

Mango nursery – A profitable enterprise

Mango is the most popular fruit among all sections of the society due to its wide range of adaptability, high nutritive value, variety, delicious taste, and excellent flavour. Diversification with new varieties for export, processing, and the domestic market is resulting in the area to expand. Farmers and field workers report that a major bottleneck is the lack of high-quality planting material. The efficiency of propagation techniques varies by region, depending on the climate, rootstock vigour, scion health and vigour, and variety.

THE scarcity of high-quality planting material is a major stumbling block to expanding the area covered by elite varieties of mango. Due to climatic conditions, the efficiency of propagation techniques varies from region to region. Mango propagation through seedlings is not recommended due to their long juvenility and heterozygosity. Inarching is still the most widely used traditional propagation method in the country. In previous years, veneer and wedge grafting experiments in Madhya Pradesh, Uttar Pradesh, Andhra Pradesh, and Bihar yielded high success rates. For the Konkan region of Maharashtra and other coastal regions, epicotyl (stone) grafting and soft wood grafting are suitable.

These findings prompted the adoption of newer grafting techniques such as veneer and wedge grafting in north India; soft wood, stone, and wedge grafting in eastern India; and side grafting in western India. Coastal areas with high humidity and moderate temperatures are ideal for stone and epicotyl grafting for mass multiplication. Protected nurseries in poly houses and net houses equipped with sprinklers, foggers, and drips are being used to overcome climatic barriers and increase the humidity level rate for optimal graft success.

Selection of seeds for rootstock growing, superior cultivars (mother-plant) as scion sources; scion preparation, packing, and transport; grafting technique; and maintenance of the grafted plant until planting, are all steps that are required for a successful venture.

Raising of rootstock

In general, standard rootstocks in mango are not used for grafted plant preparation in the country. Salt tolerant rootstock (13-1) has been used in very limited places with problematic soils. Freshly collected stones are sown in raised nursery beds in July and covered with moist leaf mould to raise rootstocks. Within three weeks of sowing, the seeds germinate and about 80% of stones germinate within one month of extraction. To prevent the fungus *Sclerotium* from causing collar rot, the stones should be washed and made pulp-free, treated with fungicide before sowing.

When the leaves turn from coppery red to green, the seedlings are moved to permanent nursery beds at 45 cm between rows and 25 cm between seedlings. Directly sowing may be done into porous organic matter and well-drained substrate inside pots or polyethylene bags. Mango seeds should be planted at a depth of 10-15 cm in a seedling bed with a depth of 25 cm of soil substrate. Due to the rapid development of the mango root system, the size and depth of the polyethylene bags are critical. In smaller bags, the roots come into contact with the bag's bottom, resulting in poor root development. Mango grafts can be made using open bottom bags with a type of railing structure that allows for adequate aeration and tap root pruning with a prune scissor, resulting in better secondary and tertiary root growth and more vigorous mango rootstock.

For each cubic metre of substrate for rootstock raising, 3 parts soil, 1 part farmyard manure should be used. The size of the bag is determined by how long grafts will be kept in the nursery before being planted. Bags of common size are 15.0-20.0 cm long, 12.5-15.0 cm wide, and 0.15-0.20 cm thick, containing about 1.8-2.0 kg of mixture for a one-year grafted plant, keeping in mind plant transportation.

Softwood grafting

The softwood grafting is similar to that of cleft or wedge grafting. Grafting is performed on newly emerged flushes. Softwood grafting can be used *in situ* to establish new orchards with pre-existing rootstocks in the field. Softwood grafting on pre-established rootstocks can be useful for establishing orchards in drier areas. The scion wood should be defoliated with the same thickness as the terminal shoot 10 days before grafting. The graft should be firmly secured with a 1.5 cm wide, 200-gauge polyethylene strip. The months of July and August, with high humidity and moderate temperatures, are ideal for softwood grafting success.

In this technique, the graft union is higher above the ground, and rootstock sprouting may interfere with scion



Wedge grafting in mango



Excellent success in wedge grafting in mango

growth if sprouts are not pinched off.

Veneer grafting

Veneer grafting has largely replaced inarching in many parts of the country due to its greater efficiency. Several factors, such as the age and thickness of the scion, the time of grafting, and the defoliation period of the scion stick, all play a role in determining grafting success. This method works best with rootstocks that are at least a year old. However, if the stock reaches a suitable thickness (about 1 cm) before a year, it can be used as rootstock. A scion stick that is 4-6 months old has a better chance of success. The scion sticks are pre-defoliated in order to activate the axillary and apical buds. At a height of about 20 cm, a downward and inward 3-4 cm long cut is made in the smooth area of the rootstock. A small shorter cut is made at the base of the cut to intersect the first and remove the piece of wood and bark. To match the stock cuts, the scion stick is given a long slanting cut on one side and a small short cut on the other. The scion is inserted into the stock in such a way that the cambium layers are on the longer side. The graft union is then wrapped in a 1.5 cm wide, 200-gauge polyethylene strip. The rootstock should be clipped in stages after the scion has been green for more than 10 days. Veneer grafting is advantageous because the graft can be prepared from scion sticks found in remote locations.

Stone (Epicotyl) grafting

Epicotyl grafting is a fast method of mango propagation that has a success rate of 75-80%. As rootstock, newly sprouted mango stones are used in this technique. The stones are planted on raised beds in June and July. The beds should be prepared by combining soil and FYM in a 2:1 ratio. Seedlings with tender stems and coppery leaves are lifted with stones after germination. After washing the soil, the roots and stones are dipped in a 0.1% Carbendazim solution for 5 min. Seedling stems are headed back, leaving a 6-8 cm long stem. A 4-6 cm longitudinal cut is made through the centre of the stem.

On the lower part of the scion stick, a wedge-shaped cut is made starting on both sides. The scion stick should be at least 4-5 months old and 10-15 cm long, with plump terminal buds. The scion stick is then inserted into the seedling cleft and secured with polyethylene strips. After that, the grafts are planted in polyethylene bags containing potting mixture. The bags are kept in the shade to avoid heavy rain. Around 15-20 days after grafting, the scion begins to sprout. During this time, removal of any sprouts on the rootstock below the graft union should be taken care. July is the best month for stone grafting.

The benefits of stone grafting include high success rates in areas with mild climates and high humidity, rootstock that is graftable in a short period of time, and the method being inexpensive and simple. Adverse climatic conditions significantly reduce grafting success rates.

Wedge grafting

This technique can be used with rootstock that is larger in diameter than the scion and it can also be used for top working. A healthy and vigorous scion stick is chosen at the age of 3-4 months. The scion (12-15 cm long) should have swollen buds but not sprouted. Grafting can be done on seedlings that are one year old, uniform, and healthy. Rootstocks are defoliated and only 3-4 leaves are left on them. At the bottom of the bud stick, two 3.5 cm long slant cuts are made in a wedge shape. Rootstock should be pushed back 20-30 cm above the ground. A 3-4 cm deep straight cut is made at the top of the rootstock. The scion stick is pushed firmly into the rootstock cut and wrapped with the graft plastic strip tightly. Any buds that sprout beneath the graft union is removed.

Under favourable environmental conditions, the grafting technique has a very high success rate. Pre-defoliated scions outperform freshly defoliated shoots. The grafting operation is carried out during the rainy season. However, the grafting season can be extended if the temperature and humidity in the poly house are made favourable. Before the scion sprouts and grows, the leaves on the rootstock play an important role in grafting

success. As a result, at least 3-4 leaves are retained on the stalk during grafting. The plastic strip and all shoots that develop below the graft union are removed once a sufficient number of leaves appear on the scion. When the shoots' leaves are mature, the new plant is transplanted.

Inarching

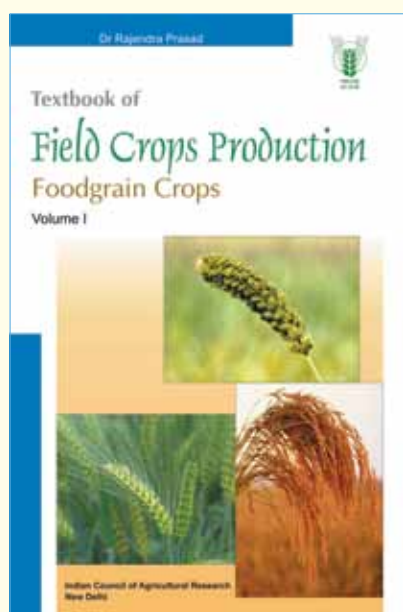
Although inarching or approach grafting is a time-consuming and labour-intensive method, it is still the most widely used method for commercial mango propagation in many parts of the country. By approach grafting, the selected shoot (scion) of a desired mother plant is joined to the potted or transplanted seedling (rootstock). Seedlings that are one year old and have reached a height of 30-45 cm and a thickness of 0.75 to 1.5 cm are ideal for this purpose. A thin slice of bark and wood, about 5 cm long, 7.5 mm wide, and 2 mm deep, is removed from

the stem of the stock as well as the scion branch with a sharp grafting knife. The resulting cuts should be perfectly flat, clean, boat-shaped, even, and smooth. Both the cut surfaces of the stock and the scion are made to face each other so that there is no hollow space between the two. Polyethylene strips 1.5 cm wide are wrapped around the union. After about a month of operation, the scion below the graft union and the stock above the graft union should be given light "V" shape cuts at weekly intervals until the grafts can finally be detached. Finally, the top of the stock above the graft union should be completely removed.

For further interaction, please write to:

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(Volume I)

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