



# 3

## FIELD PLANNING

In the previous lesson you learnt the huge potential of bamboo in various fields. We find their use in almost everything from food, clothing, buildings, disaster (its management), environment, energy etc. Realizing the potential of bamboo plantation and its industrial usage, Govt. of India have launched many schemes and initiatives to encourage more and more people to take up bamboo cultivation on a commercial scale. For establishing bamboo industries, you need to have regular supply of raw material i.e. bamboo culms. This can be done by raising plantations of bamboo. The foremost thing for establishing a bamboo plantation is to have planting material. The focus of this lesson is on getting right planting material, its method of seedling preparation, planning of plantation and nursery management. It also covers information about inputs for cultivation that includes irrigation, nutrient management.



### OBJECTIVES

After reading this lesson, you will be able to:

- establish a nursery to feed the plantation site;
- propagate bamboo plant using different methods;
- select a good plantation site;
- protect and manage the plantation site.

### 3.1 SOURCE OF PLANTING MATERIAL

You must be aware that plants can be propagated through different methods. Some plants are propagated by seeds, for e.g. rice, wheat, pulses etc. whereas many plants are propagated by vegetative propagation like potatoes, mango, rose etc.



Notes

As far as bamboo is concerned, it has traditionally been propagated through seed or through vegetative means. Each of these methods has its own advantages and disadvantages.



**Fig. 3.1: A bamboo plantation**

Large-scale planting of bamboo requires nursery-raised planting material. While the cost of the plant is a major consideration, the reputation of the nursery from where it comes is very important. Planting material can also be sourced from forest departments and government nurseries or some private laboratories. Let us understand the different modes of propagation in bamboo in little detail.

### 3.1.1 Propagation by Seed

Bamboo renews naturally by seed (Fig. 3.2). Planting material here is a seed. This method of propagation is standardized, easy and inexpensive. Seeds have the advantage of 'known physiological age', but other traits like flowering are uncertain. Therefore, plants produced through seeds exhibit wide variation in growth and productivity. Seedlings also take longer to produce full-sized, mature culms than rhizome offsets and culm cuttings.



**Fig. 3.2 Bamboo seeds**

Moreover, long, erratic and unpredictable flowering cycles lead to uncertainty in availability of viable seeds. Under normal conditions, without any preservation facility, the viability (ability to germinate) of seeds is low.

### 3.1.2 Propagation by Vegetative Methods

Planting material of vegetative origin is a replica (clone) of the parental stock. This can be a major advantage as the origin (including year of flowering) is certified by



the nursery. Bamboos can be propagated vegetatively by various planting materials of vegetative origin as follows (Fig. 3.3a, b.):



Fig. 3.3a: Vegetative propagation in bamboo

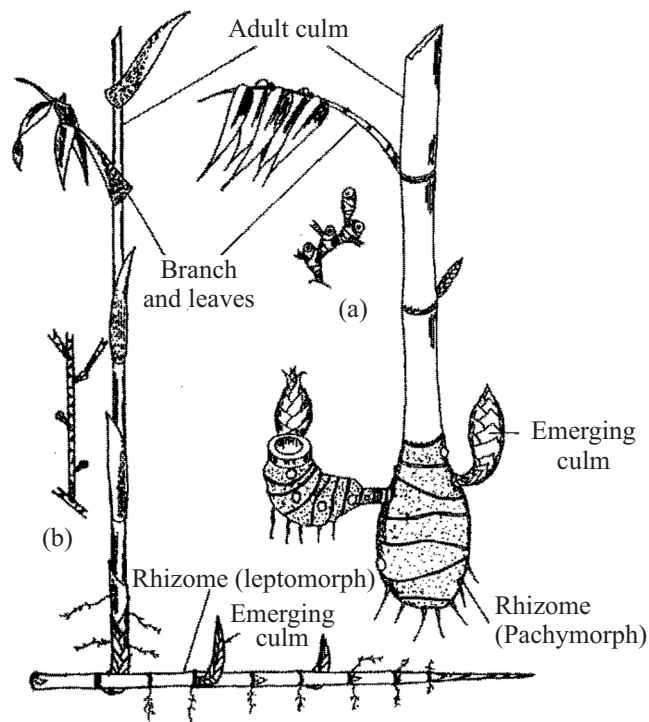


Fig. 3.3b: Vegetative propagation in bamboo

**Rhizomes:** Segments of the underground modified stems have traditionally been used for raising new plants. New shoots and roots arise from the nodes present in the rhizomes.

**Offsets:** The underground rhizome along with a portion of the over-ground stem is detached and planted as a separate plant.



Notes

**Cuttings:** Sections of a culm or branch that can be made to root are placed in soil to raise new plants (Fig. 3.4).



**Fig. 3.4: Growing bamboo from a cutting**

**Layering:** Bringing a culm or branch in contact with the soil to induce root formation at nodes which are then separated into individual plants.

Propagation by vegetative methods has the following advantages:

- Plants produced by vegetative methods are identical to the mother plant.
- Since all the traits of the mother clump are passed on to the progenies, the growth performance of the progenies is predictable.
- The processes and steps involved in vegetative propagation are easy to implement.
- The commercial gestation period of vegetatively multiplied plants is shorter than those of seed or tissue culture origin.

However, vegetative propagation also has the following disadvantages:

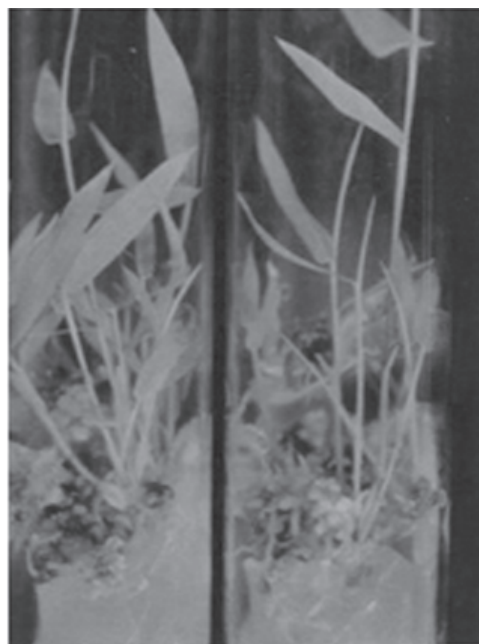
1. Offsets, being bulky, are difficult to take out, stock and transport.
2. The propagation method is labor-intensive.
3. Plant material can be produced only in limited numbers due to scarce availability of mother plants with desired traits.

4. Success in vegetative propagation is more with thick-walled bamboos. Its extent also varies with species.
5. Propagation is season-specific and is also influenced by the age of the culm.
6. Uncertainty about the life span of the plant if the age of the mother clump from which the propagule has been derived is not known.

For vegetative propagation of bamboos, the propagules should be derived only from a superior clump of known age. This will not only ensure the quality of propagules, but also the expected life span of the progeny would be known.

### 3.1.3 Micropropagation or Tissue Culture

In addition to these traditional methods of propagation by seeds or by vegetative propagules, bamboo can also be propagated using tissue culture or micro-propagation. As you read in above section, there are many constraints associated with conventional methods of propagation of bamboo (Fig. 3.5). Thus, it is desirable to go through mass multiplication of bamboos by micro propagation or tissue culture in short period (rapid mass multiplication). Tissue-cultured planting material based on superior bamboo plants which are hardened for field condition is now available for some species. The cost is little high but can reasonably be borne by a commercial plantation. Such material normally carries lower mortality (death) risks and will produce good-quality culms of uniform size and characteristics.



**Fig. 3.5: Bamboo micro-propagation by tissue culture**



**Notes**



## Notes

### 3.2 SELECTION OF THE SITE

Bamboo plantations in the form of compact blocks instead of scattered land are easier to manage. Hence, as far as possible, a compact area of land should be selected as the plantation site. This will provide cost effectiveness of management and other inputs/protection. A plantation scattered over several locations increases the cost. It also requires proportionately more inputs, like fencing, and stretches management capacities. Further, intensive cultivation in impact areas brings down the costs of harvesting and marketing.

Bamboo is a surface feeder with a shallow root system. Its rhizome network tends to spread and colonize the surrounding area. It can be invasive and compete with adjacent crops for nutrients and moisture. It is therefore advisable to choose the plantation site not very close to other cropland keeping in mind the active spreading habit of the plant.

If bamboo is planted very near cropped land, measures should be taken to prevent its roots and rhizomes from spreading into the cropped area. This can be done by digging an open trench between the two areas, at least 3–4 feet deep and 2–3 feet wide. Trench inspection and maintenance should be done annually.

#### For a good planting site

Avoid	Look for
Heavily sloped land	Level or gently sloping land
Land exposed to gusty winds	Land protected from strong winds
Waterlogged soils	Well-drained soils
Very dry soils	Moist soils

We hope that you will now be able to select appropriate planting site in view of the features of a good site explained above.

### 3.3 CLEARING AND PLOUGHING

The site should be cleared of shrubs, bushes, weeds, other grasses, dump yards, overgrown canopy which could compete with bamboo for nutrients and moisture. Removal of such vegetation facilitates the planting of bamboo with appropriate spacing as well as inter-cultivation. Sparsely distributed trees may be retained to provide protection and shade.



The land should be ploughed as thoroughly and deeply as possible. It rearranges the layers of the soil, and improves its quality. Clearing and ploughing should be done at least three weeks ahead of the planting. This will provide sufficient time for weathering of the churned soil and expose insect pests to the sun.



**INTEXT QUESTIONS 3.1**

1. Fill in the blanks
  - (a) Digging a ..... can prevent spreading of bamboo to other adjacent area.
  - (b) Planting material of ..... origin is replica of parental stock.
  - (c) Multiplication of bamboo by ..... can overcome the disadvantages of propagation by vegetative propagule or seed.
2. State whether true or false
  - (a) Bamboo can be grown very close to other cropped land as it is not invasive.
  - (b) The seed propagation of bamboo is easy and low cost.
  - (c) A plantation site is the one which is heavily sloped.
  - (d) Ploughing and clearing of plantation land must be done 3 weeks ahead of planting bamboo.

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**3.3 NURSERY AS PART OF A PLANTATION**

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You must be familiar with a nursery. A nursery is a place where plants are propagated and grown to a desired age under controlled conditions. As you use



**Fig. 3.6: A bamboo nursery**





## Notes

plant nursery to raise other crops, similarly, it is useful to plan a nursery for bamboo cultivation. It is an integral part of the process of establishing and raising/maintaining a bamboo plantation (Fig. 3.6).

A nursery can be:

1. An important source of initial plant material and primary source of plant material to replace plants that have not survived.
2. A good source to house base material (rhizomes, culms and branch cuttings) for vegetative propagation under close supervision of technical executives. These can be used independently to sustain the nursery, and to provide incremental profits.

As nursery is the part of the main plantation, its activities can be scheduled during the periods where there is relatively less activity in the main plantation areas. This will optimize the deployment of human resources and time utilization of plantation workers.

You may establish nursery at different scales of production and activity, depending on its objectives. You can also set up it on a small scale initially. Later they can be developed to larger one, as and when the need arises, and your experience, skill and confidence you have gained in operating and managing it.

There are some essential requirements that you must check before establishing a nursery. They are as follows:

- It should be a plot of land within or near about the plantation area, with similar site and soil conditions.
- The propagation and nursery beds should have equal parts of sand, soil and farm yard manure (FYM), raised and laid out in convenient strips.
- There should be a provision of shade, either through simple structures of bamboo and thatch, or through more complex arrangements such as poly-houses and shade netting.

### 3.4 SOIL AMENDMENT

Soil amendments means adding something to soil to improve its quality to make up for the nutrient and other deficiencies, if any. It is seen that addition of fly-ash to soil has been beneficial. Fly-ash can be used to enrich and condition soil in bamboo plantations, especially where the soil is nutritionally and physically poor.





### 3.5 FENCING AND PROTECTION

Once plantation has been established it needs to be looked after and protected. For this purpose you can do fencing around the plantation site. A fenced and protected plantation makes its management easier. Although fencing involves costs, there is saving over a period of time, through better culm yield. A plantation needs to be fenced to protect it from:

- Grazing by domestic animals and trampling by humans and free ranging animals, especially when the plants are young and the culms immature.
- Foraging for bamboo shoots which are relished by both animals and humans.
- Avoid culm theft.
- Fencing demarcates the plantation area.

There are many types of fencing that can be done in plantation. They differ in cost and labour. You can use one of the following types of fencing:

- **Fencing with GI barbed wire:** This is a relatively expensive option, but it is neat, easily arranged and durable (Fig. 3.7).



**Fig. 3.7: Fencing with GI barbed wire**

- **Innovative fencing** through use of local material, like stones, thorny bushes and bamboo.
- **Cattle-proof trenches:** This is a partial but cost-effective option.

Irrespective of the type of fencing, breaches and openings should be avoided and repaired regularly, wherever and whenever needed. It should be supplemented



with watch and ward and regular maintenance carried out to increase effectiveness. It is preferable for the fencing to be in place before the initial establishment activities, such as land preparation, pit digging and planting, are taken up.

### 3.6 TRANSPORTING

Planting material will generally be needed to be transported from the nursery or holding area, to the plantation site. This is especially true for larger plantations, since direct planting is neither practical nor likely to be successful on significant commercial scale. Other than rhizome offsets (of which a limited number can, and should, be planted directly), all other planting material, irrespective of the propagation method, should have been cared for under nursery or managed conditions for some months till fit for planting in the field.

Most nurseries provide planting material in polybags. As a general rule, these polybags should not be watered 1–2 days before transportation, to prevent loosening and cracking of the earth surrounding the young roots and rhizome. This norm need not apply, however, in hot weather, or if the planting material is to be transported over a long distance.

When transporting rhizome offsets, it should be ensured that they are partly encased in soil, placed in gunny bags and stacked vertically, to avoid damage to the buds.

If the objective is erosion control along river banks or landslide/ avalanche protection, the spacing can be 3 × 3 sq. meters or even 2.5 × 2.5 sq. meters. In such cases, bamboo can be interspersed with appropriate, fast-growing timber species.

### 3.7 NUTRIENT MANAGEMENT

Nutrient Management is an important part of the management practices in the intensively managed plantations. Bamboo plants need much nutrition and it responds well to fertilizers and manures. They grow more vigorously with fertilizer application than without it.

#### Chemical fertilizers

In general, bamboo needs the complete range of nutrients from fertilizers including phosphorous, potassium and nitrogen. In fact they often require a higher quantity of nitrogen. The chemical and commercially available fertilizers offer established and straightforward solutions for their nutrition requirements. However, it is a good idea if you carry out soil analysis prior to establishment of the plantation and at annual intervals thereafter, to fix and confirm the fertilizer dosages. Overdose



of fertilizer is not good for bamboo yield and increased leaching in the ground water. Under normal soil conditions, the composition of NPK can be in ratio 5 : 2 : 1 or 4 : 2 : 1.

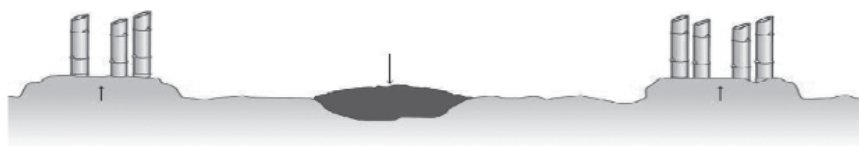
The fertilizer doses may vary depending on the purpose of the plantation. Plantations targeted for bamboo shoots need to have more intensive application of fertilizers than that for culm plantations. In the case of cultivation for culms, chemical fertilizer application may be to the extent of 1,500 kilograms per hectare per year. Cultivation for shoot will require additional nutrients, and the fertilizer application required may go up to 4,000 kilograms per hectare per year.

You should apply fertilizer first during planting when the fertilizer should be placed and mixed in the pits. After that, you should apply fertilizers within two months of planting, and then again, in the later part of the dormancy period, preferably around 4–6 weeks before shoot emergence.

You must be careful that chemical or strong fertilizers are not applied directly to the rhizome and other sensitive parts of the plant. The applied fertilizer should not touch sprouting shoots, to avoid damage. Fertilizer should be applied in ditches around the clump when the soil has enough moisture, and further topped with soil.

### **Organic nutrients**

It is also possible to cultivate bamboo without the use of chemical fertilizers, relying on compost, vermicompost and leaf litter for the necessary nutrients (See Fig. 3.8). In fact, organic farming of bamboo has more demand in market of bamboo shoot and even bamboo culm. They are also higher priced than those grown under chemical fertilization. There is also increasing concern that although chemical fertilizers boost production, in the long run they badly affect soil health and fertility. To increase productivity, and to cater to the needs of organized and intensively managed plantations, however, it is necessary to systematically plan and implement an organic farming regime.



**Fig. 3.8: Planning a compost pit between bamboo rows**

Organic fertilizers can provide a range of nutrients to the soil. They encourage microbial activity, which allows the fertilizer to provide nutrients over a longer period of time. Unlike chemical fertilizers, the nutrients in organic fertilizers are less likely to leach away in rainwater.



Notes

Manure and compost are established sources of nutrients, and simple to prepare and use (Fig. 3.8). There are many other sources of organic and naturally occurring fertilizers.

### 3.8 BAMBOO CULTIVATION IN INTEGRATED FARMING

It is possible to raise a bamboo plantation adjacent to cropland, provided a reasonable space (**minimum of 5 meters**) is maintained. Additional protection can be provided by trenching or by a rhizome barrier.

Intercropping is also possible, and can be beneficial, in the early years of a bamboo plantation, before the clumps attain maturity and canopy formation is completed. The crops should, however, be carefully selected, taking care to avoid intense consumers of nutrients. Further, the crops should not be placed too close to the bamboo plants.

In the first two years of the plantation, short-duration or shade-loving plants like **turmeric** and **ginger**, or **medicinal plants**, can be grown. Off-season **tomatoes**, **soybean** and **maize** have also been found to be successful for intercropping in bamboo plantations.

In subsequent years, the possibility of intercropping will increasingly diminish because of the closing of the canopy, as the culms reach upwards and outwards, and the laterally spreading network of roots and rhizomes. Some medicinal plants can continue to be grown in the shade, under the canopy of leaves and branches.

If the plantation is established with higher spacing than what is normally recommended (ranging from  $5 \times 5$  to  $7 \times 7$  sq. meters), intercropping can be continued for a longer period of time.



#### INTEXT QUESTIONS 3.2

1. Fill in the blanks
  - (a) ..... can be used to enrich and condition soil in bamboo plantation.
  - (b) A nursery should have similar ..... conditions as plantation site.
  - (c) Fencing protects bamboo from ..... by cattle.
  - (d) Planting material is provided in a ..... for plantation.



### WHAT YOU HAVE LEARNT

Let us summarize and list out the salient points we have learnt through this lesson:

- Bamboo can be propagated by vegetative methods, seeds and tissue culture.
- Vegetative methods include use of rhizome, offsets, cuttings and layering.
- They are exact copies of parental stock and therefore have predictable characters.
- Vegetative propagation is more labor intensive.
- Propagation from seeds is easy and low cost.
- Micropropagation or tissue culture propagated plants can be used in conditions when conventional methods are not useful.
- Site for plantation should be compact and not scattered.
- Plantation site should not be heavily sloped, waterlogged or very dry.
- Before planting, the site should be cleared of weeds and ploughed properly.
- Clearing and ploughing should be done at least three weeks ahead of planting.
- A nursery is an integral part of the process of establishing a plantation.
- Plantation site should be protected from animals and humans.
- There are various types of fencing that are available.
- Planting material are transported from nursery to plantation site in polybag.
- These bags should not be watered much before two days of transportation.



### TERMINAL EXERSICE

1. Explain the different methods propagation in bamboo.
2. Write the advantages and disadvantages of vegetative propagation in bamboo.
3. What are the considerations when selecting site for bamboo plantation?
4. Why nursery is important part of a plantation? Discuss the requirements of a nursery.



Notes

5. Why fencing is required in a plantation? Discuss the different ways of doing it.
6. List the things that should be taken care of while transporting the planting material from nursery to plantation site.



### ANSWERS TO INTEXT QUESTIONS

#### 3.1

1. (a) Trench (b) Vegetative  
(c) Micro propagation/Tissue culture
2. (a) False (b) True  
(c) False (d) True

#### 3.2

1. (a) Flyash (b) soil  
(c) Grazing (d) Polybag

#### Key Learning Outcomes

- Establish and manage bamboo nursery site.
- Propagate bamboo plant using different methods.