

Model Profile for 1.0 ha Mango Cultivation

1. Introduction

Mango (*Mangifera indica*) is the leading fruit crop of India and considered to be the king of fruits. Besides delicious taste, excellent flavour and attractive fragrance, it is rich in vitamin A&C. The tree is hardy in nature, can be grown in a variety of soil and requires comparatively low maintenance costs. Mango fruit is utilised at all stages of its development both in its immature and mature state. Raw fruits are used for making chutney, pickles and juices. The ripe fruits besides being used for dessert are also utilised for preparing several products like squashes, syrups, nectars, jams and jellies. The mango kernel also contains 8-10 percent good quality fat which can be used for soap and also as a substitute for cocoa butter in confectionery.

2. Scope for Mango Cultivation and its National Importance

Mango occupies about 36% of the total area under fruits (2010-11) comprising of 22.97 lakh hectares, with a total production of 151.88 lakh tonnes. Uttar Pradesh and Andhra Pradesh are having the largest area under mango each with around 23% of the total area followed by Karnataka, Bihar, Gujarat and Tamilnadu.

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 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 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.

3. Technical Requirements of Mango Cultivation

3.1 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.

3.2 Soil

Mango can be grown on a wide range of soils from alluvial to laterite provided they are deep (minimum 6') and well drained. It prefers slightly acidic soils (pH 5.5 to 7.5)

3.3 Varieties

Though there are nearly 1000 varieties of mango in India, only following varieties are grown in different states : Alphonso, Bangalora, Banganpalli, Bombai, Bombay Green, Dashehari, Fazli, Fernandin, Himsagar, Kesar, KishenBhog, Langra, Mankhurd, Mulgoa, Neelam, Samarbehist, Chausa, Suvarnarekha, Vanaraj and Zardalu.

Recently some mango hybrids have been released for cultivation by different institutes / universities. A brief introduction to such varieties is presented below :

Mallika - It is a cross between Neelam and Dashehari. Fruits are medium sized cadmium coloured with good quality, reported to be a regular bearer.

Amrapali - It is a cross between Dashehari and Neelam. It is a dwarf vigorous type with regular and late bearing variety. It yields on an average 16 t/ha and about 1600 plants can be accommodated in one hectare.

Mangeera : It is a cross between Rumani and Neelam. It is a semi vigorous type with a regular bearing habit. Fruits are medium sized with light yellow coloured skin, firm and fibreless flesh and sweet to taste.

Ratna : It is a cross between Neelam and Alphonso. It is a regular bearer and free from spongy tissue. Fruits are medium sized with excellent quality. Flesh is firm and fibreless, deep orange in colour with high TSS (19-21° Brix).

Arka Aruna : It is a hybrid between Banganapalli and Alphonso with regular bearing habit and dwarf in stature. About 400 plants can be accommodated per hectare. Fruits are large sized (500-700 gm) with attractive skin colour. Pulp is fibreless, sweet to taste (20-22° Brix). Pulp percentage is 73 and the fruits are free from spongy tissue.

Arka Puneet : It is a regular and prolific bearing hybrid of the cross between Alphonso and the Banganapalli. Fruits are medium sized (220-250 gm) with attractive skin colour, having red blush. Pulp is free from fibre, pulp percentage being 70 percent. Fruits are sweet to taste (20-22° Brix) with good keeping quality and free from spongy tissue. It is a good variety for processing also.

Arka Anmol : It is a semi-vigorous plant type from the cross between Alphonso and Janardhan Pasand. It is also a regular bearing and free from spongy tissues. Fruits ripen to uniform yellow colour. Keeping quality of the fruit is very good and it is suitable for export. It has got excellent sugar and acid blend and fruits weigh on an average about 300 g, Pulp is orange in colour.

3.4 Propagation

Farmers should always get vegetatively propagated, true to type plants from recognised nurseries. Inarching, veneer grafting, side grafting and epicotyl grafting are the popular methods of propagation in mango.

3.5 Planting

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 of 5m X 5m. 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.

3.6 Training and pruning

About one meter from the base on the main trunk should be kept free from branching and the main stem can be allowed thereafter spaced at 20-25 cm apart in such a way that they grow in different directions. Branches which cross over/rub each other may be removed at pencil thickness.

3.7 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.

3.8 Irrigation

Young plants are watered frequently for proper establishment. In case of grown up trees, irrigation at 10 to 15 days interval from fruit set to maturity is beneficial for improving yield. However, irrigation is not recommended for 2-3 months prior to flowering as it is likely to promote vegetative growth at the expense of flowering.

3.9 Inter cropping

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. The water and nutrient requirements of the inter crops must be met separately.

3.10 Plant Protection

Mango is prone to damages by a large number of pests, diseases and disorders. The recommended control measures for most important and common among them are briefed below :

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 and dusting 2% methyl parathion @200 g per tree near the trunk and 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.

Malformation: One spray of 200 ppm NAA in October followed by de-blossoming at bud burst stage in December - January.

Fruit drop: Regular irrigation during fruit development, timely and effective control of pests and diseases and spraying 20 ppm NAA at pea size of fruits.

3.11 Harvesting and yield

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.

3.12 Post-Harvest Management

Storage: Shelf life of mangoes being short (2 to 3 weeks) they are cooled as soon as possible to storage temperature of 13°C. A few varieties can withstand storage temperature of 10°C. Steps involved in post-harvest handling include preparation, grading, washing, drying, waxing, packing, pre-cooling, palletisation and transportation.

Packaging: Mangoes are generally packed in corrugated fibre board boxes 40 cm x 30 cm x 20cm in size. Fruits are packed in single layer 8 to 20 fruits per carton. The boxes should have sufficient number of air holes (about 8% of the surface area) to allow good ventilation.

Financial institutions have also formulated mango financing schemes in potential areas for expansion of area under mango. Individual mango development schemes with farm infrastructure facilities like well, pumpset, fencing and drip irrigation system etc. have also been considered.

The techno-economic parameters for the model project are detailed in **Annexure I**.

4. Financial Viability & Bankability

4.1 Project Cost

The unit cost varies from state to state. The cost presented here is indicative only. The entrepreneurs and the bankers are requested to consult our Regional Offices for the latest information in this regard. The unit cost estimated for this model scheme is Rs.75500 per ha capitalised upto the fifth year. The break-up details are given in **Annexure II**.

4.2 Margin Money

The margin money / down payment prescribed is 5 %, 10 % and 15% for small, medium and other farmers respectively. The rest of the cost of development will be provided as bank loan. However, in the present model, 10 % of the unit cost i.e. Rs.7600/ha has been considered as margin money.

4.3 Bank Loan

Bank loan of 85 - 95 % of the total cost of development shall be available from the financing

institution. Bank loan considered in the model is 90%. It works out to Rs.67900/ha in the model.

4.4 Rate of Interest

Banks are free to decide the rate of interest within the overall RBI guidelines issued from time to time. However, the ultimate lending rate has been considered as 12 % for working out the bankability of the model project.

4.5 Security

Banks are guided by RBI guidelines issued from time to time in this regard.

4.6 Financial Analysis

The detailed calculation of project's income and expenditure has been indicated in **Annexure III**. IRR, NPW and BCR for the model works out to 31 %, Rs. 1,07,956/- and 1.42:1 respectively and the details are given in **Annexure IV**.

4.7 Repayment period of loan

Based on the cash flow the detailed repayment schedule has been worked out and furnished in the **Annexure V**. The repayment period works out to ten years including five years grace period for repayment of principal.

DISCLAIMER

The views expressed in this model project are advisory in nature. NABARD assume no financial liability to anyone using the report for any purpose. The actual cost and returns of projects will have to be taken on a case by case basis considering the specific requirement of projects

Annexure I : Techno-economic parameters

| | |
|---------------------------------------|-------------|
| Spacing | 10 m x 10 m |
| Plant Population (plants/ha) | 100 |
| Land preparation (Rs./ha) | 1500.00 |
| Labour (Rs./manday) | 200.00 |
| Planting material (Rs./plant) | 40.00 |
| Farm Yard Manure (Rs./MT) | 120.00 |
| Urea (Rs./kg) | 5.70 |
| Single Super Phosphate (Rs./kg) | 5.80 |
| Muriate of Potash(Rs./kg) | 16.60 |
| Plant protection material (Rs./litre) | 300.00 |
| Sale price (Rs./kg) | 15.00 |

Annexure II : Project Cost

(Amount in Rs.)

| Items | Year | | | | | Total |
|-----------------------------------|-------|-------|-------|-------|-------|-------|
| | 1 | 2 | 3 | 4 | 5 | |
| Cultivation expenses | | | | | | |
| Land preparation | 1000 | 0 | 0 | 0 | 0 | 1000 |
| Digging and filling up of pits | 2000 | 0 | 0 | 0 | 0 | 2000 |
| Plant material | 4600 | 0 | 0 | 0 | 0 | 4600 |
| Planting and staking | 1600 | 0 | 0 | 0 | 0 | 1600 |
| Cost of FYM | 3600 | 3000 | 3000 | 3600 | 3600 | 16800 |
| Cost of fertilizers | 370 | 620 | 740 | 960 | 1550 | 4240 |
| Manures & fertilizers application | 1200 | 1600 | 1600 | 1600 | 2000 | 8000 |
| Irrigation | 2000 | 2000 | 2000 | 1400 | 1000 | 8400 |
| Plant protection measures | 1500 | 1500 | 3000 | 3000 | 3600 | 12600 |
| Appl. of plant protection | 600 | 600 | 800 | 800 | 1200 | 4000 |
| Interculture | 1000 | 1000 | 1600 | 1600 | 2000 | 7200 |
| Intercropping | 2000 | 0 | 0 | 0 | 0 | 2000 |
| Live fencing | 2000 | 0 | 0 | 0 | 0 | 2000 |
| Harvesting | 0 | 0 | 0 | 0 | 1000 | 1000 |
| TOTAL | 23470 | 10320 | 12740 | 12960 | 15950 | 75440 |
| Rounded off | 23500 | 10300 | 12700 | 13000 | 16000 | 75500 |

Annexure III : Income – Expenditure Statement

| | | | | | | |
|--|--|--|--|--|--|-----------------|
| | | | | | | (Amount in Rs.) |
|--|--|--|--|--|--|-----------------|

| Items | Year | | | | | | |
|-----------------------------------|-------|-------|-------|-------|--------|--------|--------|
| | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Income | | | | | | | |
| Yield (Kg per plant) | 20 | 30 | 35 | 50 | 75 | 100 | 125 |
| Yield (Kg per ha) | 2000 | 3000 | 3500 | 5000 | 7500 | 10000 | 12500 |
| Income | 30000 | 45000 | 52500 | 75000 | 112500 | 150000 | 187500 |
| | | | | | | | |
| Expenditure | | | | | | | |
| Cost of FYM | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 | 1500 |
| Cost of fertilizers | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 | 2500 |
| Manures & fertilizers application | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| Irrigation | 1000 | 800 | 800 | 800 | 800 | 800 | 800 |
| Plant protection measures | 3600 | 4500 | 4500 | 4500 | 4500 | 4500 | 4500 |
| Appl. of plant protection | 1200 | 1600 | 1600 | 1600 | 1600 | 1600 | 1600 |
| Interculture | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| Harvesting | 1000 | 3000 | 3000 | 3000 | 3000 | 3000 | 3000 |
| TOTAL | 14800 | 17900 | 17900 | 17900 | 17900 | 17900 | 17900 |
| Rounded off | 15000 | 18000 | 18000 | 18000 | 18000 | 18000 | 18000 |
| Surplus | 15000 | 27000 | 34500 | 57000 | 94500 | 132000 | 169500 |

Annexure V : Loan Repayment Schedule

(Amount in Rs.)

| Year | Loan O/s at the beginning of the year | Interest @12.0% | Gross surplus | Repayment | Deferred Interest | Total outgo | Net surplus | Loan O/s at the end of the year |
|------|---------------------------------------|-----------------|---------------|-----------|-------------------|-------------|-------------|---------------------------------|
| | | | | Principal | Interest | | | |
| 1 | 21150 | 2538 | 10000 | 0 | 2538 | 0 | 2538 | 7462 |
| 2 | 30420 | 3650 | 10000 | 0 | 3650 | 0 | 3650 | 6350 |
| 3 | 41850 | 5022 | 10000 | 0 | 5022 | 0 | 5022 | 4978 |
| 4 | 53550 | 6426 | 10000 | 0 | 6426 | 0 | 6426 | 3574 |
| 5 | 67950 | 8154 | 15000 | 0 | 8154 | 0 | 8154 | 6846 |
| 6 | 67950 | 8154 | 30000 | 5000 | 8154 | 0 | 13154 | 16846 |
| 7 | 62950 | 7554 | 27000 | 10000 | 7554 | 0 | 17554 | 9446 |
| 8 | 52950 | 6354 | 34500 | 15000 | 6354 | 0 | 21354 | 13146 |
| 9 | 37950 | 4554 | 57000 | 30000 | 4554 | 0 | 34554 | 22446 |
| 10 | 7950 | 954 | 94500 | 7950 | 954 | 0 | 8904 | 85596 |

* Income from intercrop taken into account for first 4 years