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CULTIVATION AND MAINTENANCE

Your now aware about the requirements to establish a bamboo plantation. You also know by the need to have bamboo plantation and what the prerequisites for establishing it. Once you have established a bamboo plantation, it is now necessary to maintain the plantation. The maintenance is very important as it will decide the commercial and economic viability of the plantation. It is required for getting a continuous and a good yield of bamboo culms or shoots. In this lesson you will come to know about the different practices like intercropping, irrigation, mounding, mulching, pruning, cleaning, thinning etc. that can be done in a plantation for a healthy and good yield of bamboo. You will learn to use the resources at their best by different cultivation practices. Different methods of irrigation and other practices for improving the soil quality are also discussed in this lesson.

OBJECTIVES

After reading this lesson, you will be able to:

- practice intercropping to use the resources best;
- use suitable irrigation method in the plantation;
- improve the soil condition by different practices;
- reduce clump congestion for an increased and better yield of bamboo.

5.1 INTERCROPPING

Intercropping is a farming method in which more than one crop is grown at the same time and on the same piece of land. You must have practiced intercropping

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in the crop you grow in your field. Intercropping can also be done with bamboo. It can be beneficial if done in the early years of a bamboo plantation, before the clumps attain maturity and canopy formation is completed.

If the bamboo plantation is adjacent to a cropland a reasonable space (minimum 5 meters) should be maintained between them (Fig. 5.1). Additionally,as you have learnt in previous lessons, a trench or a rhizome barrier can also be formed.

Fig. 5.1: Bamboo plantation adjacent to cropland

You should be careful in selecting the crops for intercropping. The plants should not be such which can have intense competition with the bamboo for nutrients. Further, the crops should not be placed too close to the bamboo plants. This increases the competition for sunlight and space.

Let us see what your choice of plants for intercropping with the bamboo can be.In the first two years of the plantation, short-duration (which complete their growth in short period of time and then die) or shade-loving plants like turmeric and ginger, or medicinal plants, can be grown.

Several other crops like 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 decreases. This is because as the bamboo clumps mature their canopy becomes dense. It reduces the light availability for the other plants growing with them. Also, as the culms mature the network of roots and rhizomes spreadlaterally and stop the growth of other plants. However, some medicinal plants can continue to be grown in the shade, under the canopy of leaves and branches.

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If the plantation is established with higher spacing than what is normally recommended (ranging from 5×5 m^2 to 7×7 m^2), intercropping can be continued for a longer time as there will be gaps in the canopy.

5.2 IRRIGATION

Bamboo grows best when there is adequate moisture in the soil. In the initial years of a plantation, the young plants need extra care and water. Lack of moisture in the soil badly affects the growth of rhizomes and the culms. Irrigation of the plantation reduces mortality (death) in young plants, and improves the health and productivity of bamboo clumps.

How do you know how much water is to be given to the plantation? The answer is, requirement of irrigation will vary with the local climatic conditions and the soil type. There are various irrigation methods that can be used. The type of irrigation to be used will be determined by the actual moisture in the soil, especially in the growing season.

- **Channel irrigation:** It is recommended in the dry season. It should be do neat least once a week.
- **Drip irrigation:** In an area where water is less, drip irrigations should be used. It is found to be cost-effective, but this requires technology and investment during site preparation.
- **Wick method of irrigation:** The method of irrigation using the traditional 'earthen pitcher with a wick' is effective and uses water frugally (simple and not cost too much). A 2-litre pitcher would require refilling thrice a week.

Whatever irrigation method you use care must be taken that water-logging (excess water in the soil) is avoided. Bamboos thrive in moist but not waterlogged conditions as bamboo growth stops under water-logged conditions.

In compact plantations investment in irrigation is more economical. The initial cost is compensated by the better returns that you get. In such plantations, especially in areas with annual rainfall less than 700 mm, irrigation channels and sources of water should be planned at the very beginning of the plantation.

In addition to the irrigation, efficient and regular clump management is important to ensure high productivity and to minimize wastage. The micro-environment should be maintained in a way that it supports good growth. Clump congestion must be avoided.

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5.3 SOIL LOOSENING

Soil loosening is important to maintain a good soil structure (Fig. 5.2). Loosening the soil around the clumps should be done **at least twice a year** and more often if required. This improves the growth of shoots and the root system. Soil should be loosened to a depth of 10–15 cm and 30–45 cm away from the bamboo clump.

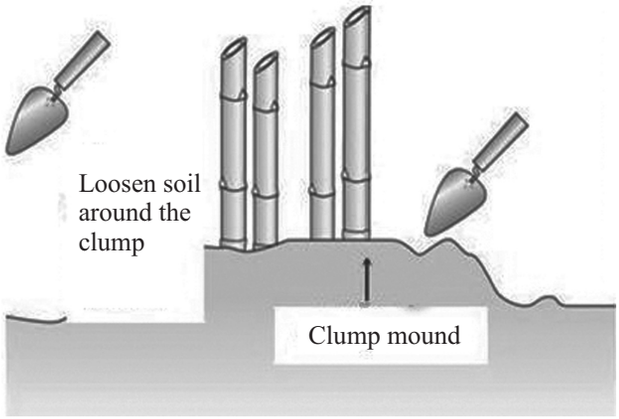

Fig. 5.2: Soil loosening

5.4 WEEDING

Weeding is the process of removing unwanted plants from the plantation. In the initial years of the plantation, regular weeding is necessary to prevent weeds and other vegetation from competing with the young bamboo for resources like sunlight, nutrients from soil and space. Intensive weeding is required at least for the first 2 years after the rains, and towards the end of the wet season. The intensity and frequency of the weeding, however, will be site-specific, depending upon the weed/grass infestation, and will come down in later years. At some places, it may be required even after non-seasonal rains.

Once the clump gets established there is considerable leaf-shedding. The leaves on the ground then act as a barrier to the growth of weeds/grasses.

5.5 MULCHING

Fallen bamboo leaves serve as good on-site soil mulch (covering) material. Mulching reduces loss of moisture due to evaporation from the soil and checks weed growth. When this mulch gets decayed by natural processes it releases valuable nutrients into the soil slowly. This improves the quality and texture of soil by adding organic carbon to it. Bamboos also have a requirement of **silica for**

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growth, bamboo leaves have silica in them and thus the fallen leaves give silica to the bamboos.

5.6 MOUNDING

Mounding means heaping fresh loose soil over and around the base of the plant. It is recommended as the rhizomes grow laterally under the soil surface. The shoots from them emerge from the ground at an upwardly inclined angle. In this period of growth, exposure to sunlight retards, and may even stop, the growth of rhizomes.

INTEXT QUESTIONS 5.1

1. Fill in the blanks

   (a) ..... plants like ginger can be grown mixed with bamboo in first two years.

   (b) Bamboo grows best in soil with ..... moisture.

   (c) Weeding is necessary to ..... competition with young bamboo plants for sunlight and nutrients.

   (d) Bamboo cannot thrive in ..... soil.

5.7 PRUNING

Pruning is the process of cutting the tips of the branches. In some species of bamboo (for example *Dendrocalamus hamiltonii* and *Bambusa balcooa*), there is heavy branching at the lower nodes of the plant. Pruning of these branches reduces clump congestion and helps provide a healthy, airy environment within the clump. Mild pruning should be undertaken in the second and third years of growth, and intensive pruning from the fourth year onwards. It should be completed before the end of the dormancy period (winter months when the growth is very less) well before the shoots emerge. Good months to carry out pruning are December and January.

5.8 CLEANING

Once clump formation starts (generally in the third year), its management is of great importance. Rhizomes grow centrifugally (from centre outwards), throwing up new shoots in enlarging circular formation.

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Bamboos can throw up many branches, which, if left unattended, can get deeply entangled. This is not desirable as they make the access to older culms towards the centre of the clump difficult. It also obstructs free vertical growth of new culms. If they are entangled, the new culms formed are twisted and turned. These type of bamboo culms are of no value and they alsocongests the clump. Such malformed culms make harvesting of the better culms difficult. Beyond a certain stage, it will not be possible to get back the natural architecture (straight tall culms) of the clump that is unique to the species. The malformed clump needs to be cut soon or else it leads to economic loss.

Therefore, it is important to clean clumps early and remove all dead and malformed culms. A well-aired clump results in the emergence and growth of healthy culms. Dead stems are not only vulnerable to pathogens, but also dry up fast and are a potential fire hazard. In conditions of low humidity and high temperatures the rubbing of culms against each other is known to cause 'sparks' and light up a fire in the entire clump/forest/plantation.

A good time to carry out clump-cleaning is February–March. In this period of dormancy, after the harsh winter is over and before the cycle of active growth begins again, the plant system is better prepared to withstand the stress of cleaning activities.

5.9 THINNING

Thinning is removal of bamboo culms or shoots to avoid over-dense clumps. This can be done either by removing young newly emerging shoots or you can also choose mature culms to be cut down to maintain your clump at desired density. Thinning the clump is essential from the third year onwards, to avoid crowding and to ensure proper growth and easy harvesting of culms. Weak and deformed culms should not be kept in the culm.

An appropriate clump structure should be maintained through thinning as well as through extraction/retention of shoots. Only shoots sprouting in the middle of the shooting season should be retained.

5.10 PEST AND DISEASE CONTROL

There are several pests that attack bamboo leaves, shoots, culms, rhizomes and even harvested culms. They are very harmful and can sometimes damage the entire bamboo crop. These pests are diverse and include 40 families of leaf-feeders, 50 borers, 130 scales, 30 aphids, 60 bugs, 5 families of timber insects. In addition to the insects many species if fungi also attack bamboo. There are 73 species of fungi

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such as *Aciculosporium* spp., *Ceratosphaeria* spp. and *Fusarium* spp. that infect bamboo. Timely control of pests and diseases are an essential part of sound management practice. The control measures may be silvicultural (such as weeding or soil loosening), biological, behavioral or chemical.

The insects attacking bamboo can be broadly divided into two categories:

Insects attacking live bamboos- The major ones include insects which attack seeds, foliage and culms. The nature of damage includes foliage feeding, sucking the sap and making bore holes on culms and shoots. They belong to insect orders including *Orthoptera, Hemiptera, Lepidoptera, Hymenoptera and Coleoptera.* The shoot and culm borers cause more damage to bamboo clumps as compared to other groups of insects. Most defoliating (the ones which feed on leaves) remain low in population and hence, are generally considered pests of minor importance. However, some of them show periodic fluctuations in population which may cause epidemics, and can cause even total defoliation (total loss of leaves) of bamboo crop. Damage caused by leaf feeders reduces the surface area available for photosynthesis, affecting vigor, growth and survival of plants.

A large number of insects feed on the sap of leaves, branches, culms, shoots, roots and rhizomes. They have highly modified piercing-sucking mouth parts. These insects can damage bamboos in four ways:

1. Removing the plant fluid,
2. Causing mechanical injury,
3. Injecting toxic compounds into the plant, and
4. Transmitting diseases,

These result in defoliation or wilting of young shoots and branches, and even death of the culm. Compared to defoliators and sap suckers, culm and shoot borers have less impact on the overall plant physiology.

Insects attacking post-harvested bamboos and finished products: The finished products made out of bamboos are also prone to attack by insect borers. The post-harvest pests are from the order Coleoptera, especially families Bostrychidae, Lyctidae and Anobidae. Of all these, Bostrychidae are the most prevalent. Nearly 16 species of Bostrychids are reported to attack postharvest and finished bamboo products. They are a major threat in the storage yards in bamboo industry in many places. Although, nearly 180 insect species are reported to be associated with bamboos in India, the pest status of many species is not known.

About 43 species of insects have been found associated with harvested and stored bamboos. They cause heavy damage to bamboo plant and sometimes making the

muse less for all practical purposes. The boring beetles are of economic concern and popularly known as 'powder-post beetles', because they turn the bamboos into fine powder by feeding. They are also called as 'ghoon' or shot-hole borers. From the economic point of view, the genus *Dinoderus*, of the family Bostrychidae is the most destructive pest of stored bamboos. You must note that the starch content of the bamboos at the time of harvest would be responsible for the severity of borer attack. A few termites are also known to attack bamboos under storage.

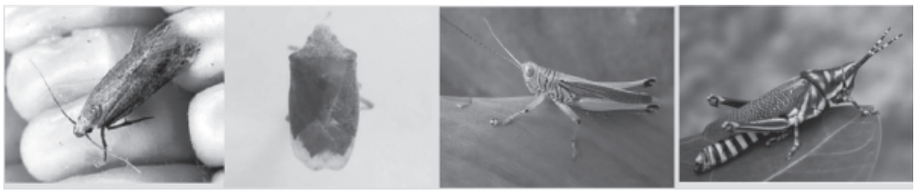

Fig. 5.3: Different insect – pests of bamboo

To prevent the bamboo plants from infestation by insect and pest, insecticides can be used. However, in modern times, you must avoid use of insecticides and resort to pest management strategies in bamboo stands involving cultural and biological methods. In natural stands of bamboos, the pest populations are regulated due to the predator-prey interactions and presence of other useful components of biodiversity. However, when intensive cultivation practices are adopted outside the natural stands i.e. in a commercial plantation, the biodiversity and the natural habitat are lost which can result in pest outbreaks.

In case of harvested bamboo, treating the green bamboo with preservative chemicals can also increase the service life. However, in the open storage yards, it has been seen that proper stacking methods alone can reduce borer attack. Some of the traditional practices which are eco-friendly and easy to replicate like water soaking, smoking over open fire, clump curing, biological preservative etc. are promising, but need to be taken up on a large-scale and methods of treatment to be regulated to suit the local conditions.

The presence of starch in the culms during the harvesting season is another factor to be considered. The starch content will vary based on the season, phases of moon, status of flowering, etc. The bamboos should be harvested at a time when the starch content would be low. It is observed that bamboos harvested during dry season and before flowering are highly susceptible to borer attack, while those harvested during wet season are comparatively resistant, and those harvested after flowering were completely resistant to borer attack.

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INTEXT QUESTIONS 5.2

1. Fill in the blanks

   (a) ..... must be done to reduce heavy branching at lower nodes of bamboo plants.

   (b) Congestion in clumps of bamboo during early growth cycle results in ..... culms.

   (c) ..... is the best time for clump cleaning operation.

2. State whether true or false

   (a) Bamboo cannot be attacked by insects and other pathogens.

   (b) Thinning of clump is not desirable as it results in loss ofculms.

   (c) Pruning of clumps makes it more airy and decongested.

WHAT YOU HAVE LEARNT

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

- Intercropping can be done in bamboo plantation with short lived or shade loving plants to utilize resources more efficiently.
- Bamboo plantation should have soil with adequate moisture.
- The type of irrigation method to be used depends on specific conditions of the area like availability of water, cost etc.
- Soil loosening should be done to maintain a good soil structure so that it can support better growth of bamboo.
- Weeding should be done regularly to avoid competition among bamboo and other plants.
- Leaves fallen from the bamboo act as a good mulching material and a source of silica for bamboo.
- Pruning is done to avoid congestion of the bamboo clumps and making it more airy.
- Cleaning and thinning of the bamboo clumps is essential to get healthy and well structured culms.
- Bamboo is susceptible to a number of insects and fungal pathogens at various stages. they must be prevented from pests and diseases using biological, chemical or other control measures.

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TERMINAL EXERCISE

1. Explain different types of irrigation methods that can be used in bamboo plantation.
2. Discuss the advantage of mulching by fallen bamboo leaves.
3. Why is cleaning and thinning important in management of bamboo plantation?
4. What is intercropping? State its importance.
5. What do you understand by pruning? Why it is desirable in bamboo plantation?

ANSWERS TO INTEXT QUESTIONS

5.1

1. (a) Short duration/shade loving (b) Adequate
   (c) Reduce (d) Waterlogged

5.2

1. (a) Pruning (b) Malformed/twisted
   (c) February to March
2. (a) False (b) False
   (c) True

Key Learning Outcomes

- Establish and manage a commercial bamboo plantation efficiently.
- Manage insect-pests affecting bamboo plantation.