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Propagation for Production of Elite Planting Material of Mango

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As many as 94 countries of the world have been growing mango but India continues to be the largest mango producing country in the world. But productivity is low in comparison to other countries. The reasons of low productivity are inferior planting material, adoption of low yielding & poor-quality varieties, traditional system of planting, improper canopy management, infestation of insect-pest & disease and faulty orchard management practices. Therefore, to increase the productivity the promising varieties and appropriate management practices and technologies should be adopted for mango cultivation. Good and quality planting material can be achieved by adopting suitable propagation methods. Propagation of plants is the process of producing new plants from existing ones. It is both art and science requiring knowledge, skill, manual dexterity, and experience for success. In nature, plants multiply naturally to sustain themselves. However, the propagation process has got commercial popularity only recently. Now-a-days, propagation practice has been totally modernized. Propagation practices have advanced from field to in-vitro. Starting from scion stick of 15 to 20 cm length, the plants are multiplied even using cell, tissue and embryo. In modern horticulture trade, plant propagation is a soaring business. It is highly profitable, employment generative, recreative and creative business.

Propagation for elite planting materials: Mango, as a cross-pollinated crop, does not guarantee true-to-type plants through sexual propagation. Consequently, nowadays, seed propagation in mango is primarily reserved for raising seedlings (rootstocks) to be used in grafting within nurseries, on-site orchards, and for the development of hybrids. The heterozygous nature of mango has necessitated the development of vegetative methods to maintain the existing superior varieties and clones.

Rootstock: Seedlings are initially cultivated as rootstocks for vegetative propagation. Mango seeds or stones should be sown in beds mixed with well-decomposed farmyard manure during the months of July and August. Farmyard manure (FYM) is incorporated at a rate of 8-10 tonnes per hectare. Alternatively, 25.0 kg of nitrogen per hectare may be applied in the form of urea, calcium ammonium nitrate (CAN), or any other available inorganic source after the leaves have turned green, in two split doses at 20-day intervals. When the seedlings reach the age of one month, they should be transplanted into well-prepared beds or black perforated polybags. During this period, proper care must be taken to promote the optimal growth of the young seedlings. Protection from frost can be achieved by placing the pots under shade or thatching the young seedlings in the field or by using a shed net or a temperature and humidity-controlled polyhouse. Plants are typically propagated using random seedling rootstocks, although polyembryonic rootstocks have shown promise in producing uniform-sized and vigorous plants.

Vegetative methods of propagation: It ensures genuine and true to the type plants. Hence, commercially mango is propagated through vegetative methods. Several methods of vegetative propagations have tried with varying successes. Some of the important commercial methods of vegetative propagation are inarching, veneer grafting, soft wood grafting and stone/epicotyls grafting which are described as below:

a) Inarching: This method is an old and traditional approach commonly practiced by private nurserymen (Fig. A). Although inarching or approach grafting is quite cumbersome and time-consuming, it remains the leading method for the commercial propagation of mango plants. This method typically involves uniting the selected shoot (scion) of a desired parent tree (mother plant) with a seedling (rootstock) through the approach method. For this purpose, one-year-old seedlings are most suitable when they reach a height of about 30-45 cm and a thickness ranging from 2.0 to 2.5 cm. These seedlings can be grown either in pots or under the mother plant from which the grafts will be prepared, depending on the availability of suitable branches. Generally, a one-year-old twig from the scion tree, about 15-20 cm in length and nearly the same thickness as the stock, is selected for grafting. To use this method, a mother plant or mother block is developed, where the branches of the mother plants are specially trained to prepare grafts.

Inarching should be performed during the growing period when the tree is actively flowing sap and experiencing active growth. Hot, very dry, and winter periods, as well as heavy rainfall periods, are not suitable for inarching. The end of the monsoon in areas with heavy rainfall and the early monsoon in areas with light rainfall are the best times for inarching. In North India, July-September is the ideal period for inarching. In the more temperate climate of South India, the operation can be conducted anytime between July and February.

A thin slice of bark and wood, approximately 5 cm in length, 7.5 mm in width, and 2 mm deep, is removed from the stem of both the rootstock and the scion branch. These dimensions can be adjusted proportionally based on the thickness of the stock and scion using a sharp grafting knife. The cuts made should be flat, clean, boat-shaped, even, and smooth. The ends of these cuts should be rounded rather than angular. The cut surfaces of both the stock and scion are aligned to face each other, leaving no hollow space between them. They are then tightly secured with polythene/alkathene strips, preferably 1.5 cm in width and 200-gauge thickness. After about a month, the scion below the graft union and the stock above the graft union should be lightly trimmed in a 'V' shape at weekly intervals, and the grafts can be finally separated during the fourth cut. In the last stage, the top of the stock above the graft union should be completely removed.

(b) Veneer grafting: This method is simple and can be successfully adopted (Fig. B). The rootstocks mentioned for inarching are also suitable for this technique. To perform grafting, create a 30–40 mm long downward and inward cut in the smooth area of the stock, at a height of about 20 cm. At the base of the cut, make a shorter incision to intersect the initial one, removing a piece of wood and bark. The scion stock should have a long slanting cut on one side and a small short cut on the other to match the stock's cuts. Insert the scion into the stock, ensuring the cambium layers make contact on the longer side. Secure the graft union with a polythene strip, as recommended for inarching. Once the scion has taken and remains green for more than 10 days, the rootstock should be pruned in 2-3 stages. The scion wood used for veneer grafting requires proper preparation. Select shoots that are about one year old and pencil-thick in size. Defoliate the desired shoots at least one week before grafting to activate the dormant buds in the axils of the leaves, causing them to swell slightly. The best time for this method is also the same as for inarching. This propagation method shows promise for mass-scale commercial propagation.

c) Stone/epicotyls grafting: In this method, success typically reaches as high as 75-80 percent (Fig. C). However, there is some mortality after the final transplanting. For grafting, sprouted mango stones serve as rootstocks, and semi-mature terminal shoots measuring 12-15 cm in length, which have already passed the purple coloration stage, are used as scions. The grafting process can be performed using either the cleft or whip method. The grafts should be placed in a polyhouse in the nursery for 12-14 days, maintaining high humidity (more than 80%). During this period, proper union occurs, and the scion begins to sprout. The grafts are then potted and kept in a greenhouse or a shaded location for some time before their final transfer to the field. The presence of stored food material in the stones and high meristematic activity contributes to proper healing and subsequent scion growth. Grafts prepared using this method require less time and are more cost-effective compared to inarching and veneer grafting.

(d) Soft-wood grafting: The technique of softwood grafting is akin to cleft grafting (Fig. D). In this instance, grafting is performed on newly emerged growth with bronze-colored leaves and stems. This approach proves beneficial for establishing an orchard in its original location. The scion wood to be employed should be defoliated 10 days before grafting and match the thickness of the terminal shoot. The graft should be securely fastened using 1.5 cm wide and 4.5 cm long 200-gauge polythene strips. July and August stand out as the optimal months for conducting softwood grafting.

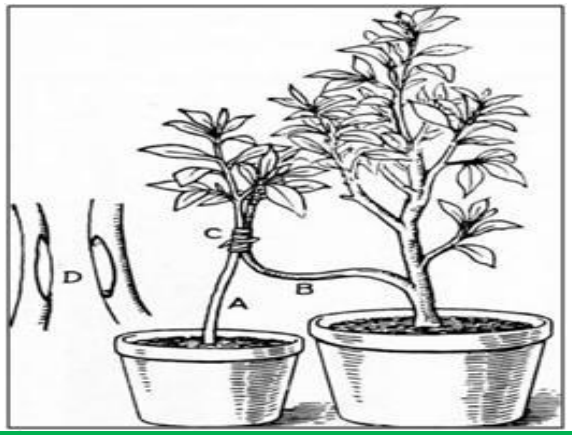

Fig. A. Inarching method

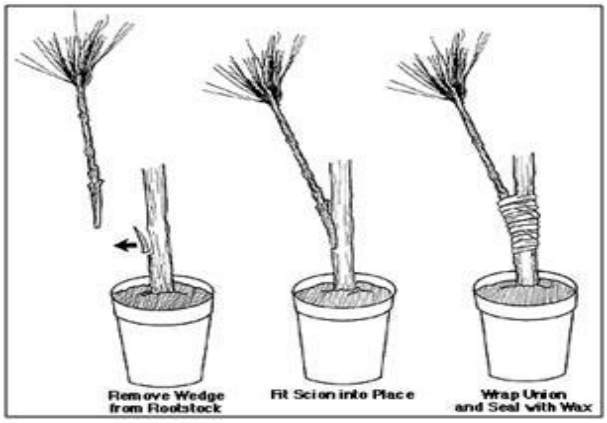

Fig. B. Veneer grafting

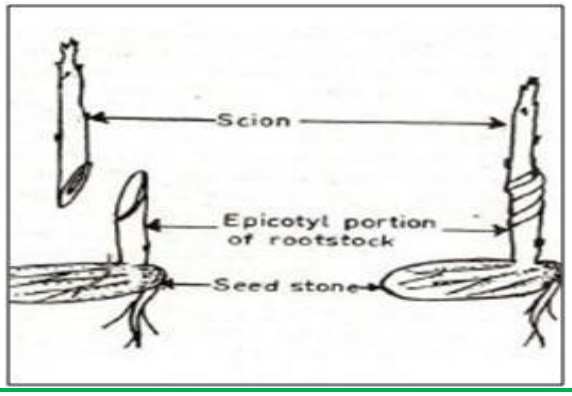

Fig. C. Stone/epicotyls grafting

Fig. D. Soft-wood grafting

Establishing and maintaining mother block: It is essential to allocate a separate space for creating a Mother Block within the nursery premises. The selection of elite mother plants is of paramount importance and should be carried out with great care, as the characteristics of

the mother plant will significantly influence the performance of the progeny. The full performance of the progeny becomes evident only after it reaches the bearing age, which is typically 5-8 years in the case of mangoes. A permanent register that indicates the layout of promising varieties in the region must be kept. Normally, the ideal period for mango propagation in northern India is 3-4 months (July-September). However, by utilizing automatic or semi-automatic polyhouse and net house structures, the propagation period can be extended to 8-9 months, resulting in greater success.

Preparing the rooting media and filling poly bags: Instead of propagating in a bed, it is advisable to use UV-stabilized poly bags for plant multiplication, as the rooting media or potting mixture plays a crucial role in producing healthy and disease-free plants. The recommended mixture includes soil (1 part), sand (1 part), and FYM or vermicompost (1 part), which should be thoroughly mixed. To ensure sterilization, it is best to steam sterilize the mixture, as it leaves no residual effects and is highly effective. Alternatively, opt for solar sterilization by spreading the mixture thinly on a cemented floor during May-June and covering it with a white polyethylene sheet. Poly bags of appropriate sizes can be used at various stages of plant multiplication. Sterilizing the entire soil is both cumbersome and expensive. However, you can economically sterilize the limited amount of rooting medium used in the containers. Additionally, containers can be relocated to a greenhouse to protect plants from rain, cold, or extreme temperatures for accelerated growth.

Conclusion

In conclusion, the propagation of elite mango planting material is a crucial element in ensuring the ongoing success and sustainability of mango cultivation. Through the utilization of various propagation methods, such as grafting, budding, and tissue culture, we can preserve the genetic purity and quality of superior mango varieties and clones. This not only results in increased yields and improved fruit quality but also enhances the overall profitability of mango farming. Furthermore, the development of innovative techniques and research in this field will make valuable contributions to the diversification and evolution of mango varieties, addressing challenges such as disease resistance and adaptability to different environmental conditions. By continuously advancing our understanding and practices in elite mango planting material propagation, we can secure a prosperous future for mango production and meet the growing demands of consumers worldwide.