop for mango farmers offering loans, agri-supplies, technical assistance, etc.	No. of centers established	DA RFOs, FCAs, LGU, Private Sector
Strategic communication	Strat 18	Production of AVPs	No of AVPs produced	AFID
		Establish database and website for mango references, training modules, seminars, etc.	Established knowledge database	HVCDP, FCAs, ICTS
	Strat 15	Conduct of webinars	No of webinars No of participants	HVCDP, ATI, BPI, FCAs

TABLE 40. MANGO INDUSTRY TARGETS FOR 2021-2025

MANGO (ALL VARIETY)	SUPPLY UTILIZATION AND PROJECTION					
	2020	2021	2022	2023	2024	2025
Population projection	109,035,343	110,452,802	111,888,689	113,343,242	114,816,704	116,309,321
Per Capita Consumption (kg/yr), 2% increase/year	6.16	6.28	6.41	6.54	6.67	6.80
Annual Demand (mt)	671,658	693,997	717,079	740,929	765,573	791,036
Supply Utilization Account						
Production (mt)	739,249.80	777,823.28	818,930.61	880,107.15	931,042.57	981,226.92
Imports (mt)						
Export (mt)	15,266.83	15,572.17	15,883.61	16,201.28	16,525.31	16,855.81
Seeds (mt)						
Feeds and Waste (mt)	44,354.99	46,669.40	49,135.85	52,806.43	55,862.55	58,873.62
Processing (mt)						
Net Food Disposable (NFD,mt)	679,627.98	715,581.72	753,911.45	811,099.44	858,654.71	905,497.49
Per Capita Consumption (kg/yr) based on SUA	6.23	6.48	6.74	7.16	7.48	7.79
Area Harvested (Ha)	186,798.1	187,185.76	187,693.76	192,109.49	193,550.15	194,269.28
Expansion Areas (ha), Based on seedling planted in 2016-2020		387.69	508.00	4,415.73	1,440.66	719.13
Yield (mt/ha), target of 5% increase per year	3.96	4.16	4.36	4.58	4.81	5.05
Increase in yield (mt/ha)		0.20	02.21	0.22	0.23	0.24
Surplus/Deficit (mt)	59,621.82	62,241.56	65,019.46	69,007.71	72,387.86	75,729.43
Local Sufficiency Level (%)	103%	105%	107%	112%	114%	117%

* based on world population review projections of 1.3% annual increase
2020 population based on National Census of Population 2020

TABLE 41. PHYSICAL TARGETS AND REQUIRED INVESTMENT FOR THE IDENTIFIED SHORT-TERM STRATEGIES

P/A/Ps	PHYSICAL TARGET						REQUIRED INVESTMENT (P'000)						RESPONSIBLE AGENCY /GROUP	REMARKS
	2021	2022	2023	2024	2025	TOTAL	2021	2022	2023	2024	2025	TOTAL		
Cluster Mango Farms (Five Clusters per Top 10 Producing Regions)	6	50	50	50	50	206							DA F2C2P, HVCDP,FCAs	100 Hectares per cluster at 5 clusters per top 10 producing regions
GAP Certified Mango Farms		10	50	50	50	160							BPI, ATI	
Creation of Island-Wide Federation		/											FCAs	
Strengthen National Organization				/									UMSP	
PRODUCTION SUPPORT														
Expansion Areas, has	294.00	607	1,000	1,000	1,000	3,901	3,151	3,973	7,000	7,000	7,000	28,124	DA HVCDP, BPI	(Impact by 2026 onwards, includes expansion for new and improved varieties)
Flower Inducer, kg	172,680.00	180,250	350,000	350,000	350,000	1,402,930	18,128	14,330	17,500	17,500	17,500	84,958	DA HVCDP	
Pesticide and other Bio-Control Agents						-		20,000	40,000	40,000	40,000	140,000	DA HVCDP. RCPC, BPI-CPMD	
Tree Rehabilitation (at 5% of bearing trees since 2014, low yielding)	88,198	89,001	497,421	481,543	473,155	1,629,318	47,336	48,800	298,452	288,926	283,893	967,407	DA HVCDP, FCAs ACPC	
Tractor Mounted Pruning Machine @ 1 unit per top producing province (mounted in 70-100 hp)			10	10	10	30			40,000	40,000	40,000	120,000	DA HVCDP, BAFE,PhilMech, FCAs	BAFE to lead in the mechanization of mango farming activities

P/A/Ps	PHYSICAL TARGET						REQUIRED INVESTMENT (P'000)						RESPONSIBLE AGENCY /GROUP	REMARKS
	2021	2022	2023	2024	2025	TOTAL	2021	2022	2023	2024	2025	TOTAL		
Orchard Sprayer (as implement)			10	10	10	30			15,000	15,000	15,000		DA HVCDP, BAFE,PhilMech, FCAs	BAFE to lead in the mechanization of mango farming activities
Bagging Materials, in bundles		10,000	10,000	10,000	10,000	40,000		20,000	20,000	20,000	20,000	80,000	DA HVCDP, FCAs, LGUs	Can also become a community level livelihood, (BUNDLES @ 4 BUNDLES PER HECTARE W/70 TREES)
Mechanical Lifting Machine		2	5	5	5	17		7,000	17,500	17,500	17,500	59,500	DA HVCDP, BAFE,PhilMech, FCAs	BAFE to lead in the mechanization of mango farming activities, conduct pilot study and procurement identified machineries and equipment in partnership with HVCDP
Harvesting aid			1		5	6			4,000	-	20,000	24,000	DA HVCDP, BAFE,PhilMech, FCAs	

P/A/Ps	PHYSICAL TARGET						REQUIRED INVESTMENT (P'000)						RESPONSIBLE AGENCY /GROUP	REMARKS
	2021	2022	2023	2024	2025	TOTAL	2021	2022	2023	2024	2025	TOTAL		
Improved mango harvester tool		100	5,000	5,000	5,000	15,100		60	3,000	3,000	3,000	9,060	DA HVCDP, BAFE,PhilMech, DOST –PCAARD, FCAs	
Ladders, ropes, and other farm tools		130	500	500	500	1,630		600	2,500	2,500	2,500	8,100	DA HVCDP	
Farm Diversification (no. of farms)		50	50	50	50	200		2,500	2,500	2,500	2,500	10,000	DA HVCDP	
POST-HARVEST HANDLING, PROCESSING AND LOGISTICS														
Plastic Crates (@1000 pcs per top producing regions)	5,280	3,225	10,000	10,000	10,000	33,225	3,615	2,248	7,000	7,000	7,000	26,863	DA HVCDP	
Consolidation and Post-Harvest Facility		5	5	5	5	20		5,000	5,000	5,000	5,000	20,000	DA HVCDP and BAFE	
Hot Water Tank Treatment (Conveyor/Pulley Type)		10	50	50	50	160		10,000	50,000	50,000	50,000	160,000	DA HVCDP, BAFE and DOST	
Community-Based Processing Facility for Mango		5	5	5	5	20		15,000	15,000	15,000	15,000	60,000	DA HVCDP, BAFE and DTI	BAFE to prepare recommended detailed engineering design and POW for such facility for different products
Reefer Vans (12-15 C)			10	10	10	30			20,000	20,000	20,000	60,000	DA HVCDP	

P/A/Ps	PHYSICAL TARGET						REQUIRED INVESTMENT (P'000)						RESPONSIBLE AGENCY /GROUP	REMARKS
	2021	2022	2023	2024	2025	TOTAL	2021	2022	2023	2024	2025	TOTAL		
Hauling Trucks			10	10	10	30			15,000	15,000	15,000	45,000	DA HVCDP	
Mobile Processing Trucks				1	5	6				5,000	25,000	30,000	PhilMech, DA HVCDP	PhilMech/DOST to conduct Feasibility Study
TRAININGS AND TECHNOLOGY DEMONSTRATION														
GAP and IRM Training	19	100	100	100	100	419	2,150	1,010	5,000	5,000	5,000	18,160	ATI, BPI-CPMD and RFO - RCPC	Includes AEWs and Farmers
Mango Contractors Skills Training and Certification @ 20 participants each session		10	50	50	50	160		1,000	5,000	5,000	5,000	16,000	ATI, TESDA,FPA	Mango Sprayers and Contractors for certification of FPA
Mango Bagging Training (20 participants per batch)		10	10	10	10	40		200	200	200	200	800	ATI, BPI	
Learning Site Establishment or TESDA Farm Schools (1 per top producing province)		10	10	10	10	40		1,500	1,500	1,500	1,500	6,000	ATI, TESDA,FPA	
Post-Harvest Handling, Value Adding and GMP, HACCP, etc		10	10	10	10	40		500	500	500	500	2,000	DA HVCDP, ATI, DOST and DTI	

P/A/Ps	PHYSICAL TARGET						REQUIRED INVESTMENT (P'000)						RESPONSIBLE AGENCY /GROUP	REMARKS
	2021	2022	2023	2024	2025	TOTAL	2021	2022	2023	2024	2025	TOTAL		
Capacity Building and Organizational Strengthening		50	50	50	50	200		2,500	2,500	2,500	2,500	10,000	DA-F2C2P, ATI, CDA	All clusters shall undergo capacity building
Mango Crop Production (NCII), no. of participants													TESDA	
Technology Demonstration Sites (Advance technologies and Practices)			5	5	5				15,000	15,000	15,000		DA Research Stations, SUCs	Showcase appropriate technologies
OTHER SUPPORT AND ACTIVITIES														
Loan Package (Loan at max of P150k/ hectare)		500	500	500	500	2,000		75,000	75,000	75,000	75,000	300,000	ACPC	Specific Loan Window for Mango Farmers
Insurance Coverage													PCIC	Including Crop Insurance and Personal Insurance
RESEARCH FOR DEVELOPMENT														
Research on Pest and Disease Management	5	1	3	1	1	11	11,100	5,000	15,000	5,000	5,000	41,100	DA-BAR, DOST-PCAARRD, SUCs	
Research on Organic Mango Farming		1		1		2		5,000	-	5,000	-		DA-BAR, DOST-PCAARRD, SUCs	

P/A/Ps	PHYSICAL TARGET						REQUIRED INVESTMENT (P'000)						RESPONSIBLE AGENCY /GROUP	REMARKS
	2021	2022	2023	2024	2025	TOTAL	2021	2022	2023	2024	2025	TOTAL		
Community Participatory Action Research (top 10 producing provinces)			10	10	10	30		-	5,000	5,000	5,000	15,000	DA-BAR, DOST-PCAARRD, SUCs, LGU, FCAs	
Research on Natural Enemies		1	1	1	1	4							DA-BAR, BPI-CPMD, DOST-PCAARRD, SUCs	
Research on Mechanizing Mango Operations		1		1		2		5,000		5,000			BAFE, PhilMech, DOST-PCAARRD, SUCs	
Research on Fruit bagging materials		1						2,000					PhilMech, DOST	
Research on consumer and market research (local and international)		1		1		2		1,000		1,000			DA - AMAS, DTI	
Establish a database for all R&D Projects for public access		/											DA HVCDP	Centralized website for all mango related information
Agribusiness Center (Service Provider) can be in Negosyo Center			5	5	5	15			10,000	10,000	10,000	30,000	DA, DTI, CDA, DOLE	Negosyo Center
National Mango Week (Festival/Congress)		1	1	1	1	4		500	500	500	500	2,000	DA HVCDP, AMAS, FCAs, PMIFI	To be conducted by April or May

P/A/Ps	PHYSICAL TARGET						REQUIRED INVESTMENT (P'000)						RESPONSIBLE AGENCY /GROUP	REMARKS
	2021	2022	2023	2024	2025	TOTAL	2021	2022	2023	2024	2025	TOTAL		
Trade Fairs and Missions and Business Forum	2	2	2	2	2	10	100	100	100	100	100	500	DA - AMAS/AMAD, DTI	
IEC Materials Printing						-	200	500	500	500	500	2,200	DA AFID, DOST, DTI	
AVP		5	1	1	1	8		500	100	100	100	800	DA-HVCDP, AFID	
TOTAL							85,780	250,821	715,352	707,826	731,793	2,377,572		

*2021 and 2022 Targets and Budget based on DA HVCDP Proposals
Highlighted in yellow are direct activities for Cecid Fly Control and Management Action PlanRECOMMENDATIONS FOR

POLICIES, STRATEGIES, AND PROGRAMS

The declining industry of mango is attributed to several factors which include cecid fly infestation, high costs of production, a challenge to adhere to the current food safety requirement of traditional importing countries, postharvest losses, and conversion of mango orchards into vegetable-based plantations, among others. Hence, there is a vital need for strategic, innovative, and long-term research and development efforts to enhance the competitiveness of the mango industry in local and export markets.

Priority Programs

Cecid Fly Control and Management Action Plan

Goal: Upgraded production systems that reduce the vulnerability of the mango industry to pest outbreaks and promote food safety, farm workers' health, and environmental protection.

Objectives: The overall objective is to reduce pesticide use in mango. The specific objectives are:

1. To provide a stopgap measure by introducing new modes of action of insecticide in the mango production system.
2. To establish a scheme that will promote responsibility and accountability in pesticide use.
3. To enable farmers to make intelligent and effective decisions in pesticide management.
4. To support science-based innovations that will develop alternatives to insecticides and improve the efficiency and effectiveness of insecticide applications.

Strategic Elements:

Strategy 1: (Stopgap) Facilitate the introduction of new modes of action (MOA) of insecticide. Make available to mango growers 2-3 new modes of action (MOA) of insecticide under a supervised trial, participatory action research, or a techno-demo.

KEY ACTION 1: FPA to issue Emergency Use Permit and BAFS to facilitate the issuance of Certificate of Product Registration (CPR) of organic biocontrol agents (OBCA) intended for cecid fly in mango.

KEY ACTION 2: DA RCPC to conduct participatory action research or techno demo using the new MOA in the context of (Insecticide Resistance Management) IRM. Limit the use to 1 cropping only until registration is completed.

KEY ACTION 3: Mango contractors to be the target partners in the action research to accelerate areas covered under IRM.

KEY ACTION 4: The pesticide industry to provide stewardship of their products during the trials while generating their data for FPA registration.

Strategy 2: Promote accountability and responsibility in pesticide use. Professionalizing pesticide application in mango will create a good image of the mango industry, reduce health hazards to farmworkers, and ensure the safety of produce.

KEY ACTION 1: FPA to review the requirements for the application and renewal of the license of mango contractors.

KEY ACTION 2: FPA to waive the initial fee for new applicants to encourage participation.

KEY ACTION 3: ACPC to design loan packages and give priority to licensed and trained contractors and mango growers.

KEY ACTION 4: BPI to study if the licensed contractors' practices could be used in the GAP certification of a farm.

KEY ACTION 5: TESDA to include IRM in the NCII IPM Module

Strategy 3: Educating and enabling mango growers and contractors regarding relevant innovative approaches and applicable standards such as Good Agricultural Practices (GAP) for Mango. Any new insecticide MOA will readily lose effectiveness if old practices of farmers and contractors remain. Education enhances decision-making. Capacitating them to put decisions into action is another.

KEY ACTION 1: DA-ATI and BAFS to support the learning and development interventions such as seminars and trainings in collaboration with the IRM trainer. (Training on bagging)

KEY ACTION 2: DA-ATI, BAFS, and DA –AFID to develop knowledge products and IEC materials such as training videos, podcasts, and other platforms.

KEY ACTION 3: Pesticide applicators of the mango contractors must be included in the trainings because they tend to sub-contract backyard growers or cleave-off from contractors as they gain confidence.

KEY ACTION 4: ACPC to develop attractive loan packages to mango growers, contractors, and certified pesticide applicators to free them up in the insecticide-locked credit system.

Strategy 4: Science-based innovation to modernize pest management R&D for sustained innovations to improve insecticide delivery methods, conserve natural enemies, develop tools to monitor resistance, and explore the use of pheromone for trapping.

KEY ACTION 1: BAR to conduct R&D to increase the cost-effectiveness of pesticide application

KEY ACTION 2: Improve the IRM recommendations by including spatial analysis.

KEY ACTION 3. BAR to conduct R&D on the development of biological control and other novel methods of control

Strategy 5: Centralize reports on monitoring and observation of Cecid fly infestation and provide immediate recommendations in control and management of the pest.

KEY ACTION 1: BPI-CPMD to create a nationwide map of incidence reports on cecid fly damage based on submission of DA – RCPC

KEY ACTION 2: DA RCPC to conduct regular monitoring on Cecid Fly infestation and provide detailed reports submitted every end of the mango fruiting season (June and December)

Table 42 shows three case scenarios for Luzon in terms of cecid fly incidence in 1-ha of 50 mango trees. The data shows the significant differences, from farms with no cecid fly, followed by with cecid fly, where a low infestation of cecid fly is observed, and finally infested with cecid fly with extreme cases of fruit drops, rejects. The drop from gross income without cecid fly reduced by 13% and 44% in cases with low cecid fly infestation and extreme cecid fly infestation, respectively. The decrease in gross income combined with an increase in expenses yields an increase in production cost per kg of PhP 13.17 and PhP 41.42 for low and extreme cecid fly infestation, respectively than that with none.

TABLE 42. DATA ON MANGO PRODUCTION WITH AND WITHOUT CECID FLY INFESTATION (LUZON)

SUMMARY	WITHOUT CECID FLY (300KAIN G)	WITH CECID FLY (200KAIN G)	INFESTED WITH CECID FLY
Harvest	5,400.00	3,600.00	2,000.00
Farm Gate Price per kilogram	30	40	50
Gross Income	P162,000.00	P144,000.00	P100,000.00
Harvest Expenses	P13,500.00	P9,000.00	P4,500.00
Expenses	P121,304.00	P128,276.00	P128,276.00
ROI	P27,196.00	P6,724.00	-P32,776.00
Production cost per 1ha./50 trees	P134,804.00	P137,276.00	P132,776.00
Production cost per kilo	P24.96	P38.13	P66.39

Note: * Farm gate price may vary depending on mango supply
Source: United Luzon Mango Stakeholders Association Inc. (ULMSAI), 2021.

Table 43 shows only two case scenarios: with and without cecid fly infestation for Mindanao unlike that of Luzon's where cecid fly infestation may come in two kinds of damage incidences. From Gross Income alone, half of the projected income without the cecid fly is lost if the farm is infested. Yet expenses incurred with cecid fly infestation is 66% of total expenses without infestation, which leaves the farm earning only 17% of the projected net income without cecid fly infestation and incurring a production cost of PhP 40.06/kg, which is higher by PhP 9.55/kg for mangoes without cecid fly infestation.

TABLE 43. DATA ON MANGO PRODUCTION WITH AND WITHOUT CECID FLY INFESTATION (MINDANAO)

SUMMARY	WITHOUT CECID FLY	WITH CECID FLY
Harvest	16,000.00	8,000.00
Farm Gate Price per kilogram	45	45
Gross Income	P720,000.00	P360,000.00
Operating Expenses	P156,637.50	P156,637.50
Harvest Expenses	P19,600.00	P10,850.00
Farm owner share 30%	P216,000.00	P108,000.00
Farm Regular Staff Commission @1.50/kg x 4person	P96,000.00	P45,000.00
Total Expenses	P488,237.50	P320,487.50
Net Cash Income	P231,762.50	P39,512.50
Production cost per1/ha./50 trees	P9,764.75	P6,409.75
Production cost per kilo	P30.50	P40.06

Losses incurred can drastically affect the livelihood of mango farmers thus it should be urgently resolved.

Tree Rehabilitation

Rehabilitation of mango trees by pruning and fertilization has been one of the priority interventions that must be made to increase productivity and yield of mango trees by at least 50% based on the observations in the conducted rehabilitation activity. The number of mango trees as shown in Table 44 was targeted based on the 5% total number of mango trees in 2014 starting 2023. This process requires pruning, chipping or rotavating, composting, and fertilization which costs from Php 570-820 per tree based on calculations. Farmers can then be encouraged to regularly conduct proper tree fertilization and maintenance as they have seen the advantage and benefits of this activity.

TABLE 44. TARGET NUMBER OF TREES REHABILITATED, 2023-2025

Region	2023	2024	2025
PHILIPPINES	497,421	481,543	473,155
CAR	1,797	1,829	1,782
Region I	39,725	38,623	37,900
Region II	48,414	48,193	47,003
Region III	92,948	92,979	92,963
Region IV A	49,260	49,168	46,425
Region IV B	10,416	9,944	9,908
Region V	3,202	3,211	3,231
Region VI	20,529	20,564	21,552
Region VII	28,606	28,662	28,678
Region VIII	925	939	942
Region IX	50,342	50,487	44,898
Region X	23,430	23,643	23,692
Region XI	36,015	22,762	22,804
Region XII	50,113	48,730	49,473
Region XIII	10,168	10,206	10,222
BARMM	31,532	31,604	31,682

Note: 2021 targets are already in place while 2022 targets have already been proposed

National Mango Association Strengthening

To ensure that the mango sector is well represented in the policy-making activities in the country, the National Mango Association should be strengthened. This will serve as an umbrella organization of different associations and cooperatives in the country, also including farm input suppliers, institutional buyers, and other key players.

Access to Financing

The Agriculture and Credit Policy Council shall create a specific loan window for mango farmers interested to apply for operating capital at a maximum loan of P150,000 per hectare. This is to help farmers cope up with the increasing cost of farm input such as fertilizers, chemicals, and labor costs, as well as the losses due to pest infestation. This will also encourage mango farm owners who have neglected their farms to engage in mango production again.

Farm Clustering, Consolidation, and Modernization

A mango farmer has average landholdings of 2 ha or below, thus farm clustering and consolidation shall be put in place to attain economies of scale, and thus achieve cost-efficient production, harvest, processing, and market operations, subsequently increasing the income of mango farmers. Provision of support such as farm inputs, equipment, and facilities will be coursed thru the farm clusters. Technologies and information dissemination will be easier. A target of 50 clusters should be created yearly until 2025 with a package of support, subject to the needs assessment.

Farming operations such as regular tree pruning, spraying, and harvesting will also be modernized by using up-to-date and state-of-the-art technologies to make our farmers competitive in terms of the cost of production, at the same time improving product quality.

Policies, Legislations, and Ordinances

- Review of the Comprehensive Agrarian Reform Program

  To attract foreign direct investors, enable technology transfer that will help modernize our farming sector that will then help increase productivity and competitiveness

- National Mango Act

  To ensure sustained support to the mango industry, a Mango House Bill shall be passed into law

- Local Ordinances

  To encourage mango farm owners to utilize their farm and to Impose strict standards on harvesting mangoes at the right age of maturity

- Exporters Incentives

  Export incentives are a form of economic assistance that governments provide to firms or industries within the national economy, to help them secure foreign markets. A government providing export incentives often does so to keep domestic products competitive in the global market.

Types of export incentives include export subsidies, direct payments, low-cost loans, tax exemption on profits made from exports, and government-financed international advertising. While less concerning than import protections such as tariffs, export incentives are still discouraged by economists who claim that they artificially create barriers to free trade and thus can lead to market instability (Kenton, 2021).

Medium-Long Term Strategy

- Establishment of export treatment or processing facilities. Examples of these facilities are VHT and IQF facilities. Few considerations must be considered when establishing the facilities such as strict compliance to the MRL requirements of importing countries, and the consistent production volume to justify the costs. Also, appropriate locations must be identified.
- Commercialization of other mango by-products. There is still a lot of potential for other mango by-products just waiting to be explored. This is evident based on what other mango-producing countries are doing to maximize the potential of their mango by-products. It is about time for the Philippines to also explore and further develop other potential mango by-products with commercialization in mind.
- Improve post-harvest technologies to prolong the shelf-life of mangoes and expand access to other export markets. As the shelf-life of mangoes is prolonged, new export destinations will open up. The current export markets for mango are only those locations that are near the Philippines because mango quality is difficult to maintain for farther locations.
- Strict border restrictions on pests and diseases to protect local mango production. Guimaras was able to strictly implement border restrictions and because of this, it was able to protect its locally grown mango from pests and diseases. However, this is not the case for the other regions, wherein entry and exit within the mango production areas are not strictly enforced. Pests and diseases can also be attributed to several ports and points of entry whether land, air, or sea, therefore it is imperative that strict border restrictions be implemented.
- Further expansion of mango plantation. This can be done through continuous expansion of areas allotted to the planting of Mango. This should be subsidized by the Government (same with coconut), and have an established minimum target of expansion given a certain period, (e.g. 5,000 hectares per year). There is a need to be proactive in protecting the Mango industry and this is one way to preserve and increase the production area of our national fruit and at the same time address the problem of low supply from the production side.

INDUSTRY CLUSTER GOVERNANCE NETWORK

The Industry Cluster Governance Network for the Mango Industry Roadmap 2021-2025 would consist of three bodies – (1) the overall implementing and monitoring body; (2) the implementing agency; and (3) the monitoring agency. Table 45 lists the roles and responsibilities of the mentioned bodies.

TABLE 45. RESPONSIBILITY MATRIX FOR THE MANGO INDUSTRY ROADMAP 2021-2025

ROLES	ACTORS	RESPONSIBILITIES
Overall implementing and monitoring body	Department of Agriculture National High-Value Crops Development Program	Spearhead the implementation of the strategies and programs in the Mango Roadmap Conduct an internal periodic review of the Roadmap Mediate planning and regular consultations between the public and private sectors Establish partnerships with private investors/companies and tap foreign funding institutions
Implementing Agency	Private Sector	Provide counterpart support to scale-up investments
	DA Regional Field Offices DA Services DA Bureaus and Attached Agencies State Universities and Colleges (SUCs) Other National Government Agencies Local Government Units	Implement the targets and strategies identified in the roadmap
Monitoring Agency	PCAF, DA-PMED, PSA	Conduct a periodic assessment of the roadmap implementation

The implementation of the Mango Industry Roadmap shall be guided by the National Mango Action Team Technical Working Group (NMAT-TWG). It must be noted that Regional Mango Action Teams would only be formed in the top 10 producing regions and top 10 producing provinces.

- The NMAT-TWG shall have the following primary roles and responsibilities:
  - Assist the HVCDP in implementing the Mango Industry Roadmap.
  - Validate and consolidate the national, regional, and provincial plans on mango.
  - Monitor the development and implementation of the Mango Industry Strategic Plan.
  - Update from time to time the Mango Industry Roadmap based on national and international developments
  - Liaise with the national policymakers, Bureaus, and other stakeholders of the mango industry.

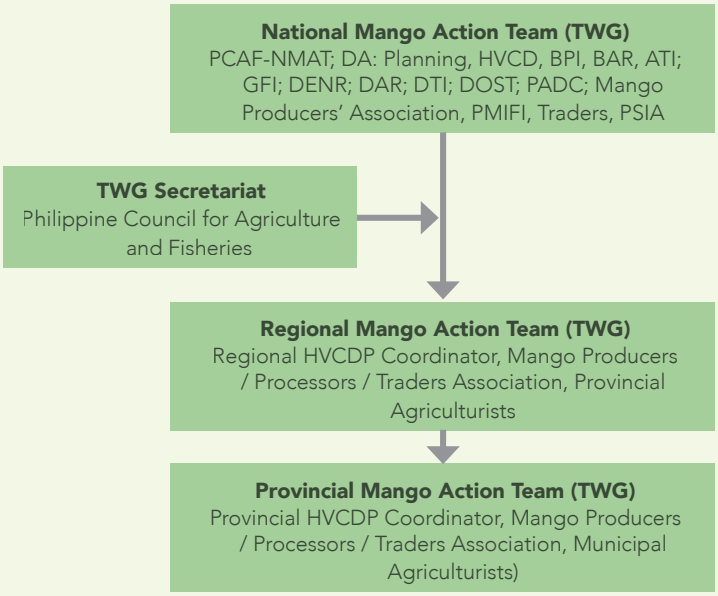
- The TWG Secretariat (Philippine Council for Agriculture and Fisheries) shall:
  - Provide administrative and technical support to the NMAT-TWG.
  - Arrange and coordinate regular and special meetings as scheduled by the TWGs.
  - Liaise with the TWG Chair to prepare meeting agendas.
  - Document the proceedings of the meeting.
  - Prepare the minutes of committee meetings, including action points arising from meetings and details of actions to be undertaken by management.
  - Prepare and transmit minutes/reports based upon information received from TWGs, as well as upon information derived from meetings.
  - Coordinate the preparation and circulation of committee papers within agreed timeframes.
  - Ensure the necessary coordination of the NMAT-TWG and RMAT-TWG.

- The Regional Mango Action Team TWG (RMAT-TWG) shall:
  - Develop the regional mango action plans to include municipal and provincial targets and programs.
  - Implement the regional plans developed from the national plan through the provincial and municipal counterparts of the Regional HVCDP.
  - Conduct regional mango congresses and field days in coordination with the regional/provincial stakeholders and relevant agencies.
  - Promote GAP in mango production.
  - Ensure reliability of data and information access on production, prices, consumption, and trade.
  - Report and represent the region in the NMAT-TWG.

- The Provincial Mango Action Team TWG (PMAT-TWG) shall:
  - Coordinate with RM-TWG to implement targets and programs;
  - Work with Regional HVCDP to implement the regional plans developed from the national plan;
  - Assist in the regional mango congresses and field days;
  - Promote GAP in mango production; and
  - Coordinate with the municipalities/cities and barangays.

To fully implement the Mango Industry Roadmap, the contributions from the private sectors and the government must be mainstreamed. It is through active collaboration that the Philippine mango industry can take off and enhance its competitiveness in world markets.

FIGURE 25. PROPOSED MANGO ROADMAP IMPLEMENTATION STRUCTURE



The TWG each level shall meet regularly as agreed upon. It shall deal mostly with programs and issues at a specific level. The TWG shall be funded by the HVCDP (re: meetings, travel expenses). The members will be pro bono (no honorarium or compensation except for the travel expenses).

Regional Mango Action Teams (RMATs) shall report important updates during the quarterly meeting of the National Mango Action Team. The creation or activation of RMATs and PMATs on top mango-producing regions and provinces shall be the responsibility of NMAT as the overseeing body.

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APPENDICES

APPENDIX 1: LIST OF ACCREDITED PLANT NURSERIES AND THEIR ACCREDITED CROPS PER REGION AS OF JUNE 8, 2021

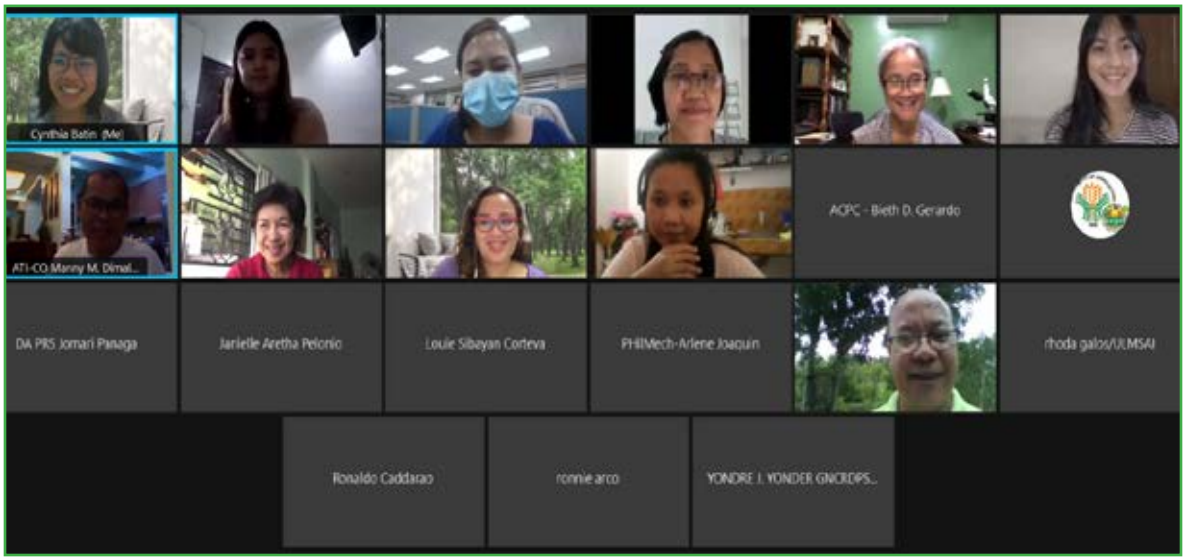
REGION	NURSERY NAME	ADDRESS	CONTACT NUMBER	ACCREDITED CROPS	VARIETIES	DATE OF EXPIRY OF ACCREDITATION
I	Pangasinan Organic Seed Growers and Nursery Multi Purpose Cooperative	Brgy. San Jose, Leet, Urdaneta City, Pangasinan	0917-508-5486/ 0917-860-4678	Mango	Lamao #1	December 28, 2020
I	Pangasinan Organic Seed Growers and Nursery Multi Purpose Cooperative	Brgy. San Jose, Leet, Urdaneta City, Pangasinan	0917-508-5486/ 0917-860-4678	Mango	GES 85	December 28, 2020
I	Pangasinan Organic Seed Growers and Nursery Multi Purpose Cooperative	Brgy. San Jose, Leet, Urdaneta City, Pangasinan	0917-508-5486/ 0917-860-4678	Mango	Sweet Elena	December 28, 2020
I	Majent Agro Industrial Corporation	Brgy. Malimpin, Dasol, Pangasinan	0918-612-3432 / 0926-658-1540	Mango	Lamao #1	June 23, 2026
I	Majent Agro Industrial Corporation	Brgy. Malimpin, Dasol, Pangasinan	0918-612-3432 / 0926-658-1540	Mango	GES 73	June 23, 2026
I	Majent Agro Industrial Corporation	Brgy. Malimpin, Dasol, Pangasinan	0918-612-3432 / 0926-658-1540	Mango	GES 85	June 23, 2026
II	DE OCAMPO'S FARM	San Manuel, Naguillian, Isabel	0905-329-6767	Mango	Lamao #1	June 07, 2021
II	DE OCAMPO'S FARM	San Manuel, Naguillian, Isabel	0905-329-6767	Mango	Sweet Elena	June 07, 2021
III	Mergel Plant Nursery	Rotary Lourdes, Bamban, Tarlac	0956-361-8686	Mango	GES 77	April 29, 2026
III	Mergel Plant Nursery	Rotary Lourdes, Bamban, Tarlac	0956-361-8686	Mango	Sweet Elena	April 29, 2026
IV-A	B.B. Vergara Plant Nursery	Brgy. Leynes, Talisay, Batangas		Mango		April 10, 2022
IV-A	Berdie's Agri-Trading	Brgy. Balas, Talisay, Batangas	0917-551-1610 / 0947-997-9223 / (043) 773-0195	Mango	Lamao #1	November 08, 2021
IV-A	Coronado's Farm Plant Nursery	Brgy. San Ignacio, San Pablo City, Laguna	0919-407-6710 / 0918-289-2559 / 0917-113-1542	Mango	GES 84	November 22, 2021
IV-A	Eure's Plant Nursery and Agri Trading	Brgy. Tumaway, Talisay, Batangas		Mango		April 10, 2022
IV-A	Gerille Averion Agricultural Supplies	Km. 86 San Ignacio, San Pablo City, Laguna Purok 3,	0936-738-0042	Mango		April 10, 2022
IV-A	Golden Leaf Nursery	Brgy. San Joaquin, San Pablo City, Laguna	0949-995-7688	Mango	GES 84	June 07, 2021
IV-A	Green Seeds Garden and Plantrees Depot Trading	Brgy. Buco, Talisay, Batangas	0909-701-4385 / 0919-575-4320	Mango		April 10, 2022
IV-A	M.A. Mendoza Plant Nursery	Brgy. Bañadero, Tanauan, Batangas	0939-905-4392	Mango	Lamao #1	November 22, 2021
IV-A	Mohammad I. Yusoph Plant Nursery	Brgy. Balas/Sta. Maria, Talisay, Batangas	0908-885-2757 / (043) 773-0534	Mango	GES 73	November 02, 2020
IV-A	Mohammad I. Yusoph Plant Nursery	Brgy. Balas/Sta. Maria, Talisay, Batangas	0908-885-2757 / (043) 773-0534	Mango	GES 77	November 02, 2020
IV-A	Mohammad I. Yusoph Plant Nursery	Brgy. Balas/Sta. Maria, Talisay, Batangas	0908-885-2757 / (043) 773-0534	Mango	GES 84	November 02, 2020
IV-A	Mohammad I. Yusoph Plant Nursery	Brgy. Balas/Sta. Maria, Talisay, Batangas	0908-885-2757 / (043) 773-0534	Mango	GES 85	November 02, 2020
IV-B	Aurelio B. Escala Plant Nursery	San Antonio, Victoria, Oriental Mindoro	0919-868-6949 / 0998-988-1905	Mango	GES 84	February 3, 2026
IV-B	Corrine's Garden	Brgy. Little Tanauan, Roxas, Oriental Mindoro	0908-866-8931	Mango	GES 84	June 25, 2021
IV-B	JMD Plant Nursery and Concrete Products	Brgy. Little Tanauan, Roxas, Oriental Mindoro	0956-699-9355 / 0918-967-1965	Mango	GES 73	May 31, 2026
IV-B	JMD Plant Nursery and Concrete Products	Brgy. Little Tanauan, Roxas, Oriental Mindoro	0956-699-9355 / 0918-967-1965	Mango	GES 77	May 31, 2026
IV-B	JMD Plant Nursery and Concrete Products	Brgy. Little Tanauan, Roxas, Oriental Mindoro	0956-699-9355 / 0918-967-1965	Mango	GES 84	May 31, 2026
IV-B	JMD Plant Nursery and Concrete Products	Brgy. Little Tanauan, Roxas, Oriental Mindoro	0956-699-9355 / 0918-967-1965	Mango	GES 85	May 31, 2026
X	Binahon Agro-Forestry Farm	Purok 3, Bol-ogan, Songco, Lantapan, Bukidnon	0917-8796880 / 0906-646-8573	Mango	Lamao #1	September 18, 2021
XI	Dayot Plant Nursery	Km. 10 Catalunan, Pequeño, Talomo District, Davao City	0928-948-1888 / 0905-474-3038	Mango	Lamao #1	June 09, 2026
XI	JC Mejos Agri Ventures	Km. 6 Mc Arthur Highway Talomo (Pob.) Davao City	(082) 221-9099 / 0917-300-0005	Mango	Lamao #1	September 24, 2020
XI	LGU Municipal Nursery	San Isidro, Magsaysay, Davao del Sur	0907 164 2876	Mango	Lamao #1	March 26, 2023
XI	Renel's Plant Nursery	Catalunan, Pequeño, Talomo District, Davao City	0955-513-5435	Mango	Lamao #1	October 29, 2020
XI	St. Padre Pios Garden	Purok 5 Wangan, Calinan, Davao City	0998-567-4851	Mango		April 07, 2022
XII	Cayona-Talento Nursery and Agri Supply	Brgy. Paco 116, Kidapawan City, North Cotabato	0926-362-5060 / 0920-798-4913	Mango	Lamao #1	December 12, 2021
XII	New Ira Nursery Products and Garden	Purok 2 Balindog, Kidapawan City, North Cotabato	0919-881-5069	Mango	Lamao #1	June 10, 2021
XII	New Ira Nursery Products and Garden	Purok 2 Balindog, Kidapawan City, North Cotabato	0919-881-5069	Mango	GES 73	June 10, 2021
XII	New Ira Nursery Products and Garden	Purok 2 Balindog, Kidapawan City, North Cotabato	0919-881-5069	Mango	GES 84	June 10, 2021
XII	New Ira Nursery Products and Garden	Purok 2 Balindog, Kidapawan City, North Cotabato	0919-881-5069	Mango	Sweet Elena	June 10, 2021

Source: Bureau of Plant Industry - National Seed Quality Control Services

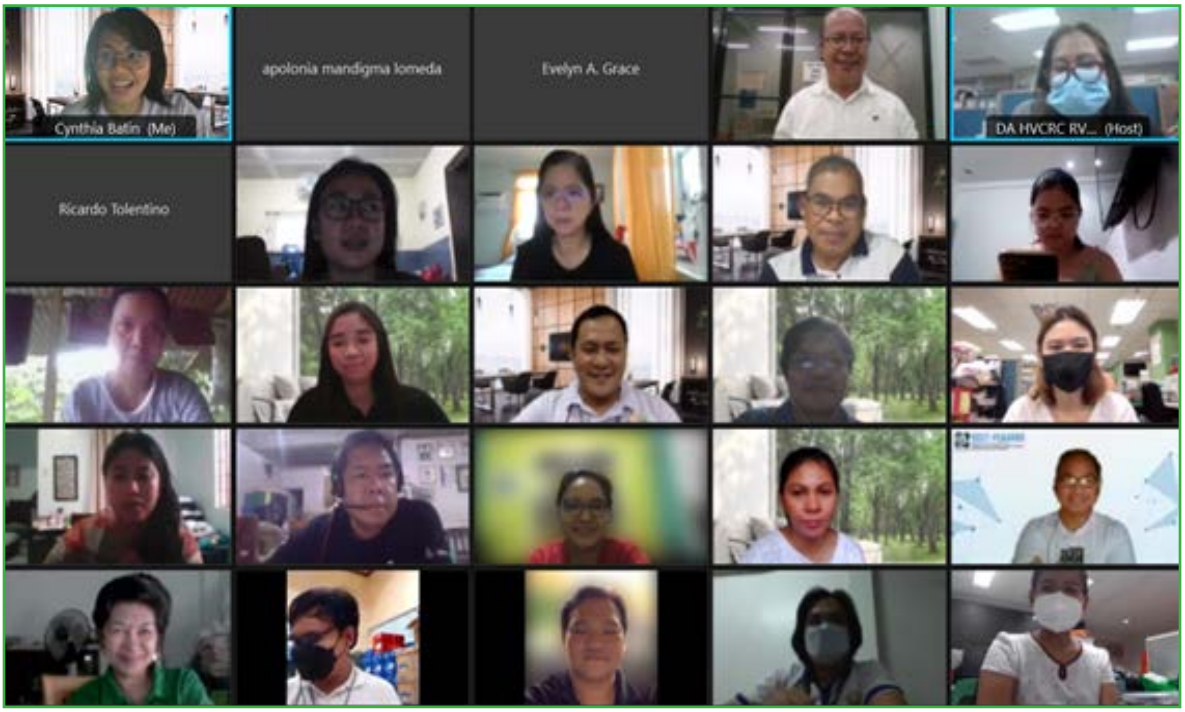
APPENDIX 2: CONSULTATION PHOTOS

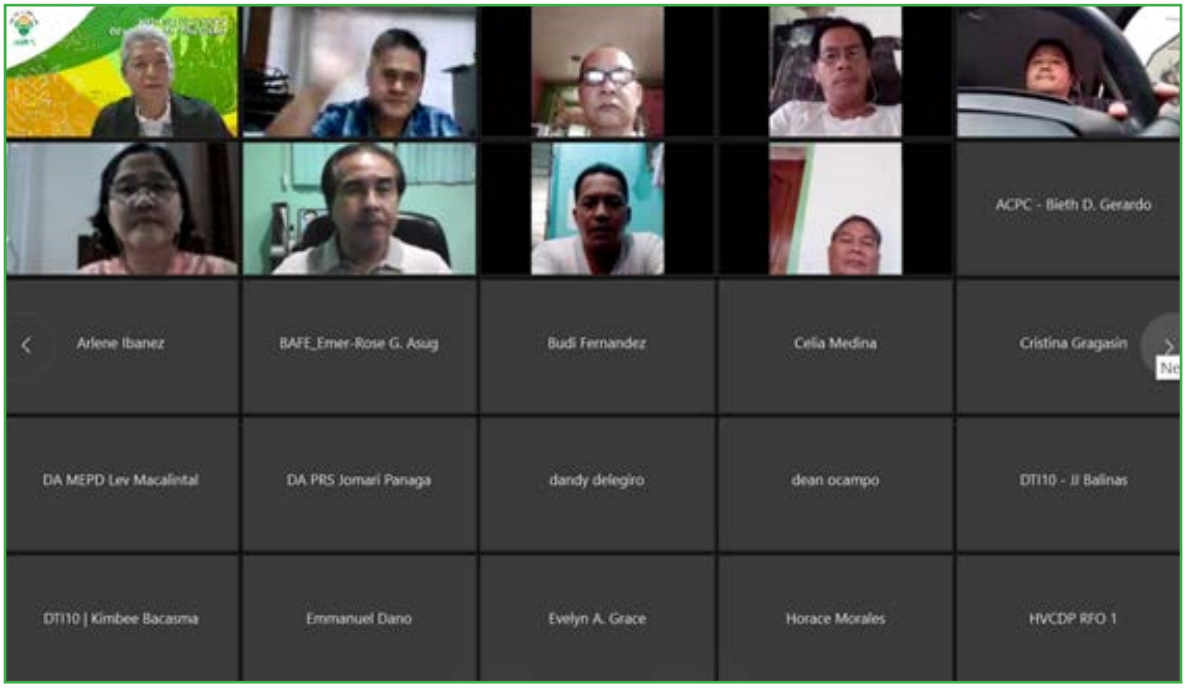
Meeting, August 17, 2021

Meeting, August 24, 2021



Public Consultation, September 13, 2021





Note: Others not included have their cameras turned off.

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Masaganang ANI Mataas na KITA