

Chapter 2

Concept and Evolution

Theoretical framework is the structure that can hold, support and justify a theory of research study. The theoretical framework introduces and describes the theory that explains why the research problem under study exists. The Theoretical Framework plays an important role in guiding the entire process of the research study. The theoretical framework is one of the more infamous components of a dissertation. A good theoretical framework gives a strong scientific research base and provides support for the rest of dissertation.

2.1. History of mango in India:

- The mango has been known to Indians since very early times. Scientific fossil evidence indicates that the mango made its first appearance even earlier – 25 to 30 million years ago in Northeast India, Myanmar and Bangladesh, from where it travelled down to southern India.
- The earliest name given to the mango was Amra-Phal. It is also referred to in early Vedic literature as *the Upanishad* and the *Puranas*, On reaching South India, the name translated to Aam-Kaay in Tamil, people further changed this to *Maanga*. The Portuguese were fascinated by the fruit; on their arrival in Kerala they introduced it to the world as Mango.

- With the rise of Buddhism, mangoes came to represent faith and prosperity among the religion's followers as there were several legends about the Buddha and mango trees.
- Next came the Mughal Emperors, whose fondness for the mango is legendary. In the medieval period, Alauddin Khilji was the first patron of the mango and his feast in Sivama Fort was a real mango extravaganza with nothing but mangoes in different forms on the lavish menu. Akbar built the vast Lakh Bagh near Darbhanga (Bihar), growing over a hundred thousand mango trees. This was one of the earliest examples of grafting of mangoes, including the Totapuri, chausa, dashehari and the expensive Kesar.
- The Mughals relished their favourite addiction, with Jahangir and Shah Jahan awarding their *khansamahs* for their unique creations like *Aam Panna*, *Aamka Lauz* and *Aamka Meetha Pulao*, a delicate mango dessert sold all through the summer in Shahjahanabad. Nur Jahan used a mix of mangoes and roses to create her legendary wines.
- Over the ages, the mango became a household fruit and Rabindranath Tagore was extremely fond of mangoes and has written several poems about the fragrant flowers of mangoes, including the very famous *aamer monjori*.
- Today, the curvaceous shape of mangoes, which has long held the fascination of weavers and designers, has become an iconic Indian motif. The mango is seen as a symbol of good luck and prosperity and in many parts of India mango leaves are strung up over the front doors of homes as *Toran*.

2.2. Mango Production and Export scenario of India:

India ranks first among world's mango producing countries accounting for about 50% of the world's mango production. Other major mango producing countries include China, Thailand, Mexico, Pakistan, Philippines, Indonesia, Brazil, Nigeria and Egypt. India's share is around 52% of world production i.e. 12 million tonnes as

against world's production of 23 million tonnes .An increasing trend has been observed in world mango production averaging 22 million metric tonnes per year. Worldwide production is mostly concentrated in Asia, accounting for 75% followed by South and Northern America with about 10% share.

Mango is now recognized as one of the best fruits of all indigenous fruits due to its excellent flavour, attractive fragrance, and beautiful shades of colour, delicious taste and high nutritive value. Among the main constituents of this fruit, carbohydrate and acid contribute a great deal to the food value of the fruit. Of the three parts of the mango, pulp is the part most utilized for human consumption. It is cross pollinated and largely propagated by seeds. Awareness in respect of improved mango production is lacking.

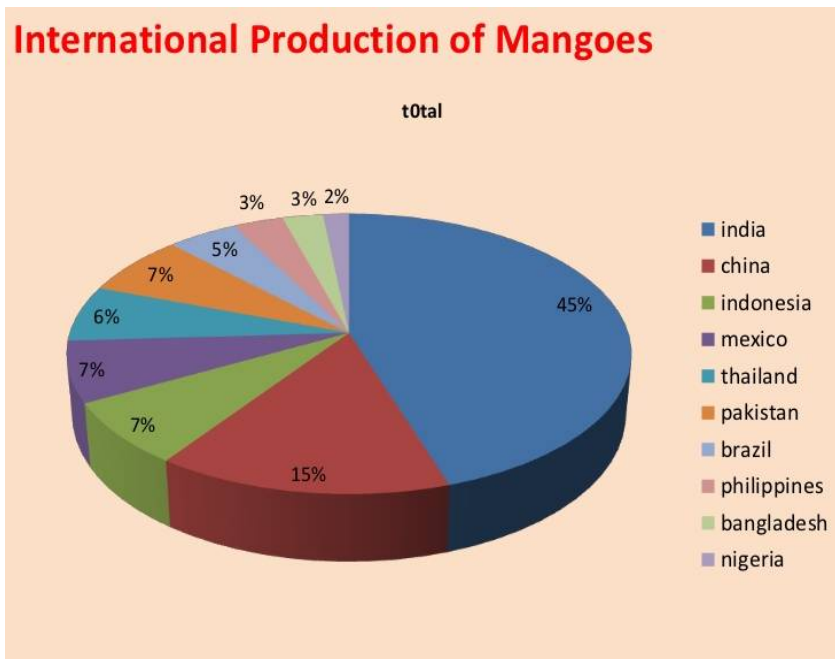


Figure no. 1: International production of mangoes(Source - National Horticulture Report 2011-2012)

During 2010 – 11 India had an area of 2.4 million ha under mango with a production of 16 million tones and productivity of 6.71

t/ha. The important mango producing states are Andhra Pradesh, Uttar Pradesh, Karnataka, Bihar, Gujarat, Maharashtra, Tamilnadu, West Bengal, Kerala and Orissa. Some of the popular varieties are Neelum, Bangalora, Alphonso, Rumani, Banganapalli, Kalepad, Peter, Sendhura, Jahangir, Mulgoa, Himayuddin, Mallika, Amrapali, Salem, Sindhu, Dashehari, Langra, Fajli and Totapuri.

It has rich luscious, aromatic flavour and a delicious taste in which sweetness and acidity is delightfully blended. Mango production has experienced continuous growth in the last decades of the twentieth century (**Baisya, 2004**).

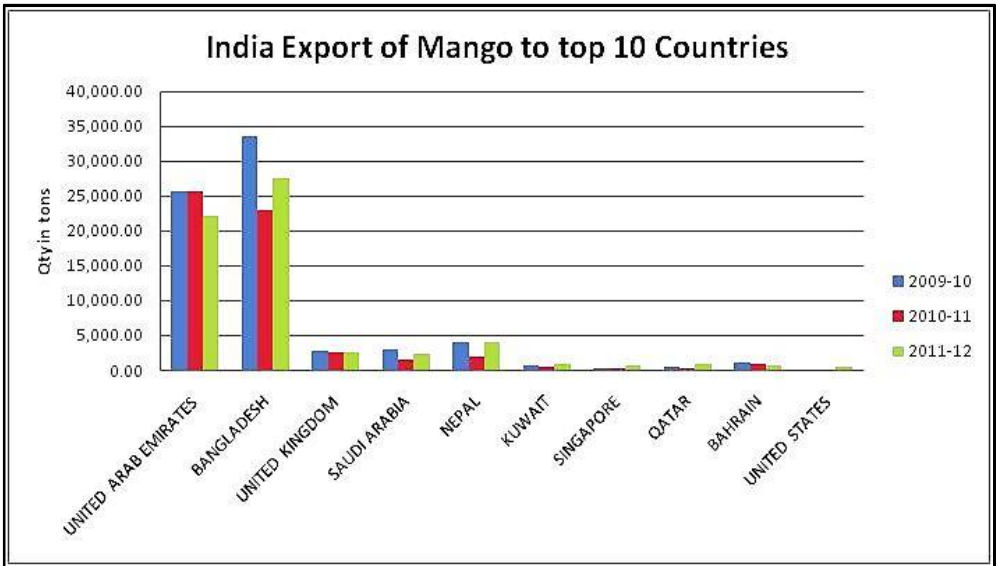


Figure No. 2:Export of Indian Mangoes to top ten countries(Source - National Horticulture Report 2011-2012)

India is the largest mango producer, accounting for about 50 per cent of the global mango production. Total mango production in India was more than 16 million tones. Most of the mangoes produced in India are consumed domestically and less than 5 per cent of the produced mangoes are processed and mango pulp is the main export product both in terms of volume and value. It accounts for about 20 per cent of the processed fruits and

vegetables exported from India. The export of fruits and vegetables from India amounted to 50 billion US\$ in 1990 and to 70 billion US\$ in 2000 and in 2009 it was more than 160 billion US\$.

2.3 Estimated Area and Production of Mango in West Bengal:

West Bengal is a major mango producing state of India. The major mango producing districts of West Bengal are Malda, Murshidabad, Nadia, Hooghly, Burdwan, North-24-parganas, Jalpaiguri, Midnapore (East) etc.

Table No. 1: Estimates of Area and Production of Mango in West Bengal and India (2009-2010)

State	2008-09		2009-10	
	Area	Production	Area	Production
	(In ' 000 Hectare)	(In ' 000 MT)	(In '000 Hectare)	(In ' 000 MT)
West Bengal	86	548.9	88.1	571
India	2309	12749.8	2350.4	13106.4

(Source - National Horticulture Board (ON54) & Lok Sabha Unstarred Question No. 6238, 04.05.2010)

Table No. 2: District wise Area and Production of Mango in West Bengal (2003-04 and 2005-06) (Area in Hectares; Production in Tonnes)

District	2003-04		2005-06	
	Area	Production	Area	Production
Darjeeling	62	220	0.072	0.28
Jalpaiguri	1550	4950	1.551	5
Coochbehar	840	1600	0.87	1.7
North Dinajpur	1350	6824	1.462	7.1
South Dinajpur	1320	6602	1.34	6.633
Malda	24850	86000	25.25	150
Murshidabad	13450	127775	13.825	120.79
Nadia	2900	25885	3.612	28.274
North24-Parganas	6026	62032	6.25	92.088
South24-Parganas	850	7650	0.965	8.1
Howrah	639	2625	0.605	2.485
Hooghly	5550	22400	5.561	30.4
Burdwan	3700	16000	3.75	15.187
Birbhum	810	7290	0.874	10.12

Bankura	653	3920	0.679	5.96
Purulia	569	3900	0.592	6.109
Midnapur(West)	659	2860	0.675	5.89
Midnapur(East)	1995	17425	2.16	17.223
West Bengal	6773	405958	70.09	513.339
Yield(kq/ha)		5990		7324

(Source - The Fertilizer Association of India)

GESTATION PERIOD OF A MANGO ORCHARD:

Once planted mango seeds usually sprout in a week or two. After planting, a mango tree takes 2-4 years to produce fruit.

Mango Varieties By State

States	Important Varieties
Andhra Pradesh	Banganpalli, Bangalora, Cherukurasam, Himayuddin, Suvarnarekha, Thothapuri, Kesar, Dhasseri, Himayat, Peddarasam, Chinnarasam, Manjeera, Neeleshan, Amarapali, Mallika, Ratana, Arkapuneet, Sindhu, K.M.H.-1
Bihar	Bombai, Langra, Fazri, Himsagar, KishenBhog, Sukul, Bathua
Goa	Fernandin, Mankurad, Alphonso
Gujarat	Alphonso, Kesar, Rajapuri, Vanraj
Haryana	Dashehari, Langra, Bombay Green
Karnataka	Alphonso, Bangalora, Mulgoa, Neelum, Pairi, Totapuri, Raspuri, Baneshan, Kesar, Mallika, Dasherri, Sindhura, Hybrid 10, Hybrid 13
Kerala	Mundappa, Olour, Pairi, Neelum, Nadassala, Suvarnarekha, Muthalamookkam
Madhya Pradesh	Alphonso, Bombai, Langra and mostly seedling types
Maharashtra	Alphonso, Kesar, Mankurad, Mulgoa, Pairi, Rajapuri, Neelum, Totapuri
Orissa	Baneshan, Langra, Neelum, Suvarnarekha and mostly seedling types
Punjab	Dashehari, Langra, Chausa
Tamil Nadu	Banganpalli, Bangalora, Neelum, Rumani, Mulgoa, Alphonso, Kalepad, Sendurga, Malguavo, Immampasant, Kallmai
Uttar Pradesh	Bombay Green, Dashehari, Fajri, Langra, Safeda Lucknow, Chausa, Ratual, S. Saurabh, Amarpalli, Malihabadi, Bombay yellow
West Bengal	Bombai, Himsagar, KishanBhog, Langra

Once the fruit appears, it takes 3-6 months to mature. Mature mango tree can live for more than 300 years. Mango trees take about 1 year to reach 3-4 ft tall. Mango tree grow to 35-40 m (115-131 ft) tall with a crown radius of 10m (33ft).

2.4. Cultivation of mango:

- **SOIL:** Mango performs very well in light soil. Rich, deep loam soil certainly contributes to maximum growth, but if the soil is too rich and moist and well fertilized, the tree will respond vegetative but will be deficient in flowering and fruiting.
- **CLIMATE:** Mangoes grow best in temperature 27-30⁰c. Mango grows well in the rainfall range of 750-2500 mm.
- **SEASON OF PLANTING:** Planting spreads from July to December.
- **PROPAGATION:** Mango trees grow readily from seed. Seeds of polyembryonic mangoes are most popular. Inarching and approach grafting are traditional in India. Tongue, saddle, and root, veneer grafting is also common Indian practices.
- **SPACING:** Mango is normally planted at 7 to 10 m either way.
- **IRRIGATION:** Regular watering is recommended till establishment. Under conventional irrigation systems, weekly irrigation is essential. With micro-irrigation the requirement is restricted to one-third of the water required for conventional method
- **INTERCROPPING:** Short duration crops like legumes, vegetables, groundnut, etc. can be raised during pre- bearing age.

MANURES AND FERTILIZRS (Kg/PLANT)	1 YEAR OLD	6 th YEAR ONWARDS
FYM	10	50
N	0.2	1
P	0.2	1
K	0.3	1

MANURES AND FERTILIZERS:

The available nutrient status of a mango orchard soil (alluvial soil) from India increased following the application of green manures. The green manuring crops were: dhaincha (*Sesbaniaaculeata*), pea (*Pisumsativum*), French bean (*Phaseolus vulgaris*), sunhemp (*Crotalaria juncea*), and cowpea (*Vignaunguiculata*). It is concluded that the practice of green manuring, by increasing soil nutrient status, will result in better leaf nutrient status and flowering in the mango plants.

FERTIGATION:

Fertigation is a method of fertiliser application in which fertiliser is incorporated within the irrigation water by the drip system. In this system fertiliser solution is distributed evenly in irrigation. The availability of nutrients is very high therefore the efficiency is more. In this method liquid as well as water soluble fertilisers are used. By this method, fertiliser use efficiency is increased from 80 to 90 per cent.

PEST OF MANGO:

PEST OF NATIONAL SIGNIFICANCE	PEST OF REGIONAL SIGNIFICANCE
Mango hopper	Scale
Fruit fly and Inflorescence midge	Termites
Mango mealy bug	Thrips
Stone Weevil	Shoot webber
Red ant	
Stem borer	
Leaf Webber	

MANAGEMENT: 1) Use resistant variety. 2)Collect and destroy the affected plant and debris. 3) Handpicking of larva. 4)Use of bio control agent- *Beauveriabassiana*, *Verticilliumlecanii*. 5) Dimethoate 1.5 ml/l of water, Imidacloprid17.8% SL @ 3ml / l, or Lambdacyhalothrin 5% EC.

DISEASE: Anthracnose, powdery mildew, bacterial canker, mango malformation etc.

- Anthracnose, caused by *Colletotrichum gloeosporioides* [Glomerellacingulata], is the most important fungal disease of mango, attacking flowers, fruits and leaves. The symptoms appear as black lesions when the fruit is mature. However, during sorting immature fruits do not show any visual symptoms, and the mango disease is difficult to recognize. Reflectance spectral signatures were obtained from healthy mangoes without any anthracnose present.
- Symptoms of mango malformation disease were observed for the first time in April 2006 in three mango orchards in the Axarquia Region in southern Spain. Symptoms included an abnormal development of vegetative shoots with shorted internodes and dwarfed leaves and hypertrophied short and thickened panicles.

MANAGEMENT:

- The major strategies in controlling post harvest anthracnose are scheduled
- preharvest sprays with thiophanate methyl or carbendazim (Topsin M OR Bavistin 0.1%) in the field to reduce the latent infection and treatment of the fruits with hot water along or hot water with fungicides after harvest to eradicate the left over latent infection.
- Hot water treatment along at $52 + (-)^{\circ}\text{C}$ for 3 minutes gives good control of Anthracnose. However, the duration of hot water treatment can be reduced to 15 minutes by supplementing it with fungicides, viz. carbendazim or thiophante methyl (Bavistin or Topsin M 0.05%)

PHYSIOLOGICAL DISORDER:

Black Tip

(Chimney disease)

Symptoms:

Symptoms become visible when the mango fruits attain some size. Small etiolated area develops near the distal end of the fruit which gradually spreads, turns nearly black and covers the tip of the fruit completely. The black area remains hard and the growth of the fruit is checked.

Management

- It can be minimized by the spray of borax (1%) or other alkaline solution like caustic soda and washing soda.
- The first spray should be done positively at pea stage followed by two more sprays at 15 days interval.
- Planting of mango orchard in north- south direction and 3 km away from the brick kilns reduce the incidence.

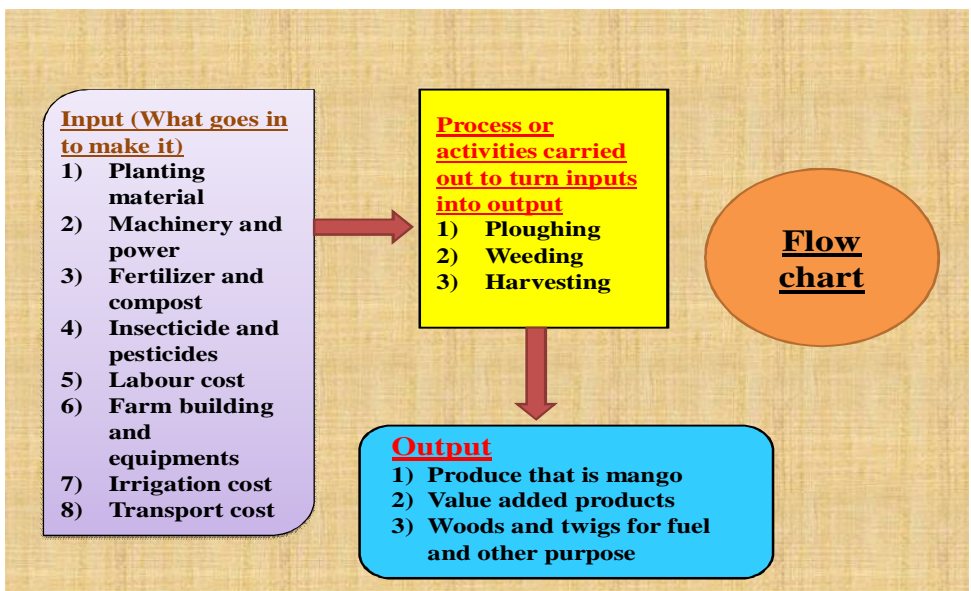


Figure no. 3: Flow chart of mango cultivation

HARVEST SEASON: Harvest spreads from March to June.

YIELD: Yield varies with varieties and spacing adopted. (a) 8 – 10 t/ha up to 15 years. (b) 15 – 20 t/ha from 15 to 20 years.

Post Harvest Treatment

- Dip the fruits in $52 \pm 1^\circ\text{C}$ hot water immediately after harvest for 5 minutes followed by 8% plant wax (Fruitox or Waxol) to reduce anthracnose disease in mango during storage. Two pre-harvest sprays of 0.20% mancozeb (2.0 g/lit) will also reduce the incidence.
- Mango fruits are to be sent to far distance places in India and also to the foreign countries. Therefore, keeping quality improvement is very important. Ozone gas (O₃) diffusion in the mango container before it is kept in the cold storage may help in the improvement of mango keeping quality. This technology has to developed and fine-tuned in India.

Uses of mango:

1. **Root and bark:** The root and bark are acrid; cooling; use as fuel in villages.
2. **Leaves:** The leaves are acrid; astringent to the bowels cure "vata", "pitta", and "kapha".
3. **Flowers:** The flowers are cooling and astringent to the bowels; improve taste and appetite; cause "vita"; cure leucorrhoea, bad blood; good in dysentery, bronchitis, biliousness, urinary discharges.
4. **Unripe fruit:** The unripe fruit is acrid, sour, and tasty; cures thought troubles, ulcers, dysentery, urinary discharges. The gum of the mango tree is used for cracked feet with good effect.
5. **Ripe Fruit:** The ripe fruit is sweet and oily; tonic; increases appetite; cooling; beautifies the complexion; heart troubles, urinary discharges, ulcers, blood impurities.

6. Seed: The seed is sweet, sour, acrid; cures vomiting, dysentery, burning in the region of the heart. The oil from the seeds is bitter; cures stomatitis.

2.5 High Density Planting (HDP):

- HDP is the most modern scientific technique to obtain very high fruit yield. This technique has been very well demonstrated by the scientist at the Jalgoan base Jain Irrigation Company at Udumalpet near Coimbatore. The company planted 4033 plants in 1.8 ha of land with a spacing of 3m x 2m in Elayamuthur near Udumalpet.
- This control of excessive vegetative growth in the tree for increased productivity is the major principle of high density orcharding.
- The cost incurred in HDP was Rs. 30,000/ ha against the traditional system cost of Rs. 15,000 – 20,000/ha. The yield obtained was 15 – 20 tones/ha.

ADVANTAGE:

- 1) Various operations like spraying, thinning, harvesting of fruits etc are easy in HDP.
- 2) Disease –pest infestation is less.
- 3) Better quality fruits suited to the market demand are produced..
- 4) Special attention, care and management are needed in HDP planting.

Health benefits of mango:

The health **benefits** of **mangoes** come from its rich content of nutrients, bioactive compounds and fiber. **Mangoes** are one of the richest sources of vitamins A, C and E, as well as minerals including potassium, magnesium, copper, calcium and phosphorus. They are also packed with pre-biotic dietary fiber and poly-phenolic flavonoid antioxidant compounds.

1. Fights cancer

Antioxidants like quercetin, isoquercitrin, astragaln, fisetin, gallic acid and methylgallat present in mango protect the body against colon, breast, leukemia and prostate cancers.

2. Keeps cholesterol in check

Mango has high level of vitamin C, pectin and fibres that help to lower serum cholesterol levels. Fresh mango is a rich source of potassium, which is an important component of cell and body fluids that helps to control heart rate and blood pressure.

3. Weight loss

Mango has a lot of vitamins and nutrients that help the body feel fuller. Also, the fibrous fruit boosts the digestive function of the body by burning additional calories, helping in weight loss.

4. Regulates diabetes

Not only the fruit but the leaves of mangoes are healthy too. For people suffering from diabetes, just boil 5-6 mango leaves in a vessel, soak it through night and drink the filtered decoction in the morning. This helps in regulating your insulin levels..

5. Eye care

Mango is rich in vitamin A. One cup of sliced mangoes equals 25% intake of your daily need of vitamin A. Mangoes help in promoting good eye sight, fights dry eyes and also prevent night blindness.

6. Helps in digestion

Mango contains enzymes that help in breaking down protein. The fibrous nature of mango helps in digestion and elimination. It is rich in pre-biotic dietary fibre, vitamins and minerals.

7. Heat stroke

When the sun is bogging you down this summer, just chop of a mango in a juicer; add a little water and a tbsp of sugar free or honey. This juice will instantly cool you down and prevent heat stroke.

8. Strengthens immune

The deadly combination of vitamin C, vitamin A and 25 different kinds of carotenoids keep your immune system healthy.

9. High iron for women

Mango is rich in iron; hence it is a great natural solution for people suffering from anemia. Menopausal and pregnant women can indulge in mangoes as this will increase their iron levels and calcium at the same time.

10. Reduces Kidney Stones

In Chinese medicine, mangoes are considered sweet and sour with a cooling energy also capable of reducing the risk of kidney stone formation.

2.6 Impact of climate change on fruit crops:

The Earth's climate, although relatively stable for the past 10,000 years or so, has always been changing, mainly due to natural causes. But since the 1990s more rapid changes have taken place and these are thought to be mainly man made.

“A change of climate which is attributed directly or indirectly to human activity that alters the composition of global atmosphere and which is in addition to natural climatic variability observed over comparable time periods”

United Nations Framework Convention on Climate Change (UNFCCC)

In the context of climate change, the fruit tree sector has specific vulnerabilities, such as perennial plantations and a complex flowering process to achieve fruit production. More particularly, warming impacts on floral bud phenology and their subsequent effects have been investigated for fruit tree species in different European regions.

Climatic variables affecting fruit production:

Temperature- At high temperature granules appear in the cytoplasm, viscosity increases and the cell membranes loses its permeability and coagulation of the entire cell contents takes place. Flower bud initiation is inhibited in many plants by high and in the others by low growing season temperature.

Soil temperature- Influences growth, water uptake, nutrient absorption, root development etc.

Soil moisture- Determines the flowering time and germination of plants.

Rainfall- Pre monsoon showers destroy crops like grape, dates etc.

Relative humidity- Extremely low or high humidity may affect yield through poor fruit set and excessive drop, poor pollen germination.

Effect on fruit quality:

According to the IPCC (Intergovernmental Panel on Climate Change) "The importance of climate change impacts on grain and forage quality emerges from new research. For rice, the amylase content of the grain—a major determinant of cooking quality—is increased under elevated CO₂." Cooked rice grain from plants grown in high-CO₂ environments would be firmer than that from today's plants. However, concentrations of iron and zinc, which are important for human nutrition, would be lower. Moreover, the protein content of the grain decreases under combined increases of temperature and CO₂. Many studies have shown that increases in CO₂ lead to decreased concentrations of micronutrients in crop plants. This may have knock-on effects on other parts of ecosystems as herbivores will need to eat more food to gain the same amount of protein.

Nutritional quality of fruits and vegetables depends on genetic and environmental factors. Soil factors, temperature, light and CO₂ are the major factors which determine the quality of horticulture produce. Most of the health-benefiting nutrients including vitamins, minerals and antioxidants are supplied through fruits and

vegetables. However, the changed climate has affected the quality of many fruits and vegetables. Elevated CO₂ has improved the vitamin C, sugars, acids and carotenoids in oranges, tomatoes and strawberries. Positive effect of CO₂ was also observed on total antioxidant capacity, phenols and anthocyanins in fruits and oil palm. However, elevated CO₂ may decrease the protein and mineral content of the produce. High-temperature stress is known to decrease vitamin C, starch, sugars and many antioxidants especially anthocyanins and volatile flavour compounds in fruits. Deficit irrigation increases sugars, anthocyanins and even volatiles in strawberries and tomatoes. However, severe stress decreases the quality of fruits and vegetables. A higher temperature coupled with water stress is going to definitely reduce the fruit and vegetable quality in terms of vitamins, antioxidants and minerals. Studies have shown that higher CO₂ levels lead to reduced plant uptake of nitrogen (and a smaller number showing the same for trace elements such as zinc) resulting in crops with lower nutritional value. Because of the lack of water available to crops in warmer countries they struggle to survive as they suffer from dehydration, taking into account the increasing demand for water outside of agriculture as well as other agricultural demands.

Baig,-M-A; Shahid-Amjad(2014) in a study examines the impact of climate and agriculture factors such as temperature, rain fall and water availability on agriculture (fruit crops) production with the support of Vector Auto Regressive (VAR) econometric approach based upon time series data over the period of 44 years from 1966-2009. This study also captures the trend of climate change impact on fruit crops production for the phase 2010-2020. Initially, it has been observed that average temperature and rainfall have no unit root while water availability and fruit crops output have a unit root at 1% level of significance through Augmented Duckey Fuller (ADF) test. The econometric results reveal that change in global climate has an adverse impact on Pakistan agriculture (fruit crops) production. Greenhouse gases (GHGs) emissions will rise global warming resulting the occurrence and intensity of extreme events

such as flood, drought, cyclone that would further harm the agriculture production and affect the water balance in future.

2.7 Marketing

Marketing is a major function after production. **Acharya and Agrawal (1999)** stated Production is the door to economic development but it is marketing that opens the lock. Thus, marketing plays an important role in agricultural production. Moreover marketing is the creation of time, place and possession utilities through which human wants are satisfied by the exchange of goods and services.

Agricultural marketing is a process, which includes farmer's decision to produce a saleable farm commodity and various aspects of marketing structures both functional and economic consideration including products assembling, preparation of market distribution and use by final consumer. According to **Pokhrel and Thapa(2005)** thus, marketing starts with the decision to plant unlike to the conventional way of thinking.

Market research or survey is any organized effort to gather information about target markets or customers. It is a very important component of business strategy. So, this variable is very important character for the study.

Mango can also be dried, frozen, or processed to add value. Green unripe or semi-ripe mangoes have been processed into chutneys, pickles, and curries. Ripe mangoes are often processed into products such as candies, canned slices, fruit bars, juice and other beverages, salsas, sorbets, and more.

2.8 Supply chain management:

Supply chain management is defined as the design and operation of physical, management information and financial systems needed to transfer goods and services from point of production to point of consumption in an efficient and effective manner. The entire chain management process is a value chain where bottlenecks, value adding factors and liability factors are identified and addressed, thus

enabling the retail organization to have an efficient supply chain. The supply is the part of retail operations that ensures that the right product is in the right place, at the right time and at the right cost. **Kaplinsky(2000)** describes Value Chain as full range of activities which are required to bring a product or service passing through the intermediate phases of production to delivery to the consumers and final disposal after use". According to **Gereffi (1994)** the actors of a value chain as well as the input-output, and the territorial structure along with technical structure also define a value chain.

Marketing channel:

The different channels of transfer of mangoes from the farmer to the consumer are mentioned here. The channels are the medium through which the produce of farmers reached to the customers or buyers. **Gummangolmath (1994)** studied the economics of production and marketing of mango in Dharwad district, Karnataka and identified this.

Channel-1: Producer →Commission agent→Retailer→Consumer

Channel-2: Producer→Pre-harvest Contractor
(wholesale)→Retailer→ Consumer

Channel-3: Producer →Processing Units Agents→
Retailer→Consumer.

Channel-4: Producer→Pre-Harvest Contractor→Commission
agent→ Retailer→ Consumer.

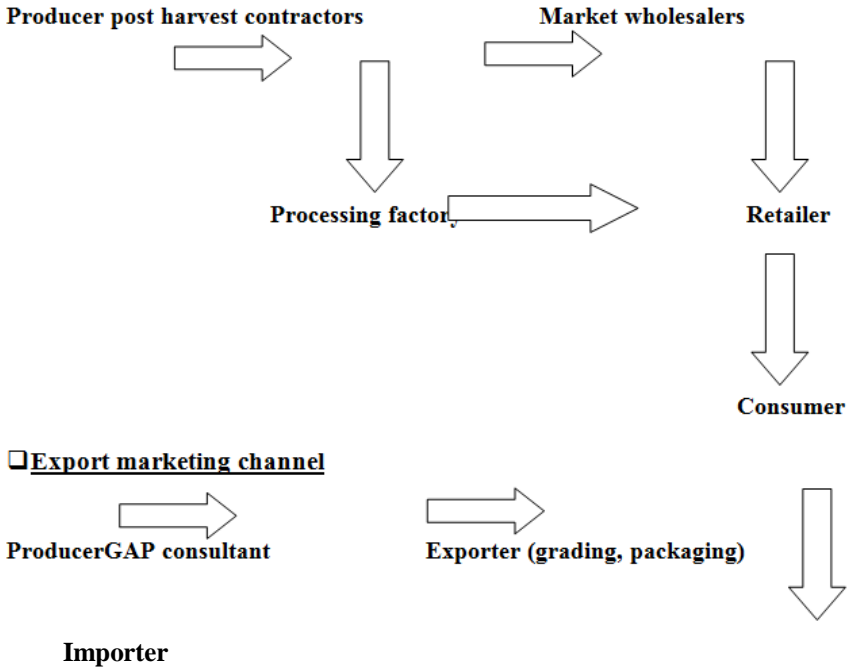
The marketing cost, margin, price spread and marketing officers of cashew in Tamil Nadu, observed following five different marketing channels of cashew studied by**Sundaravaradarajan and Jahanmohan (2002)**

1] Farmer →Village trader→Wholesaler→Processor→Trader

2] Farmer →cooperative marketing society.

3] Farmer →Commission agent→Wholesaler→Processor.

4] Farmer→Processor.



Process of the Mango Marketing:

A) Maturity

Maturity is the stage at which fruit has completed its growth and development. Growers have the fairidea about maturity indices of the fruit. But it often happens that the growers' mangoes before they attain optimum maturity for gettingbenefit of higher prices in the beginning of season. Harvesting of fruits before optimum maturityleads to development of white patches. It also results in reduced shelf life and quality i.e. lowering in total soluble solid, acid ratio, poor taste and flavour. Mango should be harvested at proper stage ofmaturity to enhance quality, storage life and marketing value and reduce postharvest loss.

B) Sorting and Grading

Sorting is done manually by visual inspection. Immature, undersized, bruised, scarred, ripen, insect, pest infested and mechanically injured fruits are removed.

C) Field Heat and Pre Cooling

Mangoes are generally harvested in the cooler part of the day. Sorted lot is arranged in heap in the field until loaded in the vehicle to send to market. Although mangoes are harvested during cooler part of the day, during April to June, the period in which mango harvesting and marketing are at peak, temperature in growing areas of Malda are usually around 35 to 40°C. Mangoes are neither washed to remove latex nor are it precooled to reduce the build-up of field heat.

D) Ripening

Mangoes that are to be marketed in local area are ripening by traders at assembly market or by growers in village and fruits that are to be marketed in distant market are ripening after reaching the destination.

E) Storage

Growers do not store the produce for long; hardly have they held it for a day or two when it is unripe. This may be because of lack of proper storage facilities available in rowing area. Farmer cannot negotiate the best rate for his produce since he is not willing to carry the risk of holding the inventory of perishable items due to lack of proper infrastructure.

F) Packaging for Transportation to Market

Growers bring unripe produce to the nearby assembling market in bulk. No packaging is used for transporting mangoes from farm to assembling markets. Dry grass, paddy or wheat straw and mango leaves are used to cushioned the produce from mechanical hazards.

G) Transportation

A three wheel motorized carrier. Alternatively, tractor or light commercial vehicle is used.

H) Marketing

Following marketing chain has been identified for mango in the present study.

1. Producer to preharvest contractors' traders in assembling market and or to commission agents.
2. Producer to village trader to traders in assembly market and or to commission agents;
3. Producer and or traders in assembling market to commission agents;
4. Trader in assembling market to processing unit;
5. Producer and or traders in assembling market to wholesaler or sub wholesaler;
6. Producer to retailer and consumers.

2.9 Problems of Mango cultivation And Marketing:

The farmers of the selected area faced several production and marketing related problems. The other actors present in the value chain also suffer from some kind of marketing related problems. The problems can be related to socio economic condition of the area. Financial problems are among this kind of problem. There is lack of information among the actors of the value chain. Mango growers and local market traders are unaware of the actual demand of the outside markets. Likewise, lack of post- harvest handling knowledge, unawareness about proper gradation is informational problem. Infrastructural problems are another part of this chain. Bad condition of roads, less storage facilities, electricity problem in rural areas are the infrastructural problem of the selected villages.

The main problems of the actors present in the studied area is classified in three types of problems i.e. informational problem, Infrastructural problem and financial problem.

Table No. 3: Various Problems of Mango Producers and Traders

Actors	Problems		
	Informational	Infrastructural	Financial
1. Producer	<p>1. Unaware of the actual demand of the market.</p> <p>2.Lack of knowledge regarding present value of the output</p>	<p>1.Lack of proper storage facilities</p> <p>2.Bad condition of roads in rural areas</p> <p>3.Lack of irrigation facility</p>	<p>1.High price of input</p> <p>2.Lower price received by producer</p> <p>3.Less credit supply</p>
2. Wholesaler	<p>1.Lack of information about proper post harvest handling</p> <p>2.Lack of information about market prices, market demands, marketing risks and risk management</p>	<p>1.Lack of proper storage facilities</p> <p>2.Bad condition of roads</p> <p>3.Electricity Problem</p> <p>4.Transportation loss</p> <p>5.Lack of mango processing units</p>	<p>1.High transportation cost</p> <p>2.Frequent strikes of various pressure groups and various taxes</p> <p>3.No regulated market for mango</p>
3. Retailer	<p>1.Lack of knowledge about market competitiveness</p> <p>2. Unawareness about proper grading system.</p> <p>3.Less idea of market demand</p>	<p>1.Lack of proper storage facilities</p> <p>2.Bad condition of roads</p> <p>3.Electricity Problem</p> <p>4.Transportation loss</p>	<p>1.Lack of Banking Awareness</p> <p>2. Lack of knowledge about price fluctuation and risk related to speculation.</p> <p>3.No regulated market for mango</p>

4. Consumer	1. No information about properly graded products. 2. Very low price information	1. Bad condition of market in rural and semi urban areas. 2. Less availability of processed product of mango	1. High price of mango and processed products 2. Various Taxes on processed products
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Production Problems of Mango:

Different production problems were listed according to the farmers perception on the given problems and ranked according to the response of the farmers. According to the study insect problem got the highest rank followed by Lack of good quality saplings, hail storm and nor'easter, high price of input, lack of credit, disease problems and lack of irrigation facility. In the study area, hailstorm is a very serious problem of mango production. Hail storm at early flowering and early bearing stage cause severe damage of fruit.

As per research findings by **Shallu Gupta and Shakuntla Gupta, 2013**, the Indian horticulture sector is facing severe constraints such as low productivity, limited irrigation facilities and inadequate and improper infrastructure facilities like cold storages, markets, roads, transportation, processing etc.

The major constraints faced by mango growers at the production level were lack of awareness on drip irrigation technology, heavy rain and wind during flowering and fruit development stage, non-availability of credit, high cost of inputs, lack of knowledge on proper plant protection chemicals and high incidence of pests and diseases and non availability of quality grafts. **Govinda Reddy et al. (1997)** identified the problems of mango growers in Srinivasapur region of Karnataka.

- **Farmer’s perception on the different problems of production:**
 - Insect
 - Lack of good quality saplings.

- Hail stone and Nor'easter
- High price of input
- Lack of credit
- Disease
- Lack of irrigation facility.

- **Marketing Problems:**

Marketing plays important role for the easy disposal of the product from producer ultimately to the consumer. Due to perish ability of agricultural products easy and safe disposal of the commodity after harvesting was of most importance. According to the farmers' perception on the specified marketing problems, problem ranking was done. Lack of proper storage facilities, lack of market information, lack of knowledge regarding post harvest handling, lack of knowledge regarding market segmentation, low price offered by traders and high transportation cost were the main marketing problems of mangoes of Malda district .

- **Role of extension in problem management:**

Today's agricultural marketing system is going through a rough period as there is no proper management in the market system. The shortcomings of public sector extension arrangements in India are well documented (**Farrington et al, 1998**) and some reform measures have been implemented. But unfortunately, planning and evaluation of such programmes is based on a very narrow view of the proper role of extension, equating it to an agency for technology dissemination. All the stakeholders are important part of the system; there should be strategies for all. Traders are not getting information like actual market demand, market opportunities, price opportunities, risk management etc. There are not enough storage facilities, transportation is a big problem in rural India, and handling of goods during transportation is also poor. So, there must be an all round approach including all the stakeholders of the value chain.

2.10 Mango entrepreneurship:

Development of economy of any nation depends primarily on the important role played by entrepreneurs. Farmers who are progressive cannot be identified as agricultural entrepreneurs, but those of them who are entrepreneurs, are essentially progressive farmers.

Entrepreneurship is the character, practice and skill of an entrepreneur. An entrepreneur is a person who organizes, manages and assumes the risk of a business. **Schumpeter (1947)** viewed entrepreneur as a manager who was making creative of innovative response. **McClelland (1961)** pointed out that the man who organized the business unit and/or increases its productive capacity is an entrepreneur. **Heredero (1979)** described agricultural entrepreneur as a person who introduced changes which directly or indirectly lead to higher agricultural output. According to **Ramkrishnan (1979)** the characteristics of entrepreneur are (a) Level of motivation (b) Managerial competence (c) Self-confidence (d) Leadership qualities (e) Risk taking ability and (g) Independence in thought and action. Thus, entrepreneurial behaviour is influenced by personal, socio economic, situational psychological and extension communicational factors. On the basis of this understanding the factors which influenced entrepreneurial behaviour of mango growers were grouped as personal, socio economic & situational, extension communication and psychological variables.

The term “**Entrepreneur**” can be defined as creative and innovative response to the environment. The entrepreneur is an economic man, who strives to maximize his profits by adopting innovations. They are men with a will to act, to assume risk and to bring about a change through organization of human efforts. Entrepreneurs play pivotal role in catalyzing economic growth as they are by nature job creators. The definition of entrepreneurship has never been differentiate on the basis of enterprises and hence could be extended to agricultural entrepreneurs without any

restriction. Mango contributed about 40 percent of total fruits production in country (**Verma and Munshi, 2003**). Thus, India is the largest producer of mango in the world.

Very few researches have been conducted in India on agricultural entrepreneurs and particularly on entrepreneurial behaviour of mango growers in a systematic way. Hence, there is an urgent need to study the “**Entrepreneurial behaviour of mango growers**” as a factor influencing their adoption of farm technology. Among all fruit crops mango is one of the choicest and ancient fruits known to mankind. Being a useful and delicious fruit it is called as the king of fruits. Therefore, more attention has been given for the development of its research and related enterprise. Though, Mango is sensitive to many pest and diseases. Sometimes it has to face the problems of no availability of electricity. Due to this farmers cannot give irrigation timely. Many times due to the cyclone and early rain the crop is damaged heavily. When there is a bumper production, due to the less storage facilities farmers have to sale it at a lower price. Thus, the farmer who earn from the crop one year, may be in loss during the next year. The highest price of mango found in agriculture, when corresponding arrivals was comparatively low. This period is better for mango growers if they can manage early harvesting. The **entrepreneurial behaviour** has some specialized characteristics like innovativeness, progressiveness, decision making, risk taking ability, self confidence, achievement motivation, ability to co-ordinate various available resources etc. Therefore, the higher entrepreneurial behaviour of farmers directly or indirectly leads to higher adoption of any innovation for the profitable and successful running of farming enterprise.

2.11. Geographical Indications:

Geographical indication is an indication or appellation of origin used to identify agricultural, natural, or manufactured goods originating from a definite territory. Those registered for geographical indication should have special qualities whose manifestation is dependent on the climate or production characteristics unique to the geographical

indication. The GI has also been identified as a guarantee of food safety.

A geographical indication (GI) is a sign used on products that have a specific geographical origin and possess qualities or a reputation that are due to that origin. In order to function as a GI, a sign must identify a product as originating in a given place. In addition, the qualities, characteristics or reputation of the product should be essentially due to the place of origin. Since the qualities depend on the geographical place of production, there is a clear link between the product and its original place of production.

What rights does a geographical indication provide?

A geographical indication right enables those who have the right to use the indication to prevent its use by a third party whose product does not conform to the applicable standards. For example, in the jurisdictions in which the Darjeeling geographical indication is protected, producers of Darjeeling tea can exclude use of the term “Darjeeling” for tea not grown in their tea gardens or not produced according to the standards set out in the code of practice for the geographical indication. However, a protected geographical indication does not enable the holder to prevent someone from making a product using the same techniques as those set out in the standards for that indication. Protection for a geographical indication is usually obtained by acquiring a right over the sign that constitutes the indication.

For what type of products can geographical indications be used?

Geographical indications are typically used for agricultural products, foodstuffs, wine and spirit drinks, handicrafts, and industrial products.

Who can use a protected geographical indication?

The right to use a protected geographical indication belongs to producers in the geographical area defined, who comply with the specific conditions of production for the product.

What is the difference between a geographical indication and a trademark?

Geographical indications (GIs) identify a good as originating from a particular place. By contrast, a trademark identifies a good or service as originating from a particular *company*.

• **BENEFITS:**

- 1) Prevents unauthorized use of a registered GI by others.
- 2) It offers legal protection to Indian Geographical Indications which in turn boost exports.
- 3) It advances economic prosperity of producers of goods produced in geographical territory.

• **GI assigned varieties of mango:**

- Himsagar
- Lakshmanbhog
- Fazli

• **Mango varieties at a glance:**

Parameters	Lakshmanbhog	Himsagar	Fazli
1)Fruit weight(gm)	300-350	300-350	500-750
2)Pulp content (%)	77-78	65-68	77-78
3)Total soluble solid(brix ratio)	Min 14	16-18	12-14
4)Total sugar (%)	10	11-12	9-10
5) Acidity(%)	0.23-0.44	0.13-0.15	0.40-0.50
6) Colour and appearance	Golden yellow with reddish tinge	Yellowish green	Greenish yellow
7) Taste and flavor	Characteristics aroma, sweet	Very sweet, delightful flavor	Sweet, pleasant aroma
8)Fibre content	Fibreless	Fibreless	Low fibre

- **Details about the GI assigned mango varieties:**
 - **Lakshmanbhog**
(The premiere Malda mango for World market)
 - **Geographical Indication no. 111**
 - Appearance quality and shelf life is well comparable with Alphanso.
 - Technical documents are discussed below-
 - **Fruit:** Medium to big, 225-390 gm, oblong oval, stalk inserted obliquely flattened, cavity shallow, shoulders un equal, ventral rising and then rounded, dorsal ending in a long curve, sinus almost absent, beak very prominent, apex broadly pointed. Skin very thick, yellowish green, dots very few, medium and not prominent. Flash attractive orange yellow, firm but melting, texture fine, fiber almost absent, pleasant flavor, taste very sweet.
 - **Stone:** Small to medium, oblong oval, short fiber, medium coarse, veins slightly forked and raised.
 - **Fruit quality:** Excellent, total solublesolids 17.3-19.5%, pulp percent 80-88, sugar/ acidity ratio- 98, keeping quality good.
 - **-Harvest time:** June, mid season variety
 - **Total area under the variety:**3030 ha
 - **Production centre:** Malda
 - **Annual production:** 29612 Metric tons.

- **Himsagar**

(The sweet mango from West Bengal)

- **Geographical Indication no. 112**

- Meets all the standards to have in foreign shelves.
- **Tree:** Tall, erect, much branched, moderately vigorous spreading, medium productive, top rounded, trunk medium, shoots medium to thick, heavy yielded though biennial in bearing.
- **Fruit:** Medium to big, 250-340 gm, oval in shape with yellowish green colour and somewhat rough skin. The taste is very sweet.
- **Stone:** small to medium, oblong oval, short fibre, medium coarse, veins slightly forked and raised.
- **Fruit quality:** Excellent, total soluble solids 17.8-19.7%, total sugar 9.7-17%, non-reducing sugar 7.27-12.35%, pulp percent 80-88, sugar/ acidity ratio 98
- **Harvest time:** June, mid season variety
- **Total area under the variety:** 1767 ha
- **Production centre:** Malda
- **Annual production:** 17506 Metric tons.

- **Fazli**

(The pride among mangoes)

- **Geographical Indication no. 113**
- Appearance quality and shelf life is well comparable with Totapuri
- Technical documents are discussed below-

- **Tree:** Tall, erect much branched, moderately vigorous spreading, medium productive, top rounded, trunk medium, shoots medium to thick, less bearing.
- **Panicle:** Medium, pyramidal, coral pink, moderately pubescent.
- **Fruit:** Big, 700-1500 gm, oblong, stalk obliquely inserted, base obliquely rounded, cavity slight to absent, shoulders unequal ventral rising and then rounded, dorsal ending in a long curve, sinus slight, apex broadly pointed, beak slightly prominent, skin rough, medium thick,, green with light yellow flush, dots small to medium, many, prominent, close, pulp attractive yellow, firm, juicy, fibre little towards the skin, flavour pleasant, taste good and sweet.
- **Stone:** Large, oblong covered with short sparse and soft fibre all over, veins parallel and slightly rose.
- **Fruit quality:** Medium, keeping and peeling qualities well.
- **Harvest time:** July-August, late variety.
- **Total area under the variety:**9595 ha
- **Production centre:** Malda
- **Annual production:**1,05,876 Metric tones