

# **STUDENT PROJECT PROPOSAL**

**FOR CONSIDERATION UNDER**

**(Quality and Excellence Enhancing Activities)**

**RUSA SCHEME**

**PROJECT TITLE**

**MANGO**

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**SRI Y N COLLEGE (AUTONOMOUS)**

**Thrice Accredited by NAAC at 'A' Grade**

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# Detailed Project Proposal

## Project Description:

Summers are here and so are the infinite perks of this season! Summers not only bring in much more liveliness and zest into our lives but also open up a wide variety of opportunities for us. For some it gives them the freedom to wear their favorite clothes, while for others it's that time of the year when they can cheerfully enjoy their pool parties. But for me it defines the time when I can welcome the king of fruits – mango!

Words fall short when I try to describe my ineffable love for this fruit. Mango is probably the most variegated fruit of India. There are almost 500-1000 cultivars of different mangoes in the country. This huge variety not only differs in its shape, size and colour but also in its scrumptious taste. Though it is not possible to describe all the varieties, today I will talk about the most famous types of Mangoes in India.

## Justification:

Famous mango varieties in India

### 1. Alphonso

Also known as Hapoo, this is the most expensive variety of mangoes in India. Maharashtra, Gujarat and Karnataka are its prime producers. It has a fibreless pulp and douses into the mouth as a smooth-creamy mango. This variety of mango is popular all over the world.

Season: May-June

### 2. Chaunsa

The name was given by the Muslim Suri Emperor Sher Shah Suri. It is sweet, juicy and very nutritious. The heavenly sweet taste of this mango will make you lick up every drop of its nectar. It is mostly grown in the northern parts of India.

Season: July end-August

### 3. Dasehri

It is the oldest variety of Mangoes in India, since its origin can be traced back to almost 200 years ago. The sweet syrup of this mango makes you have at least 2-3 mangoes at a time. Uttar Pradesh is the largest producer of this variety of mangoes.

Season: June-July

### 4. Langra

The mother tree of this variety exists in Varanasi. Since the owner of that tree was unfortunately lame, the mango was thus named as “Langra”. This variety is distinctively fibrous, with a unique taste as well. It is majorly grown in Haryana, Bihar, Uttar Pradesh and West Bengal.

Season: Mid-July to August

### 5. Safeda or Banganapalli

These mangoes have a very beautiful yellow color and are sweet and fibreless. It is the most popular variety of mangoes which comes straight from Andhra Pradesh.

Season: April to June

### 6. Kesar

This variety of mangoes is precisely consumed raw or used for making Aamrus. It comes from the Ahmedabad region of Gujarat and thus is also known as the Gujarat Kesari. It has a very intense aroma that spreads out in the entire house.

Season: June-Early July

### 7. Neelam

This is one variety that grows throughout the country. With its specialty in Hyderabad, it is a large-yielding variety of mangoes. Though it arrives early in the season, the best variety is available only in June.

# MANGO (*Mangifera indica*)

## Indian Varieties

There are nearly 1000 mango varieties in India. However, only about 20 varieties are grown commercially. Most of the Indian mango varieties have specific ecogeographical requirements for optimum growth and fruiting. Dashehari, Langra, Chausa, Bombay Green and Fazri in north India; Banganapalli, Totapuri, Neelum, Pairi, Suvarnarekha, Mulgoa, Kalapadi and Rumani in south India; Alphonso, Kesar, Mankurad, Fernandin' and 'Vanraj' in western India and 'Langra', 'Fazri; 'Chausa', 'Zardalu', 'Himsagar' and 'Malda' in eastern India are grown commercially. Brief characteristics of these varieties are given below :

## Commercial Varieties

Characteristics of important commercial mango varieties are as under :

1. **Alphonso** : This is the leading commercial variety of Maharashtra state and one of the choicest varieties of the country. This variety is known by different names in different regions, viz. Badami, Gundu, Khader, Appas, Happus and Kagdi Happus. The fruit of this variety is medium in size, ovate oblique in shape and orange yellow in colour. The fruit quality is excellent and keeping quality is good. It has been found good for canning purpose. It is mainly exported as fresh fruit to other countries. It is a mid season variety.
2. **Bangalora** : It is a commercial variety of south India. The common synonyms of this variety are Totapuri, Kallamai, Thevadiyamuthi, Collector, Sundersha, Burmodilla, Killi Mukku and Gilli Mukku. The fruit size is medium to large, its shape is oblong with necked base and colour is golden yellow. Fruit quality is poor but keeping quality is very good. It is widely used for processing. It is a mid season variety.
3. **Banganapalli** : It is a commercial variety of Andhra Pradesh and Tamil Nadu. It is also known as Chapta, Safeda, Baneshan and Chapai. Fruit is large in size and obliquely oval in shape. The colour of the fruit is golden yellow. Fruit quality and keeping quality are good. It is a mid season variety and is good for canning.
4. **Bombai** : It is a commercial variety from Bihar state. It is also known as Malda in West Bengal and Bihar. Fruit size is medium, shape ovate oblique and colour is yellow. Fruit quality and keeping quality are medium. It is an early season variety.
4. **Bombay Green** : It is commonly grown in north India due to its early fruiting quality. It is also called Malda in northern India. Fruit size is medium, shape ovate oblong and fruit colour is spinach green. Fruit quality is good and keeping quality is medium. It is a very

early season variety.

5. **Dashehari** : This variety derives its name from the village Dashehari near Lucknow. It is a leading commercial variety of north India and one of the best varieties of our country. The fruit size is small to medium, shape is oblong oblique and fruit colour is yellow. Fruit quality is excellent and keeping quality is good. It is a mid season variety and is mainly used for table purpose.
6. **Fajri** : This variety is commonly grown in the states of Uttar Pradesh, Bihar and West Bengal. Fruit is very large, obliquely oval in shape. Fruit colour is light chrome. Fruit quality and keeping quality are medium. This is a late season variety.
7. **Fernandin** : This is one of the oldest varieties of Bombay. Some people think that this variety originated in Goa. Fruit size is medium to large, fruit shape is oval to obliquely oval and fruit colour is yellow with a blush of red on shoulders. Fruit quality and keeping quality are medium. It is a late season variety mostly used for table purpose.
8. **Himsagar** : This variety is indigenous to Bengal. This is one of the choicest varieties of Bengal and has gained extensive popularity. Fruit is of medium size, ovate to ovate oblique in shape. Fruit colour is yellow. Fruit quality and keeping quality are good. It is an early season variety.
  
9. **Kesar** : This is a leading variety of Gujarat with a red blush on the shoulders. Fruit size is medium, shape oblong and keeping quality is good. It is an early season variety.
10. **Kishen Bhog** : This variety is indigenous to Murshidabad in West Bengal. Fruit size is medium, fruit shape oval oblique and fruit colour is yellow. Fruit quality and keeping quality are good. It is a mid season variety.
11. **Langra** : This variety is indigenous to Varanasi area of Uttar Pradesh. It is extensively grown in northern India. Fruit is of medium size, ovate shape and lettuce green colour. Fruit quality is good but keeping quality is medium. It is a mid season variety.
12. **Mankurad** : This variety is of commercial importance in Goa and in the neighbouring Ratnagiri district of Maharashtra. The variety develops black spots on the skin in rainy season. Fruit is medium in size, ovate in shape and yellow in colour. Fruit quality is very good but keeping quality is poor. It is a mid season variety.

13. **Mulgoa** : This is a commercial variety of south India. It is quite popular among the lovers of mango owing to high quality of its fruit. Fruit is large in size, roundish oblique in shape and yellow in colour. Fruit quality and keeping quality are good. It is a late season variety.
14. **Neelum** : This is a commercial variety indigenous to Tamil Nadu. It is an ideal variety for transporting to distant places owing to its high keeping quality. Fruit is medium in size, ovate oblique in shape and saffron yellow in colour. Fruit quality is good and keeping quality is very good. It is a late season variety.
15. **Samarbehisht Chausa** : This variety originated as a chance seedling in the orchard of a Talukdar of Sandila district Hardoi, U.P. It is commonly grown in northern part of India due to its characteristic flavour and taste. Fruit is large in size, ovate to oval oblique in shape and light yellow in colour. Fruit quality is good and keeping quality is medium. It is a late season variety.
16. **Suvernarekha** : This is a commercial variety of Visakhapatnam district of Andhra Pradesh. Other synonyms of this variety are Sundari, Lal Sundari and Chinna Suvernarekha. Fruit is medium in size and ovate oblong in shape. Colour of the fruit is light cadmium with a blush of jasper red. Fruit quality is medium and keeping quality is good. It is an early season variety.
17. **Vanraj** : It is a highly prized variety of Vadodra district of Gujarat and fetches good returns. Fruit is medium in size, ovate oblong in shape and colour is deep chrome with a blush of jasper red on the shoulders. Fruit quality and keeping quality are good. It is a mid season variety.
18. **Zardalu** : This variety is indigenous to Murshidabad in West Bengal. It derives its name from Zardalu, a dry fruit popular in North West Frontier Province and Sindh in Pakistan owing to similarity in shape. Fruit size is medium, oblong to obliquely oblong and golden yellow in colour. Fruit quality is very good. Keeping quality is medium. It is a mid season variety.

### **Hybrids**

1. **Amrapali** : This hybrid is from a cross of Dashehari and Neelum. It is dwarf, regular bearing and late maturing variety. The variety is suitable for high density planting as about 1600 plants may be planted in a hectare. It yields on an average of 16 tonnes/hectare.
2. **Mallika**: It is from a cross of Neelum and Dashehari. Its fruit is large in size, oblong

elliptical in shape and cadmium yellow in colour. Fruit and keeping quality are good. It is a mid season variety.

3. **Arka Aruna** : It is a hybrid between Banganapalli and Alphonso. It is dwarf, regular bearing and precocious. Fruits are large having attractive skin colour with red blush and free from spongy tissue. Suitable for homesteads as well as high density planting.
4. **Arka Puneet** : It is a hybrid between Alphonso and Banganapalli. It is a regular and prolific bearer. Fruits are medium sized having attractive skin colour with red blush, excellent keeping quality and free from spongy tissue.
5. **Arka Anmol** : This hybrid is from a cross of Alphonso and Janardhan Pasand. It is regular bearer and good yielder. Fruits are medium sized having uniform yellow peel colour, excellent keeping quality and free from spongy tissue.
6. **Arka Neelkiran** : It is a hybrid between Alphonso and Neelum. It is regular bearing late season variety with medium sized fruits having attractive red blush and free from spongy tissue.
7. **Ratna** : This hybrid is from a cross of Neelum and Alphonso. Tree moderately vigorous, precocious, fruits are medium sized, attractive in colour and free from spongy tissue.
8. **Sindhu** : It is from a cross of Ratna and Alphonso. It is regular bearer, fruits medium sized, free from spongy tissue with high pulp to stone ratio and very thin and small stone.
9. **Ambika**: This hybrid is a cross between Amrapali and Janardhan Pasand. It is a regular and prolific bearer. Fruits are medium sized having attractive skin colour with red blush, and late in ripening.
10. **Au Rumani**: It is from a cross of Rumani and Mulgoa. It is precocious, heavy and regular bearer with large fruits having yellow cadmium skin colour.
11. **Manjeera** : This hybrid is from a cross of Rumani and Neelum. It is dwarf, regular and prolific bearer with firm and fibreless flesh.
12. **PKM 1** : It is from a cross of Chinnasuvernarekha and Neelum. It is regular bearer, heavy yielder and bears fruits in clusters.

### **Varieties suitable for Tamil Nadu**

Banganapalli, Bangalora, Neelum, Rumani, Mulgoa, Alphonso, Senthura, Kalepad, Imam Pasand.

- Mango grows well on all types of soil provided they are deep and well drained.
- Red loamy soils are quite ideal.
- Alkaline, ill drained and soils with rocky substratum are not suitable for successful

cultivation of mango crop.

- In India, mango is grown on lateritic, alluvial, *kankar* and other types of soil.
- However, rich, medium and well drained soils give better results.
- Very poor, stony and soils with hard substratum should be avoided.
- The vigour and cropping behavior of a mango tree are affected by the soil type.
- In our country the best mango gardens are situated on the deep fertile alluvial soils of the Indo-Gangetic plain.
- On shallow soils of hill slopes, mango trees grow to a large size but the yields are not satisfactory.
- On the laterite soils of the west coast and of Bidar (Karnataka) the trees are smaller and sandy loams of Telangana region of Andhra Pradesh India, produced trees of medium height.
- The red soils of Dharwad (Karnataka) and red laterites of Belgaum and Ratnagiri (Maharashtra) and Goa Island (India) are the best soils for mango.
- Best quality fruits are produced on soils containing 5 to 10 per cent lime and sufficient quantities of peroxide of iron.
- Under such conditions fruits develop bright reddish tinge.
- The deep black cotton soils are generally considered not suitable for mango cultivation, since soils are generally avoided for planting mango plants.
- Such soils need to be reclaimed by leaching out of salts using good quality water, replacing the harmful sodium from the soil with calcium or by establishing effective drainage course to avoid salt build up.
- However, these are costly and the expenditure is likely to recur as a continuous threat of salinity faced year after year.
- The mango growing soils should preferably have a very low total water soluble salt content of 0.04 to 0.05 per cent.
- Fruit crops are most sensitive than cereals and millets.
- Mango is rated as moderately tolerant to salts with 4-6 dsm-1.
- The fertility of soil is dependant on its physical, physico-chemical and chemical characteristics.

**Climate:**



- Mango is grown in both tropical and sub-tropical conditions.
- It can tolerate a wide range of climatic conditions.
- For growing mango on a commercial and profitable scale the temperature and rainfall have to be within a clearly defined range.
- In addition to altitude, temperature, rainfall and the wind velocity also influence growth and production of mango. Mango thrives well under humid and dry conditions.
- It requires good rainfall during its growing season i.e. June to October and rainless, dry weather from November onwards.
- Rainy or cloudy weather during flowering favours the incidence of powdery mildew disease and leafhoppers.

Ideal soil for mango is red loamy. Good drainage is preferable for better establishment. Ideal pH range is from 6.5 to 8.0

### **Season of planting**

Planting spreads from July to December

### **Propagation techniques**

Mango can be raised from seed or propagated vegetatively. Several methods of vegetative propagation have been tried with varying degrees of success. Propagation from seed, though easy and cheap, is unable to perpetuate characters of the parent tree because most commercial varieties in India are cross-pollinated and monoembryonic. Plants also take more time to bear fruit. However, it is essential to raise seedlings to be used as rootstocks.

**Stone Grafting :**

Stone/epicotyl grafting is a simple, cheap and quick method of mango propagation with a success rate of 75-80%. For this purpose, stones should be sown in June-July on raised beds of size 1x3 m. the beds should be prepared by mixing soil and FYM in the proportion of 2:1. After germination, seedlings with tender stems having coppery leaves are lifted with stones still attached. The roots and stones are dipped in 0.1 per cent Carbendazim solution for 5 minutes after washing the soil. The seedling stems are headed back leaving 6-8 cm long stem. A 4-6 cm longitudinal cut is made running down through the middle of the stem. A wedge shaped cut starting on both sides is made on the lower part of scion stick. The scion stick should be 4-5 months old and 10-15 cm long containing plump terminal buds. The scion stick is then inserted in the cleft of the seedlings and tied with polythene strips. The grafts are then planted in polyethylene bags containing potting mixture. The bags are then kept in the shade protecting from heavy rain. The scion starts sprouting 15-20 days after grafting. Care should be taken to remove the sprouts on the rootstocks below the graft union during this period. July is the most suitable month for stone grafting.

**Soft-Wood Grafting :**

This method of grafting is done when the rootstock is overgrown and thus not suitable for stone grafting. Normally in this method, seedlings of 8-10 months old are selected. The grafting is done on newly emerged flush. The scion wood to be used is defoliated 10 days prior to the grafting and has same thickness as that of terminal shoot. The method of grafting is similar to stone grafting. July and August are the best months for soft-wood grafting.

**Inarching :**

The method of inarching or approach grafting is quite cumbersome and time consuming, but it is still the leading method for commercial propagation of mango plants. The method consists of uniting the selected shoot (scion) of a desired parent tree (mother plant) with the potted or transplanted seedling (rootstock) by approach grafting. For this purpose, about one-year-old seedlings are most suitable when they attain a height of about 30-45 cm and thickness ranging from 0.75 to 1.5 cm. These seedlings are either grown in pots or under the mother plant from which the grafts are to be prepared. Generally, one-year-old twigs of the scion tree about 60 cm in length and nearly of the same thickness as that of the stock is chosen for grafting. Young and non-bearing trees should not be selected as mother plants. A thin slice of bark and wood, about 5 cm in length, 7.5 mm width and 2 mm deep, is removed by means of a sharp grafting knife from the stem of the stock as well as from the scion branch. The cuts thus made should be absolutely flat, clean, boat shaped, even and smooth. The ends of these cuts should be round and not angular. The cut surfaces of both, i.e., stock

and scion are made to coincide facing each other so that there remains no hollow space between the two. Polythene/alkathene strips of about 1.5 cm in width are tied around the union. After about one month of operation, the scion below the graft union and stock above the graft union should be given light "V" shape cuts at weekly interval in such a way that the grafts can finally be detached while giving the fourth cut. In the last stage, the top of the stock above graft union should also be removed completely. Inarching should be done during the active growth period. The end of the monsoon in heavy rainfall areas and early monsoons in the light rainfall areas is the best period for inarching.

### **Veneer Grafting :**

This method of propagation possesses promise for mass scale commercial propagation. The method is simple and can be adopted with success. The rootstocks as mentioned for inarching are suitable for this method also. For conducting this grafting operation, a downward and inward 30-40 mm long cut is made in the smooth area of the stock at a height of about 20 cm. At the base of cut, a small shorter cut is given to intersect the first so as to remove the piece of wood and bark. The scion stick is given a long slanting cut on one side and a small short cut on the other so as to match the cuts of the stock. The scion is inserted in the stock so that the cambium layers comes on the longer side. The graft union is then tied with polythene strip as recommended for inarching. After the scion remains green for more than 10 days, the rootstock should be clipped in stages. The scion wood to be used for veneer grafting requires proper preparation. The desired shoots should be defoliated at least one week prior to grafting so that the dormant buds in the axil of leaves become swollen.

### **Field preparation**

Dig pits of 1 m x 1 m x 1 m. Fill in with topsoil mixed with 10 kg of FYM and 100 g Lindane 1.3% dust per pit.

### **Spacing**

Mango is normally planted at 7 to 10 m either way. However under high density planting, it varies between 5 x 5 m and 6 x 6 m. Amrapalli, a North Indian variety is highly suitable for high density planting.

## **Planting**

Grafts are planted in the centre of pit with ball of earth intact followed by watering and staking. The graft union must be 15 cm above the ground level. Land should be prepared by deep ploughing followed by harrowing and levelling with a gentle slope for good drainage. Spacing varies from 10 m x 10 m, in the dry zones where growth is less, to 12 m x 12 m, in heavy rainfall areas and rich soils where abundant vegetative growth occurs. New dwarf hybrids like Amrapali can be planted at closer spacing. Pits are filled with original soil mixed with 20-25 kg well rotten FYM, 2.5 kg single super phosphate and 1 kg muriate of potash.

One year old healthy, straight growing grafts from reliable sources can be planted at the centre of pits along with the ball of the earth intact during rainy season in such a way that the roots are not expanded and the graft union is above the ground level. Plants should be irrigated immediately after planting. In the initial one or two years, it is advisable to provide some shade to the young plants and also stake to make them grow straight.

### **Irrigation management**

Irrigation management is crucial to the production of quality fruit. Water inputs must be geared to tree water requirements, soil factors and fruit physiological requirements.

#### **NEW PLANTING**

In a new planting, trees must be irrigated throughout the year, including dry periods which occur during the wet season, to enable rapid establishment of the tree. Water inputs should be appropriate to tree size. In general up to 100 L/tree/week should be sufficient for the first two years. The radius of the sprinkler should be appropriate to tree size. Many growers find that a sprinkler with a distributor plate (radius of 1.0 to 1.5 m) is adequate for up to three years. In subsequent years sprinkler radius should be less than 3 m to ensure that the water is delivered to the root zone under the canopy edge which also helps to reduce weed growth around trees. After the second wet season trees are generally only irrigated during the flowering and fruit development period. (July to November). The soil type determines how early continuous irrigation can cease. Trees grown on light sandy and gravelly soils may require continuous irrigation for a longer period to allow them to develop an appropriate size canopy.

#### **FRUITING TREES**

In fruiting orchards there are three phases during the annual growing cycle where distinct irrigation management options need to be exercised.

- ***Phase One***

Pre-flowering, from the end of the wet season to the commencement of flowering (April to June/July).

- ***Phase Two***

Flowering and fruiting, from visible panicle bud differentiation to harvest (July to November).

- ***Phase Three***

Post harvest to the end of the wet season (November to April).

### **Phase one**

In mature orchards (established fruiting trees) water is normally withheld from the end of the wet season until flowering. This period of low soil moisture is believed to encourage earlier and more synchronous flowering. Experimental evidence is still inconclusive but it is thought that cool weather (several weeks with night temperatures less than 15°C) is the main flowering trigger. However, irrigation withdrawal is thought to enhance the flowering trigger, particularly in a year where there is an inconsistent run of cool nights.

### **Phase Two**

Irrigation is highly recommended from flowering until late fruit maturity. Some growers prefer to start irrigating after 50% of the tree is in flower and at least 50% of the flowers are open. Other growers will start irrigating from the commencement of visible flower panicle development in an attempt to speed up the flowering and fruit setting process. The present DPIFM recommendation is to start irrigating when at least 60% of the flower buds are visible. The amount of irrigation is dependent on tree size (canopy cover), evaporation rates and evaporation replacement rate. Irrigation frequency is dependent on soil type (water holding capacity) and effective root depth. The present irrigation input recommendations are based on a replacement rate (crop factor) of 0.70. Irrigation rates (Appendix 1) per tree depend on the size of the tree. Planting density and pattern interacts with tree size. Maximum percentage canopy cover in the orchard should be between 60% and 70%. This can be achieved by a few large trees (e.g. 100 trees/ha 10 x 10 m) or many smaller trees (e.g. 200 trees/ha 10 x 5.0 m). Many growers choose to water for 24 or 36 hours at the start of the irrigating season. This may not be necessary particularly if using low radius (2.0-3.0 m) sprinklers because tree water requirement is lower during the first month of flower and fruit development. The use of a hand auger to establish watering depth is recommended, particularly during the first few weeks after irrigation commences. The wetted zone should be at least 40% of the under tree canopy area and good soil moisture should occur down to 60-80 cm. Saturated soil beyond 80

cm suggests that trees are being over watered.

### **Phase Three**

Irrigation normally ceases a few weeks prior to harvest and is not recommenced until flowering in the following year. In years where the wet season begins late (late January, early February) the new vegetative flush may be delayed. This may influence the following flowering date with the most likely consequence being a later flowering. In situations where trees are grown on light soils and the build-up rains and wet season are late, trees should be irrigated to promote an early flush of growth. This should occur after pruning and fertiliser operations have taken place.

### **IRRIGATION FREQUENCY**

In simple terms the more sandy and gravelly the soil, the more frequent irrigations should be. Two to three times per week will be appropriate for most sandy sites. Long irrigations on a sandy soil result in water draining beyond the depth of the effective root zone which is a waste of water and leaches away nutrients. The use of a hand auger to determine irrigation depth can quickly alert you to potential deep watering problems. Moisture monitoring will allow an appropriate irrigation schedule to be established.

### **WATER REQUIREMENTS AND FRUIT DRY MATTER MANIPULATION**

Some growers encourage the earlier development of 14% fruit dry matter (minimum market standard) by manipulation of irrigation inputs and cut off prior to harvest. This practice should be carried out with caution as low water inputs (less than 60% replacement) and early cut off (four weeks prior to harvest) will reduce fruit size and fruit quality and delay the development of fruit peel colour. Work carried out by the Crops, Forestry and Horticulture Division to establish water requirements of mangoes, shows that fruit size increases with increasing amounts of water up to 100% evaporation replacement. Dry matter development is delayed with increasing water inputs. The current recommendation of 70% evaporation replacement is a compromise in terms of balancing the requirements for adequate fruit size, fruit quality and time to maturity.

**Average mango tree water requirements (Darwin and Katherine areas) in litres per tree per week.**

Canopy cover m <sup>2</sup> /ha	Trees per hectare						
	80	100	130	140	160	180	200
1000	490	390	330	280	250	220	200
2000	980	780	650	560	490	440	390
3000	1470	1180	980	840	740	650	590
4000	1960	1570	1310	1120	980	870	780
5000	2450	1960	1630	1400	1230	1090	980
6000	2940	2350	1960	1680	1470	1310	1180
7000	3430	2740	2290	1960	1720	1520	1370
8000	3920	3140	2610	2240	1960	1740	1570

Source: [www.nt.gov.au/dpifm](http://www.nt.gov.au/dpifm)

**Intercropping**

Short duration crops like legumes, vegetables, groundnut etc. can be raised during pre-bearing age. Inter crops such as vegetables, legumes, short duration and dwarf fruit crops like papaya, guava, peach, plum, etc. depending on the agro-climatic factors of the region can be grown

**Manures and fertilizers**

Manures and Fertilizers	1 Year old	Annual increase	6th year onwards
FYM	10.00	10.00	50
N	0.20	0.20	1.0
P	0.20	0.20	1.0
K	0.30	0.30	1.5

Manures and fertilizers may be applied in September – October. Fertilizers are applied 45 to 90 cm away from the trunk upto the peripheral leaf drip and incorporated.

### **Fertiliser Application:**

In general, 170 gm urea, 110 gm single super phosphate and 115 gm muriate of potash per plant per year of the age from first to tenth year and thereafter 1.7 kg, 1.1 kg, and 1.15 kg respectively of these fertilisers per plant per year can be applied in two equal split doses (June-July and October). Foliar spray of 3% urea is recommended before flowering in sandy areas

### **Training and Pruning**

Rootstock sprouts and low lying branches have to be removed. Remove overlapping, intercrossing, diseased, dried and weak branches in old trees to get good sunlight and aeration. For the internal branches, pruning may be done during August – September, once in three years. Flowering should not be allowed upto three years. Among crowded terminal shoots, weak shoots are trimmed to retain two healthy shoots during August-September annually.

### **Growth regulators**

NAA @ 20 ppm is sprayed at flowering to increase the fruit retention. During February 0.5% Urea (5 g/lit.) or 1% Potassium Nitrate (10g/lit.) may be sprayed to induce flowering, if trees do not flower by that time. Spraying of 2% KNO<sub>3</sub> at mustard size will increase the fruit set and retention of fruits.

Application of Paclobutrazol @ 10 g a.i. for non-bearing trees during first fortnight of September will induce flowering and fruitset yield during off years.

### **Plant Protection**

#### **Pests**

#### **Hopper**

Spraying two rounds of acephate 75 SP@ 1g/lit or phosalone 35 EC @ 1.5 ml/lit or carbaryl 50 WP 2 g/lit or phosphamidon 40SL 2 ml/lit of water will control hopper. First at the time of panicle emergence and the second two weeks after first spray. Wettable sulphur @ 2 g/lit may be sprayed after spraying carbaryl to avoid mite resurgence. Phosphamidon + neem oil 5 ml/lit of water can be mixed with any insecticides for the control of hopper and shoot webber.



**Leaf galls and Aphids**

Application of Dimethoate or Methyl demeton @ 2 ml/lit will control the pests.

**Flower Webber**

Application of Phosalone 35 EC @ 2 ml/lit will control webber.

**Nut Weevil**

Fenthion 100 EC 1ml/lit spray during marble stage and second spray 15 days after the first spray will control nut weevil.

**Mealy bug**

Spraying of Chlorpyriphos 20 EC 2.5ml/lit or Monocrotophos 36 WSC 1.5ml/lit will give control over the pest. Band the trees with 20 cm wide 400 gauge polythene sheets will prevent the spread of the pest. Similarly, release of Australian ladybird beetle, *Cryptolaemus montrouzieri* @ 10/tree will be a very effective bio-control measure.

**Stem borer**

Monocrotophos (36 WSC) 10 ml is soaked in absorbent cotton and placed on the affected stem by removing the bark of 2.5 cm<sup>2</sup>. Then the portion is wrapped with gunny or plastic papers thereby the chemical gets into the system so as to kill the stem borer. The trees should not be treated during their bearing stage. Application of carbofuran 3 G @ 5g per bore hole and plugging with mud after mechanically removing or killing the grub by introducing a needle or wire will also control the pest.

**Fruit fly**

Spraying of Fenthion 2 ml/lit or malathion 2 ml/lit will control the pest. Ploughing the inter spaces will expose the pupae. Pheromone trap with methyl eugenol 1 ml in 1 litre of water + 1 ml of malathion solution will attract and kill the female insects. Take 10 ml of this mixture per trap and keep them in 25 different places in one hectare between 6 a.m. and 8 a.m. Collect and destroy the fallen fruits.

**DISEASES****Powdery mildew**

Application of Sulphur dust (350 mesh) in the early morning will protect new flush or spray Wettable sulphur 0.2% or Tridemorph 0.05% will control powdery mildew.

**Anthracnose and stalk end-rot**

Pre-harvest spraying of Mancozeb 2g/lit or Carbendazim 1g/lit or Thiophanate methyl 1g/lit or Chlorothalonil 2 g/lit, 3 times at 15 days interval will control anthracnose and stalk end-

rot.

### **Sooty mould**

Spraying Phosphamidon 40 SL @ 2 ml/ litre + Maida 5% (1 kg Maida or starch) boiled with 1 lit of water and diluted to 20 litres will control the incidence of sooty mould. Avoid spraying during cloudy weather.

### **Mango malformation**

#### **Use of disease free planting material.**

- Diseased plants should be destroyed.
- Incidence reduced by spraying 100-200ppm NAA during October.
- Pruning of diseased parts with the basal 15-20 cm apparently healthy portions.
- Followed by the spraying of Carbendazim (0.1%).

### **Stem end rot**

- Dip mangoes in 6 percent borax solution at 43°C for 3 minutes.
- Harvest mangoes on clear dry day.
- Injury should be avoided to fruits at all stages of handling.
- Spray Carbendazim (0.1%) or Chlorothalonil (0.2%) in the field.

### **Red rust**

- Bordeaux mixture (1%), or Copper oxychloride 0.25%

### **Harvest and Yield**

Harvest spreads from March to June. Graft plants start bearing at the age of 3 - 4 years (10-20 fruits) to give optimum crop from 10-15th year which continues to increase upto the age of 40 years under good management.

#### ***Waiting Period***

	14 days
Dimethoate	
Methyl demeton 0.05%	14 days
Fenthion 0.05%	14 days
Quinalphos 0.05%	12 days
Lindane 300 g a.i./ha	2 days

- Yield varies with varieties and spacing adopted
- 8 – 10 t/ha upto 15 years.
- 15 – 20 t/ha from 15 – 20 years.

## **Post harvest management**

### **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.

### **Post harvest handling of mango**

Post harvest losses are 25 -30 per cent of total produce due to improper handling and storage practices. Which amounts to over Rs. 250 crore.

### **Management steps includes**

- Pre harvest management
- Assessment of harvest maturity
- Harvesting
- Sorting and grading
- Pest management
- Uniform ripening of fruits
- Packaging
- Storage
- Transport

### **Pre-harvest management**

- Bagging of fruits for controlling the post harvest diseases and bruises with newspaper or brown paper bags one month prior to harvest.
- Harvested fruits ripe uniformly without any disease and fruit fly infestation.
- The problem of blackening upon ripening never come.
- The shelf life of such fruits is also increased by two to three days.
- Checks jelly seed formation (softening of pulp near stone).
- This technique is eco-friendly and job oriented. (Bags are not suited for coloured mango varieties)

## **Harvest maturity**

- The harvest maturity takes 12 – 15 weeks after fruit set.
- Dashehari and Langra - 12 weeks
- Chausa and Mallika - 15 weeks
- At the time of maturity, stone becomes hard and pulp colour changes from white to cream.
- In few varieties fruits sink in water (Langra, Chausa)

## **Harvesting**

- The harvest maturity takes 12 – 15 weeks after fruit set.
- At the time of maturity, stone becomes hard and pulp colour changes from white to cream.
- In few varieties fruits sink in water (Langra, Chausa).

## **Sorting and grading**

- Separate mature unripe fruits from immature and ripe fruits.
- Grade fruits according to size and weight
- Sort out defected, deformed, bruised and diseased fruits.

## **Pest management**

- Bagging of fruits check development of post harvest diseases and fruit fly infestation.
- If bagging has not been done, pre treatment of fruits is required for controlling post harvest diseases.
- Harvested fruits should be dipped in 0.025 per cent Carbendazim in hot water ( $52\pm 10C$ ) for 10 minutes.
- Fixing of wooden block methyl eugenol traps @ 10 traps per hectare commencing from first week of May to manage fruit fly

## **Ripening**

Do not use calcium carbide, a banned chemical, for ripening of fruits.

- Such fruits do not ripen uniformly and quality of fruits is inferior.
- Calcium carbide is hazardous to health.
- Ripen fruits with ethylene gas (100 ppm or 0.1 %) in airtight room by exposing them for 24 –48 hrs under controlled conditions of temperature and humidity

Alternatively, ripen the fruits with dip treatment of ethrel / ethephon solution (250–750 ppm) in hot water (52±20C) for 5 minutes.

- The same solution could be used four times.
- Premature fruits (fruits harvested up to 2 weeks prior to maturity) could be ripened to an acceptance quality by dipping the fruits in 750 ppm ethrel solution.
- Less mature and mature fruits are ripened by dipping the fruits in 500 and 250 ppm ethrel solution, respectively.

Fruits ripen uniformly with attractive colour.

- Fruits ripen within 4 - 8 days depending upon the maturity.
- This technique is also useful for processing industries.
- Sorting of ripe fruits is not required due to uniform ripening of fruits.

### **Packaging**

- The filled boxes / packages should be kept under shade.
- Package should meet the handling and shipping requirements of international standard.
- The pack should be labeled with name of variety, grade, class and brand, if any.

### **Storage**

Fruits could be stored for 6 – 12 days under ambient conditions, according to variety.

- For increasing the shelf life, fruits are stored at low temperature and high humidity.
- Pre cool the fruits to required temperature before storing at low temperature.

Store the fruits at critical low temperature with 85-90 % R.H. (Shelf life of 3 weeks)

– Dashehari 120C

– Langra 150C

- Chausa 100C
- Mallika 120C

- The shelf life of fruits at low temperature is 2 –3 weeks.
- Use rigid containers that can withstand stacking without getting deformed.
- Do not store other fruits with mango under low temperature conditions.
- Store fruits until they are marketable and profitable.
- Transfer cold store fruits gradually to room temperature to minimize sweating.

### **Transport**

- Do not throw the packages during loading or unloading.
- Stack 4 – 8 containers, as per their strength, in pallets.
- Arrange the boxes in the truck to allow proper air circulation
- Transport the produce during the cooler part of the day, i.e., during night.
- Cover the truck with tarpoline leaving proper ventilation.
- Avoid using large containers for packaging and transport of fruits.
- Transport cold stored fruits in a refer van.

## Different Types of Mangoes | Best Mango Variety in the World

Each mango variety has a distinct flavor and unique texture! Explore mouth-watering Different Types of Mangoes, if you love this fruit!

There's a reason why mango is the king of fruits! It's delicious and juicy taste is simply hard to beat! This fruit is native to India, but many cultivars are grown around the world. Let's know about the different types of mangoes available!

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### Different Types of Mangoes across the World

Check out some of the best different types of mangoes across the world!

#### 1. Honey



**Flavor:** Sweet and sour

**Flesh:** Peachy tropical aroma with smooth, firm flesh without fibers and a small pit

Honey mangoes are available from March to July. The primary sources are Mexico, Brazil, Peru, and Ecuador. When fully ripe, the fruit turns Deep yellow with small wrinkles and acquires flattened oblong shape

## 2. Francis



**Flavor:** Sweet and fruity

**Flesh:** Peach-like, tropical fragrance, and juicy, soft, fibrous flesh

You can have this luscious mango from May to June. The primary sources are Haiti and Ecuador. The fruit grows with green overtones that become yellow and change to more golden when mango ripens.

## 3. Haden



**Flavor:** Sweet and sour with a mildly bitter aftertaste

**Flesh:** Firm flesh with fruit-like aroma and medium fibers



Haden is mainly cultivated in Mexico, Peru, and Ecuador. These bright red mangoes have green-yellow shaded skin with

#### **4. Keitt**



**Flavor:** Sweet and fruity

**Flesh:** Citrusy aroma and juicy, firm flesh, with little fiber

Mexico, Ecuador, the United States, and Brazil are primary sources of Keitt mango. You can relish the fruit from March to April, August and September. They are famous in Asian cuisines, where they are enjoyed in pickles.

#### **5. Kent**



**Flavor:** Sweet with sour notes

**Flesh:** Tender, juicy flesh with limited fiber and tropical peachy aroma

The main countries that are producing kent variety are Mexico, Ecuador, and Peru. This variety is ideal for juicing and drying. It is Available from December to February. When the fruit starts to ripe, yellow dots cover the skin of the fruit.

## 6. Tommy Atkins



**Flavor:** Tart with sweet notes

Tommy Atkins mango is native to Florida. It is the most extensively grown variety in the United States. This fruit is primarily grown in Brazil, Mexico, Guatemala, and Ecuador. You can have this delicious mango variety from March to July.

## 7. Carabao



**Flavor:** Sweet

**Flesh:** Juicy and soft flesh with less fiber

Carabao mango belongs to the Philippines. It is also known as Manila mango, champagne, or Philippine mango. It is the national fruit of the Philippines, and the country comes on number six after India, China, Pakistan, Brazil, and Mexico in its production.

## 8. Graham



**Flavor:** Sweet

**Flesh:** Aromatic orange-colored, fiberless flesh

Graham mango was originated in Trinidad from the seedling of the Julie mango. It is oval-shaped and turns yellow with a bumpy skin when ripe.

### Different Types of Mangoes in Indian Subcontinent

As Mangoes were originated in India and its neighboring countries, we are showcasing the best mango varieties in this section that are Grown primarily in the subcontinent.

## 9. Sein Ta Lone



**Flavor:** Sweet

**Flesh:** Fruity aroma, juicy, and a less fibrous texture.

Also known as a diamond solitaire mango, it is one of the popular varieties from Myanmar. This variety is available for two months and Ends in June.

## 10. Alphonso



**Flavor:** Sugary-sweet

**Flesh:** Distinct aroma rich, buttery, tender texture, and a saffron-colored juicy pulp with no fiber.

From 1000 mango species around the world, alphonso mango is surely the number one in taste and flavor. The main producer of this Delightful variety is the Maharashtra state of India. It is available in summers.

## 11. Kesar



**Flavor:** Sweet

**Flesh:** Smooth and soft with no fiber

Kesar ranks second as the largest export variety mango of India. It is grown in Girnar hill of Gujarat India, and available from May to July. The fruit is also used for making various desserts and juices as well!

## 12. Dasheri



**Flavor:** Sweet and aromatic

This variety is available from mid-May to late August. Lucknow state in India is the highest producer of this variety. Dasherri is long and Oval-shaped, with yellow-green skin when ripe.

### 13. Chausa



**Flavor:** Sweet

**Flesh:** Deep yellow luscious pulp with little fiber

Hardoi in North India is famous for Chausa mangoes. The fruit is consumed by sucking. You can have this juicy mango in summers.

Chausa mango has its roots from Multan, Pakistan.

### 14. Bombay Green



**Flavor:** Sweet

**Flesh:** Hard pulp with little to no fiber

Bombay Green variety is cultivated in the Northern part of the Indian subcontinent. It is also famous as Malda and Shehroli. It displays Spanish green peel and prized with an aromatic flavor. They are available from May to July.

## 15. Langra



**Flavor:** Sweet

**Flesh:** Juicy fibreless pulp rich in fibers

Langra is the most well-known mango variety of the Northern Indian sub-continent. It originally belongs to Varanasi, and the best Variety is from Patna and Bihar, the states in India. The fruit has a juicy flavor, sweet and tart taste

## 16. Amrapali



**Flavor:** Sweet

**Flesh:** Deep orange-red flesh with medium fibers

Amrapali is a hybrid between Dasherri and Neelam Mangoes and was created in 1971. People grow it all over India, in farms and Orchards. The fruit has a short shelf life as compared to the other mango varieties. You can also grow it in containers due to the small size of the tree.

## 17. Neelam



**Flavor:** Sweet

**Flesh:** Juicy and semi-hard with no fibers

These mangoes are available throughout the season. Though the tastiest ones come in the month of June when monsoons occur. They are grown all over the world.

## 18. Banganpalli/Safeda



**Flavor:** Sweet and sour

**Flesh:** Fiberless firm, yellow flesh.

Banganpalli hits the market first in the season. This mango variety belongs to Andhra Pradesh state in India and offers an unmistakable taste, savored by the locals and everyone alike!



## 19. Chok Anan



**Flavor:** Sweet

**Flesh:** Hard, yellow-colored with medium to no fiber

Chok Anan or ‘chocanon,’ is native to India, Bangladesh, Thailand, and Pakistan. It is also popular as ‘honey mango’ and miracle mango, as it fruits twice a year, in both summer and winter seasons.

## 20. Badam Mango



**Flavor:** Sweet

**Flesh:** Hard, juicy, yellow-colored with no fiber

The most popular and one of the most consumed mangoes in India; the Badam is famous for its size, canary yellow color, and flesh with juicy taste. Karnataka and the Andhra Pradesh States of India are the leading producers of it.

## 21. Totapuri



**Flavor:** Sweet and sour

**Flesh:** Hard, with no fiber

It has one of the most unique shapes in mangoes! It is oblong, with pointed ends and a golden yellow color. The fruit has a distinctive sweet/sour taste and hits the market early in the summers of India.