

Value Chain Analysis Of Mango In Karnataka

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Abstract

Mango is called the King of fruits. The world mango production averages 22 million metric tons per year, of which India contributes 12 million metric tons. India is the world's largest producer of mango in the world, contributing nearly 52% of the total world production. Nearly 1000 varieties of mango are produced in India. In 2017 Mango production in India was 19.5 million tons. Karnataka accounts for 7% of the horticultural output of India, \$ 6 billion worth of horticultural crops and 16.2 million tons of horticultural production in 2013-14. Karnataka's Horticultural products contribute 5.74% to the State's GDP (Economic Survey 2015-16), and 40% share to the economy of agriculture and allied sectors in the state. Farmer Producer Organisations (FPOs) create collection centers, cold storage facility, refrigerated transport facility, processing and value addition centers. The annual value of the horticultural produce in the state is Rs.35,307 crore. The average productivity of horticultural crops in the state is 8.46 metric tons per Hectare. The state has the capacity to grow more than 800,000 tons of mangoes every season. But it produced hardly 1866.23 metric tons from an area of 1,73,080 Ha in 2018-19.

Value chain analysis helps ensure a better price for the farmer's produce by identifying and systematizing different stages/processes involved in taking the produce from farmer's field to the consumer. Value chain analysis assumes greater significance particularly in the case of perishable products like vegetables, fruits and flowers in which unorganized disposal of the produce by the farmer results in a negligible share of the consumer's price, and the market intermediaries gobbling up the lion's share.

Key words: Value chain, Value chain analysis, post-harvest management, grading.

Introduction

Karnataka produces 106 varieties of Horticulture crops. About 17 fruits, 33 vegetables, 18 spices, 7 Plantation, 17 flowers, 7 medicinal and 7 aromatic crops are being published annually. The major mango growing belts in Karnataka are Kolar, Chikkaballapura, Dharwad, Ramanagara, Tumkur, Haveri and others. Annually, the state has the capacity to grow more than 800,000 tons of mangoes every season. The Kolar district has about 47 percent of the acreage under mango in the state. Srinivasa Pura is the chief mango growing taluk with 22,325 ha under the fruit. Srinivasapura is one of the biggest mango markets in south India with nearly 6 lakhs quintals of mango every year. The market arrivals are influenced by various factors. Quantity of arrivals in the APMC in the starting season April are very less. The peak season is from May 15th to June 15th, low quantity arrivals are observed at the end of the season (August).

The main mango producing states in India are Andhra Pradesh (24.5%) and Uttar Pradesh (24.4%) both of which contribute 50% to the overall production and the rest is shared by all other states, nearly Karnataka (10.0%), Bihar (7.6%), Gujarat (5.6%), Odisha (4.2%), West Bengal (4.1%), Tamil Nadu (4.0%), Maharashtra (3.5%), Jharkhand (2.9%), Kerala (2.4%) and others (6.9%). (Indian Horticulture Database 2013).

Value chain analysis in agriculture and its benefits to farmers

A 'value chain' in agriculture covers a range of activities and set of actors that bring agricultural product from production in the field to final consumption, wherein at each stage value is added to the product. Value chain actors are those who are directly involved in value chain activities. Vertical linkages connect actors involved in different activities of the value chain, from input suppliers to producers, processors, wholesalers, distributors, exporters, and so on, all the way to the consumer.

Value chain management, also known as supply chain management, has come a long way to become what it is today. In the past, value chain analysis was focused more on logistics, on the manual aspect of the process, and of optimizing the mechanized aspects. Today, it is more focused on automation, digitizing the process, and the coordination and integration of all the elements involved in the supply chain.

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disposal of the produce by the farmer results in a negligible share of the consumer's price, and the market intermediaries gobbling up the lion's share.

Mango Value Chain System

In the Mango value chain system, efficiency and the proper value-added process are very important to increase the productivity. Currently, the Mango value chain system has shown improvement, particularly in terms of grading of fruits, but the process needs upgrading. The chain of activities gives the product more added value than the sum of added values of all activities. This is because the grading of the Mango fruit is vital to improve the quality of fruits. High quality fruits can be exported to other countries for generating a good income. Mango is the most important fruit product in Karnataka. However, in Karnataka mangoes are graded by farmers only. There are demands for this fresh fruit from both local and

foreign markets. For increasing customer satisfaction there is need for managing cost. A systematic approach is needed to develop of competitive advantage in the product.

In the value chain at each stage, there would be an additional value to the product create in the form of packaging, processing, quality branding, grading, etc.

Mango is a rich source of vitamin A and C. The fruit can be consumed either raw or ripe. Good mango varieties contain 20per cent of total soluble sugars. The acid content of ripe fruit varies from 0.2 to 0.5 percent and protein content is about 1 per cent. Raw fruits of local varieties are used for preparing various traditional products like raw slices in brine, amchur, pickle, murabba, chutney, panhe (sharabat) etc. Presently, the raw fruit of local varieties are used for preparing pickle and Alphonso variety is used for squash in the coastal western zone.

Table. No.01: Output of Mango in Karnataka State - at Current and Constant Prices (in Rs. Lakhs)

(At Current Prices)					(At 2011-12 Prices)				
2011-12	2012-13	2013-14	2014-15	2015-16	2011-12	2012-13	2013-14	2014-15	2015-16
223710	285313	152014	233837	234639	223710	214945	210211	197153	206632

Source: Government of Karnataka, Horticultural Statistics at a Glance 2018

Two types of actors were distinguished from the mango value chain: direct and indirect actors.

- The direct actors are those directly involved in mango production and commercialisation and for whom mango plays a significant role in their income generating strategies. These included the nursery producers, fresh mango producers, harvesters and assemblers, processors and the traders.
- Indirect actors are agencies providing support such as financial assistance or capacity building support to direct actors in the mango sector.

Steps involved in Grading of Mango

1. Determine the size of mango by calculating the area.
2. Detect the colour of mango by determining the mean of the three colour array for red, green and blue.
3. Apply edge detection algorithm to determine skin of image mango.

4. The three values of size, color and skin to compute the grade of mango.
5. Rank the mango quality based on mango grade.

Mangos are sold through different channels starting with the farmers and till the product reaches ultimate consumers. The price realised, the trade practices followed, the purpose of mango purchase and there is a need to study the marketing channels followed by the farmers in selling mango in order to throw light on choosing channel more profitable to the farmers.

Good Agricultural Practices (GAP) require:

- Adoption of improved cultivars.
- Adoption of high-density planting in cultivars
- Regulating flowering and increasing intensity of flowering.
- Pruning malformed mango shoots at bearing stage

- Alternate bearing needs to be managed by reducing fruiting during a year by adoption of pruning and thinning practices
- Providing life saving irrigation at the critical stage of fruit growth etc.
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- Integrated nutrient and water management.
- Management of spongy tissue through sod mulching.
- Integrated pest and disease management practices and timely control of pests and diseases, especially mango hopper, mango mealy bug and sprays of Bavistin at fruit development stage especially after rains.

In India more than a thousand varieties of Mangoes are grown. However, only about 30 varieties are grown on a commercial scale in different states. Karnataka mainly cultivated Mango varieties are Alphonso, Totapuri, Banganapalli, Pairi, Neelum, Ratna, Sidhu, Ambika 2000, Arunika 2008, Arka Puneet, Arka Anmol, Arka Neelkiran Mallika and Malgoa. Season of harvesting of mango in Karnataka starts in mid- April ending in mid-July. Method of harvesting is plucking with the help of a pole and sickle, shaking the branches there by making fruits fall on a soft bed of grass.

Major mango assembling markets in Karnataka

Bangalore, Srinivaspur, Kankapura, Chinthamani, Madhugiri, Malur, Arsikere, Athani, Karawar, Hubli . Mangoes are exported to from Karnataka to other states, especially north Indian states exclude UP.

Important Mango Varieties grown in Karnataka

Table. No.02: India's Production and Export of Mangoes

The details of India's exports of mangoes during the last three years and the current year are as under:

ITCHS	Commodity	2015-16		2106-17		2017-18		2018-19 (UPTO Nov-18) *	
		Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
08045020	Mangoes Fresh	36779.26	50.10	52761.00	66.46	49671.32	59.45	43063.70	53.80
08045030	Mangoes Sliced & Dried	3644.09	6.94	376.78	2.40	569.05	3.05	1035.56	3.39
08045040	Mango Pulp	128866.01	121.29	130886.07	126.14	110923.73	104.54	72187.96	64.12
TOTAL		169289.36	178.33	184023.85	195.00	161164.10	167.04	116287.22	121.31

Source: Government of India, DGCI&S, *Figures of 2018-19 are provisional only

Table. No.03: Area and Production of Mango in Major Districts in Karnataka

Districts	Area in '000 Ha		Production in '000 MT	
	2014-15		2015-16	
	Area	Production	Area	Production
Ramanagara	23.46	234.59	22.72	228.01
Tumkur	15.15	151.52	15.67	167.91
Chikballapur	13.95	109.70	16.00	128.97
Dharwad	11.55	55.79	12.50	107.43

Mandya	6.54	73.28	6.50	74.43
Bangalore Rural	6.97	66.06	6.98	66.12
Belgaum	5.13	63.98	5.08	62.95

Source: Government of Karnataka, Horticultural Statistics at a Glance 2018

Production

Karnataka's Mango production was 1725.67 metric tons in 2015-16, 1719.73 metric tons in 2016-17, 1760.60 metric tons in 2017-18 and 1866.23 metric tons in 2018-19. Karnataka's share of production was 11.71 per cent.

Post-Harvest Management of Mango

Post-harvest management means the handling of an agricultural product after harvest to prolong its storage life, freshness and an attractive appearance. In order to deliver a quality product to the market and ultimately to the consumer to command buyer's attention and give the grower a competitive edge, proper post-harvest management is the need of the hour. Mangoes will continue to ripen indoors, but are the sweetest if allowed to ripen on the tree, so it is profitable to wait until mangoes have become colored before picking. About 20-25 per cent of fruits are damaged and wasted due to faulty post-harvest practices during harvesting, packaging, storage, grading etc. This wastage can be reduced to some extent through proper and scientific methods. Most of the mango cultivators tend to sell their product immediately after the harvest at low prices prevailing at that time. Some of mango cultivators in India sell mango before the harvesting. Due to substantial rise in supplies, Indian markets are glutted in the post-harvest season. Traders and middlemen often take advantage of this situation. About 60 to 80 percent of the mangoes are marketed in the first quarter of the harvest season. Besides the above, many people use a 'picking stick' to reach fruits at top positions of the tree. To get If you want green mangoes is better to just pick

Criteria for and Description of Grades

According to Agmark standards, mangoes are classified into the following categories, as per details given in the table below.

them once they have reached full size but have yet to change colour.

Post-harvest operations refer to activities undertaken to the process the fresh produce to meet the requirements of the target market. These operations can be done in the field or in collection centers or in a packing house. The packing area should provide adequate protection from sun and rain, always kept clean. Pet animals should be kept away from the packing area, and all workers should practice good personal hygiene. Curing, washing, grading, packaging, storage, transportation, processing and marketing etc are the important post-harvest operations.

Post-harvest management can be considered as a second production operation that adds value to the products and provide the basic means for effective marketing. Post-harvest management operations are quite diversified, consisting of plucking/collection, curing, pre-treatment, grading, packaging, pre-cooling, low temperature storage, pallet loading, transporting, and there depend upon crops variety. Improved post-harvest practices result in reduction in losses, improve overall quality, extend shelf life and higher profits for growers and marketers.

Normally, Mangoes do not need any post-harvest treatment for marketing in local markets, except for simple washing with water to remove the latex and dust. On a commercial scale or for export purpose, they are sometimes dipped in hot water, containing fungicide for the control of diseases. Hot water treatment (HWT) is an effective post-harvest treatment for mangoes. Dipping newly harvested fruits in hot water minimizes fruit fly damage, anthracnose, and stem-end rot infections.

Table. No.04: Details of grade designation and sizing of mango as per AGMARK standards

Grade designation	Grade requirements	Grade tolerances
1	2	3
Extra class	Mangoes must be of superior quality. They must be characteristic of the variety. They must be free of defects, except for very slight superficial defects, provided these do not affect the general appearances of the produce, the quality, the keeping quality and presentation in the package	5% by number or weight of mangoes not satisfying the requirements for the grade, but meeting those of Class I or exceptionally, coming within the tolerances of that grade
Class I	Mangoes must be of good quality. They must be characteristic of the variety. Mangoes may have following slight defects, provided these do not affect the general appearance of the produce, the quality, the keeping quality and presentation in the package. - slight defects in shape; - slight skin defects due to rubbing or sunburn, suberized stains due to resin exudation (elongated trails included) and healed bruises not exceeding 2,3,4,5 sq. cm. for size groups A, B, C, D respectively	10% by number or weight of mangoes not satisfying the requirements for the grade, but meeting those of Class II grade or, exceptionally coming within the tolerances of that grade.
Class II	This grade includes mangoes which do not qualify for inclusion in the higher grades but satisfy the minimum requirements. Mangoes may have following defects, provided they retain their essential characteristics as regards the quality, keeping quality and presentation. - defects in shape, slight skin defects due to rubbing or sunburn, suberized stains due to resin exudation (elongated trails included) and healed bruises not exceeding 4,5,6,7 sq. cm. for size groups A, B, C, D respectively	10% by number or weight of mangoes not satisfying the requirements of the grade but meeting the minimum requirements.

Source: Government of India, APEDA AGRI EXCHANGE

Grading: Grading of agricultural produce as per the accepted quality standards helps farmers, marketing functionaries, processors, traders and consumers in efficient marketing. After harvest, mangoes are arbitrarily classified as "Class A" (good quality; for export or for institutional buyers like supermarkets and hotels) or "Class B" (local grade or for the domestic market). Grading on the other hand, refers to the classification of mangoes based on the standard criteria accepted by the industry. Mangoes that are of good quality and safe for consumption are mature, clean, well-formed, free from insect and disease damage, or mechanical damage such as cuts, abrasion and punctures, free from microbial, chemical and physical contamination. Defects, if any, are only minimal as in the case of windscar and latex stain.

The fruits graded according to their size, weight, colour and maturity benefit both the producer and consumer. It has been observed that bigger-size

fruits take 2-4 days more time in ripening than smaller ones and hinder to achieve uniform ripening. Therefore, grading according to size plays an important role in the packaging of the fruits. During grading, the immature, overripe, damaged and diseased fruits should be discarded. In Karnataka, percentage of losses during grading of mango at different levels at different stages are producers (1-2%), preharvest contractors (1-2%), wholesalers (2-5%) and processors (1%), totally amounting to 5 to 10 percentage losses of mangoes during grading levels. Percentage of losses during storage are producers' level (1-2%), wholesaler level/C.A. level (1-2%), retailer level (3-5%), cold storage (1%). Percentage of losses during preparation for market are producers (1%), wholesalers/C.A. (2-5%) and retailers (5-10%).

In Karnataka grading parameters used for grading of Mangoes are:

- Producers Colour, Shining, Size, Firmness
- Wholesalers Colour, Shining, Size, Firmness
- Retailers Colour, Shining, Size, Firmness

Sorting: Mangoes tend to get damaged in the extreme cold temperature of the refrigerator. Hence, they are best stored at room temperature until completely ripe (and then refrigerated for a few more days if necessary – but they should not be put in a bag as they need airflow). They should last about a week in the fruit bowl. Mangoes can be frozen for use in smoothies and sorbets. Sorting is the grouping of mangoes based on the criterion chosen and there is no definite set of standards followed. This is the most common practice in selling mangoes.

Freezing: In addition to protecting quality, post-harvest cooling provides marketing flexibility by making it possible to market at the optimum time. Some of the cooling methods are room cooling, forced air-cooling and hydro cooling. Peel and slice the mangoes and lay the slices over a tray covered with baking paper, and freeze. Once frozen, pack into zip-lock bags, removing as much air as possible. Alternatively, purée mango and freeze in airtight containers. Mangoes can be kept frozen for up to 12 months.

Drying: Peel slightly under-ripe mangoes and cut into very thin slices with a vegetable peeler. Put them on a lightly oiled wire rack set on a tray in an oven heated to its lowest temperature, with the fan on and the door slightly ajar. Dry them for 30 minutes, then turn them over and dry for another 30 minutes, or until the slices are dry but tacky to touch. Leave to cool in the oven, then store in a jar in the refrigerator for up to 12 months – but check after a week to make sure there is no condensation. If there is, dry the mango in the oven a little longer. If preferred, dried mango can be stored in the freezer for up to 2 years. You can also dry mango slices in the sun – place the fruit on a rack on a table and cover with muslin (cheesecloth) so that bugs and dirt don't land on the fruit. Place the legs of the table in saucers of water to stop insects crawling up from the ground. The fruit should be left out in hot sunshine for 5–7 days but brought in at night. You can also dry green mango. This is traditionally ground (you can use a coffee grinder) to make am choor ('am' is mango and 'choor' is powder in Hindi), which is used like a spice in curries, adding a sour flavour.

Packaging: Proper packaging is essential in maintaining product quality during transport and subsequent handling. Packaging materials, should provide adequate protection to its contents, should facilitate convenience in handling the produce, attract consumers and sell the contents, and inform the consumers about the produce inside the pack.

Packaging materials: Rigid containers such as plastic crates are highly recommended for fresh mangoes since they provide adequate protection against compression damage. They have smooth inside finish and can be easily cleaned. They are also stackable and reusable/returnable. Although more expensive than traditional packaging containers, plastic crates with long-term use (5-6 years), the packaging cost per kg of produce is relatively cheaper. Semi-rigid containers such as bamboo baskets are also used but these should NOT be over-packed. Overpacking results in compression damage. Baskets should be lined with clean paper, jute sack or any suitable cushioning material to prevent abrasion and punctures on the fruit since these containers usually have a rough inside finish. Cartons or fiberboard boxes should be equipped with a vertical divider in the middle and with ventilation holes at the sides to prevent heat buildup inside the carton. The physical strength of fiberboards decreases as they absorb moisture with time. Recycled cartons should NOT be over packed and over stacked as this results in compression damage and the incidence of premature ripening. While awaiting transport, filled cartons should not be used as a "resting" area as this will lead to damage, particularly compression and bruising which may not be apparent at the green stage but will show up later in the handling chain, especially when fruits are already ripe.

Transport: The main objective of transportation is to ensure that mangos will arrive in good condition at the final market. Mangoes may have to be transported between several points in the supply chain:

- Field to collection center.
- Farmers to consumers
- Collection center to wholesale market.
- Wholesale market to retail market.

At all these stages, good transport practices summarized below, must be followed:

- Handle containers gently; they should not be dropped or thrown on to each other.
- Containers at the bottom of the stack, should not be used as steps to allow stacking to a

greater height, especially if semi-rigid containers like cartons are used.

- Allow air to circulate in the stacks or piles of packaged produce by providing space in between stacks. If canvass is used as cover, provide space for air to pass through at the bottom and top of stack, use light-colored material as cover as this will reflect heat.

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