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From One to Many: A Simple Guide to Macropropagation of Bael

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Bael (*Aegle marmelos*) is a sacred and medicinal fruit tree widely valued in India for its nutritional, cultural, and drought-tolerant properties. However, large-scale cultivation often faces the challenge of obtaining true-to-type planting material because seed propagation leads to genetic variation. Macropropagation offers a practical and low-cost solution for multiplying superior bael plants without the need for laboratory facilities. Techniques such as budding, grafting, air layering, and stem cuttings allow farmers to produce uniform plants with desirable traits like high yield, better fruit quality, and early bearing.

What is Macropropagation?

Macropropagation is a simple, low-cost plant multiplication technique used to produce many plants from a selected mother plant. Unlike micropropagation (tissue culture), it does not require sophisticated laboratory facilities. Instead, it relies on natural regenerative ability of plants using techniques such as branch cuttings, layering, budding and grafting. In bael, macropropagation helps in multiplying elite trees that have desirable traits like high fruit yield, better pulp quality, disease resistance, or early bearing.

Why Macropropagation is Important in Bael

Bael is commonly propagated through seeds, but seed propagation has a major drawback i.e., genetic variation. Seed-grown plants may not retain the superior qualities of the parent tree. This leads to inconsistency in fruit size, taste, and yield.

Macropropagation ensures:

- Uniform plants with true-to-type characteristics
- Faster establishment of orchards
- Early fruiting compared to seedlings
- Conservation of superior germplasm

Simple Methods of Macropropagation in Bael

1. Budding

Budding is one of the most successful methods for bael propagation. A healthy bud from a superior mother plant is inserted into a rootstock. Once union occurs, the bud grows into a new plant with the same characteristics as the parent.

Patch budding or T-budding

Steps:

- Select 8–12 month old healthy rootstock seedlings.
- Choose a mature, disease-free bud from the desired mother plant.
- Make a suitable cut on the rootstock and insert the bud patch.
- Tie firmly with budding tape or polythene strip.
- After 2–3 weeks, check for bud union and remove the wrapping.

Advantages:

- High success rate under proper humidity

- Efficient use of scion material
- Early fruiting compared to seedlings

2. Grafting

In grafting, a scion (a shoot from the desired plant) is attached to a compatible rootstock. Softwood grafting is commonly practiced in bael and shows good success rates under proper humidity and temperature conditions. Three types of grafting are commonly practiced in bael.

Whip Grafting (Splice Grafting)

Whip grafting is suitable when both the rootstock and scion are of equal diameter, usually pencil thickness. In this method, long slanting cuts are made on both the rootstock and the scion so that they fit together closely, ensuring good contact of the cambium layers.

Best time:

Late winter to early spring, before active growth begins, or during mild weather conditions.

Procedure:

- Select healthy rootstock seedlings (8–12 months old).
- Choose a disease-free scion stick with 2–3 healthy buds.
- Make a slanting cut (about 3–5 cm long) on the rootstock.
- Make a similar slanting cut on the scion.
- Place the two cut surfaces together so that the cambium layers match properly.
- Tie firmly with grafting tape or polythene strip.
- Keep the grafted plant under partial shade and maintain moisture.

Advantages:

- Simple and easy to perform
- Good cambial contact
- Strong union if done properly
- Suitable for young nursery plants

Saddle Grafting

Saddle grafting is also performed when the scion and rootstock are of similar thickness. In this method, the scion is shaped like a saddle and placed over the rootstock. The rootstock is cut into a wedge shape, and the base of the scion is cut in an inverted V shape so that it sits over the rootstock like a saddle.

Best time:

Early spring or during active growth, when sap flow supports healing.

Procedure:

- Cut the rootstock at a suitable height.
- Shape the top of the rootstock into a wedge.
- Prepare the scion by making a downward cut in the center to form a saddle-like opening.
- Fit the scion over the wedge-shaped rootstock.
- Ensure proper cambial contact on both sides.
- Tie securely with grafting tape.
- Maintain shade and adequate humidity until union occurs.

Advantages:

- Provides better mechanical support
- Good surface contact between scion and rootstock
- Strong and stable graft union

Cleft Grafting

Cleft grafting is commonly used when the rootstock is thicker than the scion and is particularly useful for top working older plants. A vertical split (cleft) is made in the rootstock, and a wedge-shaped scion is inserted into the split.

Best time:

Late winter to early spring before active growth begins.

Procedure:

- Cut the rootstock horizontally at the desired height.
- Make a vertical split (3–5 cm deep) in the center of the cut surface.

- Prepare the scion with a wedge-shaped base.
- Insert the scion into the cleft, ensuring cambial layers align.
- Tie firmly and cover with grafting wax or tape to prevent drying.
- Keep under partial shade until union occurs.

Advantages:

- Useful for rejuvenating old or inferior trees.
- Allows conversion of low-quality plants into superior varieties.
- Strong and durable union.

General Care After Grafting

- Maintain partial shade for 2–3 weeks
- Avoid water stress and waterlogging
- Remove sprouts emerging from the rootstock
- Gradually expose plants to sunlight after successful union
- Protect from pests and fungal infections



Fig 1: Grafted plant cuttings in polybags showing successful bud sprouting after union establishment

3. Air Layering

Air layering induces root formation on a branch while it is still attached to the mother plant.

Steps:

- Select a pencil-thick healthy branch.
- Remove a ring of bark (2–3 cm).
- Apply rooting hormone if available.
- Wrap moist sphagnum moss or soil mixture around the wound.
- Cover with polythene and tie securely.
- After 4–8 weeks, roots develop and the branch is cut and planted.

Advantages:

- Simple technique
- No need for separate rootstock
- True-to-type plants

4. Branch Cutting Method (Stem Cuttings)

Branch cutting is an economical and simple macropropagation method. In this technique, sections of branches are used to develop new plants under controlled nursery conditions.

Although bael is moderately difficult to root, proper management and use of rooting hormones can improve success rates.

Types of cuttings used in bael:

- Hardwood cuttings (from mature branches)
- Semi-hardwood cuttings (from partially mature shoots)

Best time:

Late winter to early monsoon, when plants are entering active growth.



Fig 2: Air layering for root development

Steps for Branch Cutting Propagation

1. **Selection of Mother Plant:** Choose a healthy, high-yielding, disease free tree with desirable fruit characteristics.
2. **Preparation of Cuttings**
 - Select 15–20 cm long pencil-thick branches.
 - Each cutting should have 3–5 nodes.
 - Make a clean slanting cut at the base.
 - Remove lower leaves while retaining a few at the top (if semi-hardwood).
3. **Treatment**
 - Dip the basal end in rooting hormone to enhance root formation.
 - Allow treated cuttings to dry briefly before planting.

Planting

- Insert cuttings into well-drained rooting medium (sand + soil + compost).
- Plant at one-third depth in nursery beds or polybags.
- Maintain partial shade and regular moisture.

Aftercare

- Avoid waterlogging.
- Provide misting or maintain humidity.
- Root development may take 4–8 weeks.
- Once established, gradually expose plants to sunlight.

Advantages of Branch Cutting:

- Low-cost and simple
- Suitable for small farmers
- No need for rootstock
- Rapid multiplication from elite trees

Challenges:

- Moderate rooting percentage
- Requires careful moisture management
- Rooting hormone improves success significantly



Fig3: Hardwood stem cuttings showing new shoot emergence in nursery bed

Nursery Management for Better Success

For all macropropagation methods, proper nursery care is essential:

- Maintain 50–60% shade during initial stages
- Ensure good drainage
- Protect from pests and fungal infections
- Provide light irrigation
- Harden plants before field transplanting

Benefits for Farmers and Growers

Adopting macropropagation techniques in bael cultivation offers several advantages:

- Uniform orchards with predictable yield
- Early fruiting and better market returns
- Conservation of superior local varieties
- Reduced dependence on seed variability
- Enhanced income opportunities

Future Prospects

With increasing demand for natural health products and herbal formulations, bael cultivation has strong commercial potential. Standardizing macropropagation techniques and improving rooting success through research can further enhance large-scale multiplication. Extension programs and nursery training can empower farmers to adopt these techniques confidently.

Conclusion

Macropropagation transforms a single superior bael tree into many identical, high-performing plants. Whether through budding, grafting, air layering, or branch cuttings, farmers now have practical tools to ensure quality planting material. From one to many macropropagation is not just a technique, but a pathway toward sustainable bael cultivation and improved livelihoods.

References

1. Bose, T. K., Mitra, S. K., & Sanyal, D. (2001). *Fruits: tropical and subtropical*. Volume 1.

2. Ghosh, S. N., Roy, S., & Bera, B. (2012). Studies on propagation of bael (*Aegle marmelos* L.) under Jhargram conditions. *Journal of Horticultural Sciences*, 7(2), 214-216.
3. Kabir, M. A., Karim, R., Rahman, S., Prince, M. H., Hasnat, G. T., & Jahan, S. H. (2018). Clonal propagation of *Aegle marmelos* through IBA treatment for sustainable nutritional and medicinal supply for the poor people of agrarian Bangladesh. *International Journal of Agriculture System*, 45-59.
4. Singh, A. K., Mishra, D. S., & Sharma, B. D. (2022). Seventy five years of research and development in arid and semi-arid fruit crops. *International Journal of Innovative Horticulture*, 11(2), 214-27.
5. Srivastav, A., & Baksh, H. (2024). Comparative studies on budding methods and timings for bud success and growth in Bael (*Aegle marmelos* L.) cv. Narendra Bael-5. *International Journal of Agricultural Invention*, 9(1), 87-90.