

MANGO

Botanical Name: Mangifera indica,

Family: Anacardiaceae;

Chromosome Number: $2n=40$, $n=20$

Origin: Indo-Burma region

BOTANY

- Medium to large (9-31 m) evergreen tree: Open or dense symmetrical canopy;
- Long tap root and dense fibrous roots;
- Lanceolate shaped leaves-simple and leathery;
- Inflorescence –panicle (male & hermaphrodite flowers); The flowers are produced in panicles which are about ten to twelve inches in length. hermaphrodite flower is male and female flowers in the same flower panicle.
- Fruit –drupe, Shape (round,oval or ovoid-oblong), size (60g-2.3kg) ;
- single seeded may be mono or polyembryonic.



USES

- **Unripe Fruits:** pickles, chutneys and *amchur*.
- **Ripe fruits:** table fruits, squash, nectar, jam, mango leather and toffee.
- **Leaves:** tender leaves are used as vegetables in Java, Philippines, fumes from burning leaves are used for relief from hiccups.
- **Flowers:** treating diarrhoea and chronic dysentery and also yield tannin, worship
- **Bark:** bark yields *mangiferine* and tannin, useful against diphtheria and rheumatism.
- **Wood:** furniture, flooring, packing boxes, match boxes, boats etc.
- Mangoes are full packed with vitamins, minerals and anti-oxidants and contain like all fruits very few proteins, fats and calories. They are perfect to replenish salts, vitamins and energy after physical exercise.
- Dietary fiber has a protective effect against degenerative diseases, especially with regards to the heart; may help prevent certain types of cancer, as well as lowering blood cholesterol levels.

Scope and Importance for Mango Cultivation and its National Importance

Mango occupies about 36% of the total area and production share about 20.7% under fruits comprising of 25.16 lakh hectares.

Fresh mangoes and mango pulp are the important items of agri-exports from India. India's main export destinations for mango are UAE, Bangladesh, UK, Saudi Arabia, Nepal, Kuwait, USA, Japan and other Middle East countries with a limited quantity being shipped to European market. Although, India is the largest mango producing country, accounting about 45% of world production, the export of fresh fruit is limited to Alphonso, Kesar and Dashehari varieties. India's share in the world mango market is about 15 percent. Mango accounts for 40 percent of the total fruit exports from the country. There is good scope for increasing the area and productivity of mango in the country.

Cultural Requirements of Mango Cultivation

Climate

- ❑ Mango can be grown under both **tropical and sub-tropical climate** from sea level to 1400 m altitude, provided there is no high humidity, rain or frost during the flowering period.
- ❑ Places **with good rainfall and dry summer are ideal for mango cultivation.**
- ❑ It is better **to avoid areas with winds and cyclones which may cause flower and fruit shedding and breaking of branches.**
- ❑ Localities which experience bright sunny days & relatively low humidity during flowering are ideal.

CLIMATE

- Mango is a mainly tropical fruit crop.
- It can grow from sea level to about **1400 meters** provided there is no high humidity, rain or frost during the flowering period.
- Temperature ranging from **24-30°C** although it can grow as high as **48°C** during the period of fruit development and maturity (if irrigation facility available).
- The most favourable temperature for growth of young mango plant is **25°C**.
- Cold temperature limits the crop production.

Soil

❑ Mango can be grown on a wide range of soils from **alluvial to laterite** provided they are deep (minimum 6') and well drained and except black cotton soils .

❑ It prefers **slightly acidic** soils (pH 5.5 to 7.5).

Saline and alkaline soils are not conducive to profitable mango cultivation.



Mango Variety

Alphonso	Maharashtra, Goa, Karnataka, Gujarat, Himachal Pradesh, Tamil Nadu, Kerala
Banganapalli	Andhra Pradesh, Kerala, Tamil Nadu, Karnataka, Odisha
Bombay Green	Bihar, Jharkhand, West Bengal, Odisha, Chhattisgarh, Madhya Pradesh, Uttarakhand, Uttar Pradesh, Assam
Chausa	Uttar Pradesh, Uttarakhand, Punjab, Bihar, Jharkhand, Himachal Pradesh, Haryana, Jammu & Kashmir, Rajasthan, Delhi
Dashehari	Uttar Pradesh, Punjab, Uttarakhand, Bihar, Jharkhand, Gujarat, Rajasthan, Haryana, Odisha, Himachal Pradesh, Chhattisgarh, Madhya Pradesh, Jammu & Kashmir, Delhi
Fazli	Uttar Pradesh, Uttarakhand, Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, West Bengal

Gulab Khas	Bihar, Jharkhand, Uttar Pradesh, Uttarakhand, West Bengal
Himsagar	West Bengal, Bihar, Jharkhand, Odisha , Tripura, Mizoram
Kesar	Gujarat, Maharashtra
Kishen Bhog	West Bengal, Bihar, Jharkhand, Rajasthan
Langra	Uttar Pradesh, Punjab, Uttarakhand, Bihar, Jharkhand, Odisha , West Bengal, Himachal Pradesh, Delhi, Chhattisgarh, Madhya Pradesh, Jammu & Kashmir, Haryana, Rajasthan, Gujarat
Mankurad	Goa, Maharashtra (Ratnagiri)
Neelum	Andhra Pradesh , Tamil Nadu, Karnataka, Kerala, Gujarat
Pairi	Maharashtra, Karnataka, Kerala
Totapuri	Andhra Pradesh , Karnataka, Tamil Nadu, Odisha , Gujarat
Mulgoa	Tamil Nadu, Kerala, Karnataka
Imam Pasand	Andhra Pradesh , Kerala

Suvernarekha	Andhra Pradesh
Vanraj	Gujarat
Zardalu	West Bengal, Bihar
CISH (Central Institute for Subtropical Horticulture), Lucknow (Hybrid)	
Ambika	Gujarat, Andhra Pradesh , Karnataka
IARI (Indian Agricultural Research Institute), New Delhi	
Mallika	Uttar Pradesh, Bihar, Delhi, Jharkhand, Karnataka, Andhra Pradesh , Tamil Nadu, Odisha , Uttarakhand, Haryana, Punjab, Rajasthan, Chhattisgarh, Madhya Pradesh, Kerala, Tripura, Jammu & Kashmir
Amrapali	Uttar Pradesh, Bihar, Delhi, Jharkhand, Andhra Pradesh , Tamil Nadu, Odisha , Madhya Pradesh, Chhattisgarh, West Bengal, Punjab, Uttarakhand, Tripura, Nagaland, Assam, Karnataka, Himachal Pradesh, Haryana, Delhi, Rajasthan, Jammu & Kashmir
Pusa Arunima	Uttar Pradesh, Uttarakhand, Bihar, Jharkhand, Punjab, Andhra Pradesh , Tamil Nadu, Odisha , West Bengal
Pusa Surya	Uttar Pradesh, Bihar, Jharkhand, Andhra Pradesh , Tamil Nadu, Odisha , West Bengal, Punjab, Uttarakhand
Pusa Lalima	Uttar Pradesh, Delhi, Punjab, Haryana
Pusa Shreshth	Uttar Pradesh, Bihar, Jharkhand, Andhra Pradesh
Pusa Pratibha	All over India
Pusa Peetamber	Uttar Pradesh, Delhi, Punjab, Haryana, Rajasthan

**BSKKV (Balasaheb Sawant Konkan Krishi Vidyapeeth), Dapoli,
Maharashtra**

Ratna	Maharashtra, Karnataka
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Sindhu	Maharashtra, Gujarat
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IIHR (Indian Institute of Horticultural Research), Bangalore

Arka Aruna (Banganapalli x Alphonso)	Andhra Pradesh, Karnataka, Tamil Nadu, Andaman & Nicobar Islands (Port Blair)
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Arka Anmol (Alphonso x Janardhan Pasand)	Andhra Pradesh, Karnataka, Tamil Nadu, Andaman & Nicobar Islands (Port Blair)
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Arka neelkiran (Alphonso x Neelum)	Andhra Pradesh, Karnataka
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HYBRIDS OF MANGO

Hybrids	Parents	Released	Characteristics
Amrapali	Dashehari × Neelum	I.A.R.I., Delhi	Dwarf, regular
Mallika	Neelum × Dashehari	Do	Semi-vigorous, regular, first released hybrid of
Pusa Arunima	Amrapali × Sensation	Do	
Arka Aruna	Banganpalli × Alphonso	I.I.H.R., Bangalore	Dwarf, regular, free from spongy tissue
Arka Anmol	Alphonso × Janardan Pasand	Do	Semi-vigorous, fibreless, regular, free from spongy tissue
Arka Neelkiran	Alphonso × Neelum	Do	Good colour, fit for export, semi-vigorous
Arka Puneet	Alphonso × Banganpalli	Do	Free from spongy tissue, fibre less

Hybrids	Parents	Released	Characteristics
Aurumani	Rumani × Mulgoa	(R.F.R.S.), (Regional fruit research station) Kodur, Karnataka	Prolific bearer, fibreless, good flavor
Neeleshan	Neelum × Baneshan	Do	
Neelgoa	Neelum × Pera Mulgoa	Do	
Neeluddin	Neelum × Himayuddin	Do	
Swarnajehangir	Chinasuvarnarekha × Jehangir	R.F.R.S., Anantapuram, AP	
Ratna	Neelum × Alphonso	R.F.R.S., Vengurla, MH	Regular, free from spongy tissue
Sindhu	Ratna × Alphonso	Do	Stone very thin, free from spongy tissue
Ruchi	Neelum × Alphonso	Do	Regular, Good for pickling

Hybrids	Parents	Released
Sundar Langra	Langra × Sundar Pasand	Sabour Ag. College, Bihar
Alfazli	Alphonso × Fazli	R.F.R.S., Sabour, Bihar
Prabha Sankar	Bombai × Kalapadi	Do
Mahmood Bahar	Bombai × Kalapadi	Do
Neeleshan Gujarat	Neelum × Baneshan	R.F.R.S., Paria, Gujarat
Neeleshwari	Neelum × Dashehari	Do
Neelphonso	Neelum × Alphonso	Do
A.U. Rumani	Rumani × Mulgoa	R.F.R.S., Sangareddy, Telengana
Manjira	Rumani × Neelum	Do
P.K.M. 1	Chinasuvarnarekha × Neelum	R.F.R.S., Periyakulam, Tmilnadu
Ambika	Amrapali × Janardan Pasand	C. I.S.H.
Sai Sugandh	Kesar × Totapuri	M.P.K.V.(Mahatma Phule Krishi Vidyapeeth), Rahuri, Maharastra

Major Mango Producing Belts in Odisha and Andhra Pradesh

Andhra Pradesh: Srikakulam, West Godavari, Guntur, Nellore, Prakasam, Chittoor, Kadapa, Anantapur, Kurnool, Mahabubnagar, Rangareddy, Medak, Nizamabad, vKarimnagar, Warangal, Adilabad, Khammam, Nalgonda.

Odisha: All Districts (Amrapali, Mallika), Koraput, Nabaranpur, Rayagade, Kendujhar (Keonjhar), Mayurbhanj, Kandhamal, Debagarh (Deogarh), Sundergarh, Sambalpur, Dhenkanal, Angul, Subarnapur (Sonepur), Cuttack, Puri, Gajapati.

Commercial mango varieties grown in different states

Andhra Pradesh	Banganapalli, Suvarnarekha, Neelum and Totapuri
Karnataka	Alphonso, Totapuri, Banganapalli, Pairi, Neelum and Mulgoa
Tamil Nadu	Alphonso, Totapuri, Banganapalli and Neelum

Himachal Pradesh	Chausa, Dashehari and Langra
Punjab	Chausa, Dashehari and Malda
Uttar Pradesh	Bombay Green, Chausa, Dashehari and Langra
West Bengal	Fazli, Gulabkhas, Himsagar, Kishenbhog, Langra and Bombay Green
Rajasthan	Bombay Green, Chausa, Dashehari and Langra
Haryana	Chausa, Dashehari, Langra and Fazli
Bihar	Bombay green, Chausa, Dashehari, Fazli, Gulabkhas, Kishen Bhog, Himsagar, Zardalu and Langra



Gujarat	Kesar, Alphonso, Rajapuri, Jamadar, Totapuri, Neelum, Dashehari and Langra
Maharashtra	Alphonso, Kesar and Pairi
Madhya Pradesh	Alphonso, Bombay Green, Dashehari, Fazli, Langra and Neelum

State wise availability of mango in India

Andhra Pradesh	March to mid – August
Bihar	May-end to mid-August
Gujarat	April to July
Haryana	June to August
Himachal Pradesh	mid-June to mid- August
Karnataka	May to July
Madhya Pradesh	Mid-April to July
Maharashtra	April to July
Rajasthan	May to July
Tamil Nadu	April to August
Uttar Pradesh	Mid-May to August
West Bengal	May to August

POLYEMBRYONIC CULTIVARS

- Bappakai
- Chandrakaran
- Goa
- Kurukkan
- Olour
- **Vellaiculamban**
- Nakkare
- Bellary
- Kasargod
- Mazagaon
- Nileswar Dwarf
- Salem

SUCKING MANGO CULTIVARS

- Small fruited,
- Highly fibrous types
- Can not be sliced easily

Ex:

- Gaurjit
- Safeda Jauhari
- Sukul
- Sinduri
- Yakuti
- Gilas
- Mithawa

COLOURED MANGO CULTIVARS

- Golabkhas Red (Sinduriya)
- Surkha Calcutta
- Zafran
- Husnara
- **Janardan Pasand**
- Lal Mulgoa
- **Vanraj**
- **Suvarnarekha**
- **Sensation**
(most brilliant coloured cultivars of mango from Florida, USA)

Banganpalli:

Bombay Green:

Carabao:

Creeping:

Dusehri Aman:

Edward:

Extrema: Native place Brazil

Fazli:

Florigon:

Naomi: originated in Israel

Menaka: selection from Gulabkhas, Bihar

Niranjan: Selection from private garden of Nizam.



Gaurjit:

Gulab Jamun:

Gulab Khas:

Headen: Florida

Himsagar:

Irwin: Florida

Jamadar: Gujarat

Jawahar: BAU, Sabour

Keitt: Florida

KMH-1: Cherukurasam x Khader

Commercial Cultivars for different Regions of India

Northern Region

Dashehari,
Langra,
Chausa
Bombay Green

Eastern Region

Himsagar,
Langra,
Fazli,
Krishnabhog
Gulabkhas

Western Region

**Alphonso,
Pairi,
Kesar,
Rajapuri,
Mankurad
Jamadar**

Southern Region

Bangalora, Neelum, Swarnarekha, Pairi(Peter),

Banganpalli, Mulgoa and Badami (Alphonso)

Rootstock:

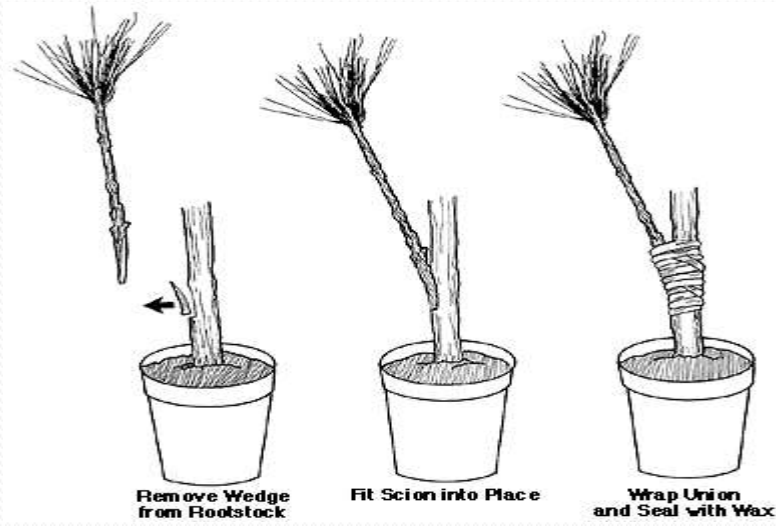
❖ **Seedling rootstock is used.**

Other rootstocks are:

- ✓ **Creeping: dwarfing**
- ✓ **Kurukkan: Polyembryonic and salt tolerant**
- ✓ **Olour: Dwarfing**
- ✓ **Rumani: Dwarfing**
- ✓ **Totapuri Red Small: dwarfing**

Veneer Grafting (commercial method):

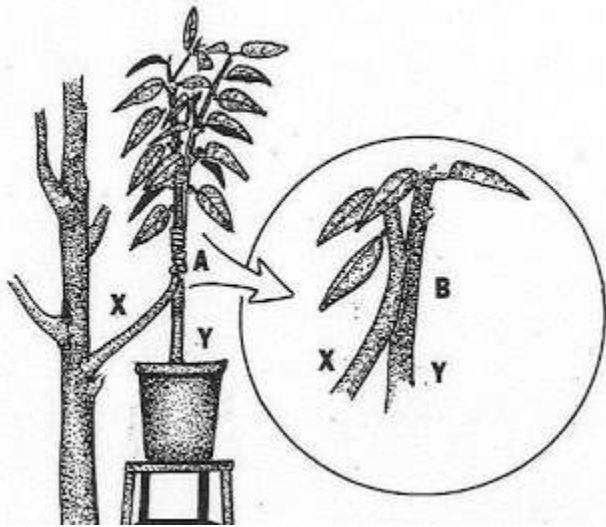
- ❑ In this method **a terminal shoot of 10-15 cm** length having pencil thickness is used as scion.
- ❑ **About 10 days before grafting**, the scion –shoot is defoliated to facilitate swelling of bud.
- ❑ **Shallow downward** incision is prepared on the root stock.
- ❑ Similar matching cut in slanting manner is prepared on lower portion of scion.
- ❑ Both rootstock and scion are united together **using polythene tape** .
- ❑ **During May and Sept** this system is quite successfully and good result is obtained.
- ❑ When scion sprouts completely, the upper portion of root stock above graft union is removed.



Inarching:

- ❑ In this method scion is detached after completion of union.
- ❑ **Root stock is grown in pot or container** and this root stock is brought close to the scion.
- ❑ 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.
- ❑ The root stock and scion shoots of pencil thickness are selected.
- ❑ Both are **brought to close to each other** and wrapped using polythene tape.
- ❑ When union takes place, the upper portion of rootstock is cut and scion shoot is detached from the mother plant.
- ❑ During **July-Aug** is the best time.

Inarching:



Epicotyl or Stone grafting

- ❑ It is also known **as stone grafting**.
- ❑ In this method **seeds of mango are sown in nursery bed** and covered with 5-7 cm thick layer of FYM.
- ❑ While sowing seed, **preference is given to sand bed** which provides ease in uprooting of seedling.
- ❑ The germinated seedlings of **7-10 days age**, when it leaves remain **coppery in colour** used for grafting.
- ❑ The seedling is **deheaded at a height of 10 cm** above the ground level.
- ❑ A **vertical cut of 2.5-4cm** length is given on deheaded portion of rootstock.

- ❑ **Scion 2-3 months age** having pencil thickness is used.
- ❑ The leaves of scion is defoliated 10 days before grafting to facilitate sprouting.
- ❑ After uniting the rootstock and scion, it is wrapped using polythene tape.
- ❑ The grafted plants are maintained in other bed or pots in nursery.
- ❑ This method of grafting is practiced during **June-July** during which environment remains sufficiently moist.

Epicotyl or Stone grafting



Fig: 1 ten days old seedling



Fig: 2 scion prepared for the grafting



Fig: 3 scion union at the base of grafted rootstock



Fig: 4 one year old graft for sale

Soft wood grafting

- ❑ It is very successful technique of *in situ* grafting.
- ❑ In this method mango seeds are sown at desired distance in the field.
- ❑ When plant becomes **one year old** and **attain pencil thickness**, it is used for grafting.
- ❑ **It is done during rainy season when new growth appears on rootstock.**
- ❑ When new leaves start turning **green from coppery colour** grafting is performed.
- ❑ Scion shoot 10-15 cm length, 3-5 months of age and pencil thickness girth is selected.

- ❑ At 10-15 cm height, the root stock is beheaded and **left 3-4 leaves.**
- ❑ A vertical slit of 2.5-4.0 cm length is given on rootstock.
- ❑ On scion shoot similar matching cut is prepared in slanting manner on both the surface in lower portion.
- ❑ It is inserted in incision on rootstock and wrapped using polythene tape.
- ❑ In about 4-5 weeks sprouting starts and graft starts growing.

Planting distance:

Plant to Plant: 8 to 10 m.

Row to Row: 8 to 10 m.

For high Density Planting: 5 x 5 m

Planting System: Square, Quincunx, or Triangular system.

Planting time: July to October

Pit size: 1 x 1 x 1 m

- ☐ Pit should be dug out and filled about one month before planting and allow to settle.
- ☐ Pit should be filled first with top soil, well mixed with 30 kg well rotten FYM.
- ☐ Then the pit should be filled with the subsoil mixed with 10-15 kg FYM and ½kg SSP and 10ml Chloropyrifos / 10 L water per pit

Planting time

July to October: Early planting is desirable.

If adequate irrigation facilities are available, **the plantation can be done in spring (February-March).**

Irrigate newly planted trees to get high survival rate.



☐ **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.

MANURING:

- 10 kg Fym, 2.5kg bone meal, 1.0 kg potassium sulphate for 1 year old plant and
- Increased by 5 kg FYM, 0.5 kg bone meal and 0.4 kg potassium sulphate per year till 10th year.
- Bearing trees may be given 750g N, 200g P₂O₅ and 1150g K₂O/year/tree.
- It is better always to apply organic manures during October.
- Manures should be applied in small trenches dug from about 1.5-2.0 m away from the trunk up to the drip line. Watering should be done soon if no rains.

Time of application:

Time of fertilizer application variable depending upon the method adopted and location.

Half dose of manures and fertilizers should be applied just after harvesting of fruits and rest half should be applied during the pea stage of fruit growth in the month of April.

For tropical climate: Beginning of monsoon.

For sub-tropical climate: Two month before flowering.

Srivastava (1984) suggested that following time for manuring in mango trees.

January-February: In, North India trees come to bloom in this period and manuring is done facilitate proper development of fruit.

June-July: Manuring is done in this period to enhance the vegetative growth. But it happens that major portion of fertilizers (especially nitrogenous fertilizer) wash out in case of heavy rain in North India.

September-October: This period is through to be better than June-July for fertilizer application in those area receiving heaving rainfall. This period of fertilizer application is recommended for most part of country.

- ❑ In A.P. the manures and fertilizers are applied in two split doses.
- ❑ First dose is given during June-July, consisting of complete **Nitrogen with half potash** at the onset of monsoon.
- ❑ The second dose is applied **during** September-October with FYM, **super phosphate and** remaining **half of potash**.

Foliar application:

- ☐ To promote growth, improve fruit set, yield and quality Foliar spray is given with urea @ 1-2% and
- ☐ Another after flowering and at marble stage to improve fruit set and to reduce fruit drop.

IRRIGATION:

- ☐ Irrigation should be given according to the soil and weather conditions.
- ☐ Bearing trees need to be irrigated regularly at 10-15 days interval from fruit set to maturity.
- ☐ Plant should be given rest by withholding irrigations at least 2-3 months before flowering for maximum fruit bud development.
- ☐ Through drip irrigation the tree may be given @ 40 liters/tree twice a week.

INTERCULTURAL:

- ❑ It should be done in pre-bearing period to keep the land free from weeds.
- ❑ Intercropping can also be taken with **phalsa, papaya and pineapple or vegetables** if irrigation facilities are available.
- ❑ Cover crops like **sun hemp, daincha, cow pea, cluster bean**, etc, can also be grown during rainy season and ploughed into the soil before the end of the rainy season.
- ❑ Land should be ploughed twice a year during April-May and October- November.

PRUNING AND TRAINING:

- ☐ Mango needs no regular pruning except removing dead and diseased branches.
- ☐ Young plants should be trained properly to get good framework.

Training:

- ❑ The training of mango plants in the initial stages is very essential to give them proper shape.
- ❑ At least 75 cm of the main stem should be kept free from branching and the first leader of main branch should be allowed.
- ❑ After that The main branches should be spaced in such a way that they grow in different directions and are at least 20-25cm apart. Otherwise there is every chance of breakage due to smaller crotch angles.

Pruning:

❑ Proper pruning of mango trees after the harvest gives the best results in *terms of disease and pest management*, diversion of food materials to the productive shoots, increased photosynthetic activity and increased carbohydrate and starch content, early production of new flush that bear the crop in the next season.

❑ Pruning also helps in increased *cytokinin, Ascorbic acid and auxin content*, which is beneficial for flowering. Abscissic acid level will also increase which inhibits the vegetative growth and promote flowering. Thus pruning helps in obtaining regular fruiting and production of quality fruits.

FLOWERING AND FRUIT SET:

□ Flower bud formation takes place 2-3 months prior to flowering.

• *Time of flowering:*

South India – November to December

East India – January to February

North India – February to March

• *Duration of flowering:* flowering period of flowering of mango is usually of short duration of 2 to 3 weeks, low temperature extends it and high temperature may shorten it.

Fruit Drop:

Fruit drop is serious problem in mango and cause great loss to the growers.

A tree producing several thousand panicles yields only a few hundred fruits. Most of the flowers falling down **after full bloom or at later stage of development.**

Only 0.1 to 0.25% perfect flowers or even less develop in to mature fruit.

❑ Maximum fruit drop takes place in **last week of April or first week of May** depends upon favourable condition.

Fruit Drop:

- ❑ The fruit drop can be divided into three distinct phases eg., **pin head drop, post setting drop** and **May drop**.
- ❑ The flower drop as well as the fruit drop is primarily due to the formation of **an abscission layer at the point of attachment of the fruit with the twig**.
- ❑ Several factors have been considered responsible for the formation of abscission layer.
- ❑ The causes can be divided into two-



External causes:

Unfavorable climatic conditions.

High incidence of serious diseases like powdery mildew and anthracnose and pests like hoppers and mealy bugs.

Internal causes:

- I. Poor soil**
- II. Lack of pollination**
- III. Low stigmatic receptivity**
- IV. Defective perfect flowers**
- V. Poor pollen transference**
- VI. Occurrence and extent of self incompatibility.**
- VII. Abortion of embryo**
- VIII. Degeneration of ovules.**
- IX. Competition between developing fruit lets.**
- X. Drought / lack of irrigation.**

Measures to prevent fruit drop:

Spraying of 2, 4-D @ 10 ppm or NAA @ 50 ppm at pea stage and at marble stage helps in preventing fruit drop.

Providing pollenisers for self incompatible types.

Maintaining sufficient soil moisture also prevents fruit drop and helps in increasing the size of the fruit.

Provision of wind breaks all around the orchards, which prevents drop due to high velocity winds at the time of fruit development.

Physiological disorder :

Mango malformation:

❑ Production of thick vegetative shoots and transformation of floral parts into a compact mass of sterile flowers.

❑ Some varieties like **Chausa** and **Bombay green** are more susceptible than others in N. India.

---Two types of malformation:

vegetative malformation and

Floral malformation.

Vegetative malformation: is more pronounced in young plants. Affected mango seedlings or young plants develop excessive **vegetative branches which have limited growth, swollen and with very short internodes and develop abnormally compact rosette like shoots presenting a bunchy top appearance.**



Dr. P. Srinivas, Senior Scientist, CHES (IIHR), Bhubaneswar, Odisha, India

Floral malformation: The affected inflorescence becomes clustered and round. Most of the flowers lack essential organs and don't set fruit and its inflorescence continuously hang on the tree for months, being more green and sturdy.

Causes: Various causes like nutritional disorders, physiological, viral and fungal are reported.



❑ Malformation is serious in **North India** than in **South India**. It may result in loss of about 50-60% crop.

❑ Krishnabhog, Collector, Langra, Neelum are tolerant (seedling trees are found to be tolerant).

Causes:

Virus, fungus, mites, nutrients, C/N ratio, carbohydrates, nucleic acids, amino acids, proteins, phenolic compounds, enzymatic activity in the plant, phytohormones and occurrence of malformation like substance are all supposed to be the probable causes for malformation.

Control measures:

- a. Destruct the infected small plant or plant parts
- b. Spraying a fungicide like Captan @ 3g. or Bavistin @ 1g. / litre of water
- c. Remove the affected parts by pruning 30 cm below and paste with Bordeaux paste.
- d. Early deblossoming at bud burst stage combined with NAA 20 ppm spray during October also reduces this considerably.
- e. Application of nutrients: High NPK added with FeSO₄, Cobalt sulphate

f. Growing of resistant varieties like **Bhadauran, Alib** and **Illaichi Bhardhan** are resistant and free from this infestation.

g. In spite of this, malformation is still a puzzling problem. It is therefore concluded that malformation can be kept under check by maintaining

- ✓ Orchards cleanly using disease free planting materials only.
- ✓ Regularly inspecting the orchard
- ✓ Regularly removing all malformation parts and
- ✓ Spraying of insecticides and after each pruning.

Spongy tissue:

- ❑ **A non-edible patch of flesh develops in the mesocarp of the fruit and becomes spongy, sour and yellowish is termed as spongy tissue.**
- ❑ **This can be detected only after cutting the ripen fruit.**
- ❑ **It is a physiological disorder in which the fruit pulp remains unripe because of un-hydrolised starch due to inactivation of ripening enzyme because of high temperature, convective heat, exposing to sunlight after harvest are supposed to be the causes.**
- ❑ **Alphonso variety is very susceptible to this spongy tissue.**

Remedial measures:

- ❑ **Sod culture and mulching** are useful in reducing spongy tissue.
- ❑ Growing mango hybrids **Ratna and Arka Puneet**, which are free from this problem.
- ❑ Harvesting fruits when they are **three fourths matured rather than fully matured ones** also reduces this malady.

Spongy tissue:



BLACK TIP:

- ❑ The distal end of fruit become **black and hard**
- ❑ Due to polluted atmosphere with smoke, carbon monoxide, carbon dioxide, sulphur dioxide, acetylene. \
- ❑ Spraying with Borax @ 0.6% from fruit set at 10-15 days intervals controls this disorder (Punjab, UP, Bihar, W,B).

Soft Nose

- ❑ Physiological disorder caused by **Ca deficiency** causing breakdown of flesh towards the apex of the fruit before ripening.

BIENNIAL BEARING IN MANGO:

Mango producing good crop one year and no crop or fewer crops in the next year is known as **biennial bearing or alternate bearing**. This is genetic and inherent in mango varieties.

CAUSES FOR BIENNIAL BEARING:

1. Climatological factors: Rain, high humidity, low temperature making on to off year
2. Age and size of shoots: Shoots of 8-10 months maturity will be productive.

3. Carbon/Nitrogen ratio: High carbon/moderate N encourages flower bud formation (30-40)

4. Hormonal balance: Higher levels of auxin and inhibitor like substance and lower levels of **gibberellins** like substances were found to be vital for a flowering shoot.

In spite of several studies, the biennial bearing is still an unsolved problem which is thought could be corrected by genetic engineering only.

SUGGESTIONS/ MEASURES:

- 1. Proper maintenance of mango orchards.**
- 2. Deblossoming in on year with NAA application.**
- 3. Smudging and chemical regulation like application of paclobutrazol (5-10gm/tree), spraying 1-2% KNO₃, 6-8% CaNO₃, etc.**
- 4. Pruning: Pruning of the fruited shoots to keep open the tree top properly.**
- 5. Growing regular bearing cultivars: **Bangalora, Rumani, Neelum, Amrapalli** and almost all hybrids.**

Harvesting:

❑ Mango normally takes 90-120 days from fruit set to maturity .

Stage of harvesting is very important, which will be indicated by

- (1) Starting of Colour development**
- (2) Falling of one or two fruits from the plant**
- (3) Specific gravity of 1.0 to 1.02(more reliable)**

❑ Fruits should be harvested individually along with pedicel and collected gently in baskets with the help of mango harvesters for minimizing damage.

Yield:

❖ The yield of mango depends on no. of factors like

- Age of the plant,
- Soil fertility,
- Climatic conditions,
- Variety, type of plant material like graft or seedling, management of the orchard etc.

❑ Mango grafts come to bearing in **about 2-3 years** but commercial yields can be had **from 8-10 years** and may continue up **to 40-60 years**.

❑ Average yield is **8 tonnes/ha** and may vary according to variety and locality.

PACKING AND TRANSPORT:

- ☐ Mangoes are normally packed in bamboo baskets using straw as the padding material.
- ☐ Wooden and card board boxes are also used. Wrapping fruits individually maintains the quality of the fruit.
- ☐ Waxing 3% with hot water treatment improves storage life.
- ☐ Mangoes can be stored at 5-14°C and 90% RH for about 2-7 weeks depending upon the variety.

Plant Protection

Mango hopper: Two sprays (at panicles emergency and at pea size of fruits) of carbaryl (0.15%), monocrotophos (0.04%) or phosphamidan (0.05).

Mealy bug :

- ✓ Ploughing inter spaces in November
- ✓ Dusting 2% methyl parathion @200 g per tree near the trunk
- Fixing 20 cm wide 400 gauge polythene strips around the trunk with grease applied on the lower edge in January as prophylactic measures and
- ✓ Two sprays of monocrotophos (0.04%) at 15 days interval as control are needed.

Powdery mildew: Two to three sprays of wettable sulphur (0.2%) or Karathane (0.1%) at 10-15 days interval.



Anthracnose: Two sprays of Bavistin (0.1%) at fortnight interval.



