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BAMBOO PROPAGATION

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Branch Cutting

Culm Cutting

Layering

Macro-propagation

Bamboo Rhizome

BAMBOO PROPAGATION-BRANCH CUTTING

- Branch cutting is a **non-destructive method** of propagating bamboo that is mainly employed for bamboo **species with swollen branch bases**, **aerial roots and prominent branching**.
- This method, using primary and secondary branches, is effective for **thick-walled bamboo species**, such as *Dendrocalamus spp*. and *Bambusa spp.*
- The most ideal time to practice this method is in the **early monsoon** (after pre- monsoon showers or within two months of the onset of the monsoon).
- In order to **stimulate the development of swollen branches**, a portion of about 2-3 m can be cut from the top of healthy culms between one and two years' old. This will induce lateral branches, including swollen branches. **Topping off** should be executed about one year before carrying out branch cutting.

BRANCH CUTTINGS

It is advised to propagate branch cuttings in sand beds because sand is locally available, chemically inert and comparatively cheap

Sand accelerates drainage, improves aeration, allows easy rooting and rhizome formation.

And minimises damage of roots and rhizome while transplanting.

Use three layers of bricks to hold the sand. The size of the sand bed could be as follows:

height = ≈20 cm, width = 1.2 m, length = 5–10 m or more (depending on requirements).

BRANCH CUTTINGS: SELECTION OF BRANCHES:

- Select bamboo culms with prominent branches; the best swollen branches are between **six to eight months old** and come from **bamboo stems of one to three years old.** (Do not use old swollen branches older than one year). Check for a swollen branch base; it will look similar to rhizomes of bamboo (aerial roots, buds, leaves).

- Cut the branches with swollen branch bases using a hacksaw. Do not split the swollen base. **Secondary branches** with the same characteristics as the **primary branches** (swollen base, buds and leaves) can also be used.

I. BRANCH CUTTINGS: SELECTION OF BRANCHES:

- Keep **three to five nodes from the swollen base** with viable buds. **Trim all tertiary branches** and leaves after cutting the branches from the main culm (to avoid water loss). Use a hacksaw to cut big branches and secateurs for pruning the smaller branches and leaves.
- Store the cuttings in shade, cover with litter/straw and keep moist.
- Transport the cuttings to a nursery site as early as possible.

NURSERY PROCESS:

1. Dip or immerse the cuttings in rooting hormone solution (**Indole butyric acid [IBA],** concentration 200 ppm (0.02%), or **naphthalene acetic acid [NAA])** for a few hours (preferably overnight). Soaking helps in better root formation and higher survival. If propagation is carried out during the pre-monsoon season, there is no need for rooting hormones.
2. Before planting, dip the cut ends of the branch cuttings in **fungicide (1 ml/g/L of** water) for five minutes.
3. Place the swollen branch base inside the sand propagation bed (make holes by hand).

NURSERY PROCESS:

4. Use **cow dung or sticky clay** to cap the cut end in order to minimise drying and water loss.

5. Establish a sand bed in **partial sunlight.**

6. **Shower water** on the bamboo cuttings at least three to four times a day.

NURSERY PROCESS:

7. **Check for roots and rhizome formation.** Remove the branch cuttings from the bed without damaging the roots. (Sprouting of branch buds happens in 10 to 20 days. Depending on the species of bamboo and season of branch cutting collection, the **root formation time** ranges from 25 to 90 days)

8. **Transplant the rooted cuttings** into polybags (size: 15 × 20 cm or bigger) filled with the potting medium (soil, sand and manure: 1:1:1 or soil and compost: 3:1)

9. After transplanting, plants must be **regularly watered** and kept in partial shade for the first month, before shifting them to direct sun light.

Bamboo saplings will be ready for planting in the field after four to six months

2. PROPAGATING BAMBOO: CULM CUTTING

Culm cutting is a vegetative propagation method that is highly suitable for **thick-walled bamboo** with prominent nodal buds (picture on left) or branches with aerial roots.

The best season to practice this method is pre-monsoon/early monsoon as the culms have high growth hormones and carbohydrate reserves during this

Propagation Medium: Propagate culm cuttings in a sand bed (pictures below).

Sand bed:

Use three layers of bricks to hold the sand. The size of the sand bed (pictures above) could be as follows: height = ≈20 cm, width = 1.2 m and length = 5 or 10 m or more (depending on requirements). Alternatively, locally available material like flattened bamboo can be used instead of bricks

Note: **Please note that sticky or clayey soil should be avoided**

II. PROPAGATION THROUGH CULM CUTTING : STEPS

1. **Select a one- to two-year-old bamboo culm**. To avoid younger or older bamboo stems, it is advised to mark the age of the bamboo culms using different colours of paint. Cut the selected poles at their base with an axe, knife or hacksaw. Avoid splitting of culms.

2. **Discard the top of the culm**. In most species, the middle portion of bamboo is highly suitable. Now, prune its foliage and retain the branches (up to three to five inter-nodes) close to the culm portion.

3. A culm cutting can have one, two or three inter-nodes with buds or branches.. Avoid damage to buds or splitting of poles. **Cut at the half inter-nodal point on each side**

PROPAGATION THROUGH CULM CUTTING : STEPS

4. Cuttings should be stored in **shade and be covered in wet rice sacks** during transport to the nursery.

5. In the nursery, leave the cuttings immersed in **rooting hormone mix** (IBA or NAA solution, 200 ppm) for a few hours (preferably overnight).

Note: Soaking in rooting hormone combinations improves root formation and increases the survival rate. However, if propagation is carried out during the pre-monsoon season, rooting hormones are not needed for most of *Dendrocalamus spp*.

6. Just before planting, dip the cut ends of the **culm cuttings in 0.1% fungicide solution** (1 g/L). **Fill the hollow interior part of the culm with wet soil/**sand to facilitate moisture availability

PROPAGATION THROUGH CULM CUTTING : STEPS

7. Ensure that the culm cuttings are **placed flat on the sand bed at a distance of 10 cm** to avoid overcrowding and root overlap. Cover the cuttings with sand/soil.

8. **Sprouting usually takes 10-20 days** from the day of planting and continues for two to three months. Depending on the variety of bamboo, **root and rhizome formation takes approximately one to three months.**

Note: Partial shade is necessary to avoid drying of cuttings and to maintain humidity. Water the sand beds twice daily but avoid water logging in case of soil beds

PROPAGATION THROUGH CULM CUTTING : STEPS

9. Check for root and rhizome formation before removing the cuttings from the propagation beds. Scoop the cutting with roots, rhizome and stem intact. In the case of soil beds, water them thoroughly for a few days before transplanting.

10. Keep the potting mixture ready (soil, sand and compost; 1:1:1 mixture) beforehand. Carefully separate the bamboo plant (roots, rhizome and stem) using a hacksaw or sharp knife

PROPAGATION THROUGH CULM CUTTING : STEPS

11. Immediately after separating the bamboo plants from the cuttings, **transplant them into polybags.** Water the plants immediately and place them in partial shade. Water them regularly.

Note: Keep the plants under partial shade for a month and then expose them to direct sunlight. **After four to six months, the bamboo saplings are ready for planting in the field.**

III. PROPAGATION THROUGH LAYERING:

Layering comprises a set of techniques where the **culm (nodes) and branches (nodes) are brought in contact with the rooting medium** (soil, sand, litter) to enable sprouting and rooting at nodes/buds.

This can be a successful method of getting new plants to grow at the nodes/buds while attached to the parent plant.

There are three methods of layering, which are as follows:

- (a) Simple layering,
- (b) Air layering/ marcotting and
- (c) Seedling layering.

METHOD OF LAYERING

(A) Simple layering

- Identify bamboo culms of one to two years of age.
- Make a partial cut at the bottom portion of the culm (two to three nodes above the ground) to enable bending.
- Bend the culm to the ground; chop the top portion of 2–3 m of the culm to induce lateral branches.
- Keep branches (two or three inter-nodes) close to the culm.
- Trim the leaves and branches to avoid water transpiration.

SIMPLE LAYERING

- Place the culm on the shallow trench and peg with stone or any other local material.
- Cover with soil or any other rooting medium (5 cm deep in sand, soil, dense leaf litter, etc.). Rooting medium should be kept moist by watering (if no rain) and should not be waterlogged.
- Once the new plant is established (roots, rhizome, stem and leaves), the plants can be separated and transplanted to polybags.

Simple Layering

(B) AIR LAYERING/ MARCOTTING

1Air layering, also known as marcotting, is a method for propagating bamboo by growing new roots from the culm, or stem, rather than from the root system:

1. **Cut the top**: Cut the top of the bamboo and trim back any new shoots.
2. **Wait**: Check for new branching below the cut top after a few weeks.
3. **Wrap with moss**: If new branches appear, wrap them with sphagnum moss, soak with water, and cover with tin foil.
4. **Wait for roots**: After a few months to two years, new roots should grow.
5. **Cut and repot**: Cut the culm below the moss and tin foil, trim the new branches, and repot.

AIR LAYERING/ MARCOTTING

Air layering is a form of propagation that creates clones of the plant. It involves making a small cut in the plant and placing a moistened growing medium over the cut to encourage new roots to develop

TRANSPLANTATION:

1. Use a handsaw or sharp knife to dissect each plant from the mother stem. Each plant should have well-developed rhizomes, roots, stems and leaves.

2. Before separation of plants, trim branches/leaves to minimise water stress. Separation and transplanting should be carried out in the evening or on rainy days.

3. Immediately after separation, transplant the plants to polybags and water thoroughly

Note: Keep the separated plants in partial shade (50% shade) and water them daily. **After one month, the plants can be transferred to direct sunlight**

(IV) MACRO-PROPAGATION

Multiplying bamboo plants by rhizome separation is called macro-proliferation. Using this technique, one bamboo plant (with multiple stems) can be separated into two or more viable plants.

A bamboo plant flowers and produces seeds only once in its lifetime (monocarpic plant), and its seeds are not regularly available.

The vegetative methods of propagation (rhizome, branch cuttings, culm cuttings and layering) take longer and can only be applied successfully during the pre-monsoon and early monsoon periods, when the starch content and rooting hormone in the bamboo culms are high.

Using this method, bamboo plants can multiply on a regular basis

STEPS FOR MACRO-PROPAGATION

Four- to six-month-old, well-managed bamboo plants having multiple culms (three or more) with well-developed roots and rhizomes are suitable for macro-proliferation.

Before starting macro-proliferation, bamboo seedlings (from seeds) or transplanted saplings (by vegetative propagation) should be free of **weeds and watered thoroughly.**

A few days before multiplication, **water the plants thoroughly;** this will loosen the soil particles and minimise root and rhizome damage

STEPS FOR MACRO-PROPAGATION

1. **Trim nearly 75% of leaves and branches** to minimise water loss.

2. **Remove the polybags and soil particles attached to the roots and rhizome.** Avoid damaging the rhizome, emerging shoots and roots.

3. **Wash the underground portion** (roots and rhizome) thoroughly in water. This aids in clearly identifying the rhizome neck for dissection or separation





STEPS FOR MACRO-PROPAGATION

4. Use secateurs or a sharp knife to **dissect each plant at the rhizome neck**. After rhizome/culm separation, keep the rhizomes in water in a container to avoid drying. Each plant should have well-developed rhizomes, roots and stems. Shorten the roots to 2–4 cm; this will stimulate rooting from rhizomes and prevent root damage while re-planting.

5. To minimise mortality, rhizome/culm division should be carried out in the evening or on selective days when the **temperature is cool** (rainy days).

6. Immediately after rhizome division, re-plant the bamboo in separate polybags and water.

***Note**: Keep the separated plants in partial shade (50% shade) and water them daily. After one month, the plants can be transferred to direct sunlight*

(V) PROPAGATION THROUGH RHIZOME (OFFSET)

Introduction:

Bamboo offsetting (or rhizome propagation) is a traditional and commonly used method practiced by farmers across the world. An offset consists of an underground rhizome with the roots and bottom portion (three to five inter-nodes) of the bamboo culm. The separated portion or offset contains all the necessary elements required to establish itself as a new plant.

Planting season:

The best time to undertake rhizome propagation in nursery is the pre-monsoon or pre-rainy season, as during this period, the food reserves and growth hormones in bamboo rhizomes and culms are high. With the onset of rains, bud elongation and shoot formation occurs (rhizome buds develop into shoots). The chances of bud damage are high, and the stored food or nutrients can be used or transferred for new shoot or culm growth.

PREPARATION STEPS

1. **Identify young bamboo culms (one to two years old)** from a healthy bamboo clump with desirable qualities.

2. **Cut down identified bamboo poles at three to five nodes above the ground. Check for prominent culm buds at the nodes.** If buds are not available, cut after the node locations with buds and/or branches.

3. **Excavate the surrounding covering soil** without damaging the rhizome and buds and identify the rhizome neck

PREPARATION STEPS

4. Cut the neck portion with a saw or sharp knife without harming the rhizome buds or emerging shoots.

PREPARATION STEPS

Detach the rhizome with roots and culm from the clump.

Use scissors to **shorten the roots** to 2-4 cm; this will stimulate rooting from rhizome and prevent root damaging while re-planting.

Immediately **cover the rhizome portion with wet rice sacks or any locally available material** and **store the offset in the shade** and transfer the offsets to the plantation field or nursery

TEMPORARY MAINTENANCE IN NURSERIES:

Offsets or rhizomes can be temporarily maintained in nurseries (sand beds or bags) for a period of one to two months.

The sand beds or bags must be established **under partial shade and regularly watered.**

With the onset of rains/the monsoon, offsets can be **transferred to the plantation** fields.

PLANTING OF RHIZOMES:

Planting of rhizomes: Early rainy/monsoon season is the best time for direct offset planting because the rhizome buds are elongated at this time.

It is advised to avoid damaging the rhizome buds during excavation. For planting, the pit size varies with the size of the rhizome.

For small bamboos like *Oxytenanthera spp.*, the pit size is 40 × 40 × 40 cm, whereas for medium-sized bamboo like *Bambusa spp*. and *Dendrocalamus spp.*, a pit of 60 × 60 × 40 cm is required.

IMPORTANT POINTS

The rule of thumb is to dig a planting pit that is twice as deep and wide as the size of the rhizome. During planting (in a nursery or the field), use cow dung/soil cap or polythene bags to cover the top cut end of the bamboo offset to prevent drying. Offsets must always be planted vertically in the pits and should be made to stand firm.

The survival and growth rate of plantations using the rhizome propagation method is high. This method is destructive to the bamboo clump. It is not suitable for large-scale plantations, considering the cost and availability of planting material.

If the ideal season for plantation has passed, a "part clump method" can be adopted, wherein two or three interconnected offsets can be collected and planted. This method is suitable for thin- walled bamboo species

(VI) Propagating Bamboo From Seeds

Bamboo is a **‘monocarpic plant’** (i.e. it flowers and produces seeds only once in its lifetime), and the length of its flowering cycle is in the range of 3–120 years (depending on the species).

In addition, bamboo seeds are short lived, and they lose viability in one to three months, making it difficult to propagate bamboo from seeds. Bamboo seeds vary in size and shape according to the species. Some seeds are grain-like, similar to rice, while others can be like berries or mangoes




PROPAGATING BAMBOO FROM SEEDS

Medium of sowing: Seeds should be sown in a raised soil bed platform with good drainage to ensure there is no waterlogging. The propagation medium should be a mixture of soil, sand and compost (1:1:1); the ratio can be altered depending on the type of soil. The seeds should be germinated in partial sunlight (shade net or under tree shades).

Preliminary preparation: It is advisable to **sow the seeds immediately after collection.** Delay in seed sowing will result in a rapid loss of viability. Before sowing, it is necessary to **soak the seeds in normal water (overnight**), remove the floating seeds and only germinate the seeds that have settled at the bottom.

PROPAGATION STEPS

1. Create a shallow trench or holes in the seed bed using twigs or fingers (≈5 mm deep).

2. Place the seeds shallowly beneath the soil and ensure that they are not exposed

3. Refill the trench with the displaced soil.

4. It is important to keep the seed bed moist, and therefore, daily watering is advised.

PROPAGATION STEPS

5. Seed germination starts after 5–7 days and continues up to 25 days. As soon as the seedlings attain the stage of having four to six leaves, the plants can be transplanted.

6. The potting medium in polybags should be a mixture of soil, sand and manure (1:1:1). In the case of sandy loam soil, potting medium can be soil and manure mixture (3:1). Add 30% in volume of fine coconut fibre/peat or rotten leaf mould. These will stabilise the medium in the polybag. Bags will not burst during transport and planting.

7. Keep the potting medium filled in polybags before removing seedlings from germination beds. Water them thoroughly to enable settling of soil medium

PROPAGATION STEPS

8. Make a hole using tree twigs or the fingers. Gently place the underground portion of bamboo seedlings inside the holes. Press the surrounding soil with the fingers. The size of polybags should be 6 × 8 inches or bigger.

9. Keep the seedlings **in partial shade (50–75%) or under trees or shade nets for one to two months.** The seedlings must be exposed to direct sunlight for at least one month (all shade should be removed) before transferring to direct sunlight




PROPAGATION STEPS

10. Daily watering and regular weeding is necessary to maintain the health of seedlings.

11. Approximately six- to nine-month-old seedlings are most suitable for planting in the field

Thanks