
UNIT 1 CULTIVATION OF TASAR FOOD PLANTS

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1.0 OBJECTIVES

After reading this unit, you will be able to:

- summarize various Tasar and Oak Tasar food plants;
- explain the raising of nursery, cultivation propagation practices of different Tasar food plants; and
- describe the management practices of plantation maintenance.

1.1 INTRODUCTION

Very few countries in the world produce non-mulberry silks. India, a versatile country, produces all types of non-mulberry silks. It also enjoys the monopoly in the rough and tough Tropical Tasar and golden Muga silk production. It is necessary to know that China produces the highest quantity of Temperate Tasar (called Oak tasar) and Eri silks.

Tasar silkworms are generally wild. They are classified as Temperate and Tropical. Tropical tasar silkworm, known as *Antheraea mylitta*, feeds on wide variety of primary and secondary food plants. The primary food plants are Arjun (*Terminalia*

arjuna), Asan (*T. tomentosa*) and Sal (*Shorea robusta*) plants. The secondary food plants are *Lagerstroemia parviflora* (Sidha), *L. speciosa* (Jamun), *L. indica* (Saoni) and *Zizyphus mauritiana* (Ber). Humid and dense forests are the best shelter for these food plants. They are commonly found in Central and Southern plateau of Central India covering the principal states of Jharkhand, Chhattisgarh, Bihar, Madhya Pradesh, Orissa, West Bengal, Maharashtra, Uttar Pradesh and Andhra Pradesh.

Similarly, the temperate tasar silkworm, known as *Antheraea proylei*, feeds on a variety of food plants like *Quercus incana*, *Q. himalayana*, *Q. semicarpifolia*, *Q. grifithi*, and *Q. serrata*. These food plants are available in the entire sub-Himalayan belt extending from Jammu & Kashmir in the North to Manipur in the North-east. The temperate tasar silkworm is completely domesticated like mulberry in North and reared outdoors like tropical tasar in North-east India. However, the silkworm feeding on these plants is specific depending upon the altitude.

Raising and Maintenance of Tasar Host Plants:

The host plants on which the silkworm primarily depends for its feeding are referred to as primary host plants. Other host plants are called as secondary and tertiary host plants on which the silkworm has less dependence.

Shorea robusta, a forest based plant is a slow growing tree which are multiplied through natural regeneration. However, the other primary host plants of tropical tasar, Arjun and Asan are raised through seeds and maintained as economic plantations for obtaining sufficient foliage.

Propagation of these host plants is also possible through air layering and cuttings, but to a limited extent. Suitable nursery plantation techniques and package of practices developed by the Research and Development Institutes of Central Silk Board, help in strengthening and contribute in increasing the productivity.

Cultivation of Oak Tasar Host Plants

There are seven known species of Oak tasar host plants in India, namely, *Quercus serrata* (Uyung), *Q. semiserrata*, *Q. dealbata*, *Q. grifithi*, *Q. incana* (Banj), *Q. semicarpifolia* (Kharshu), and *Q. himalayana* (Moru) are used in silkworm rearing (Fig.1.1.)

Distribution and cultivation of the Oak species varies with the altitude. The same species sprouts at different times at different altitudes. *Q. semicarpifolia* which is a slow maturing variety is abundant at higher altitudes (7,000-9,000 feet above Mean Sea Level) and *Q. himalayana* is found at an altitude of 5,000-7,000 feet above mean sea level.



Fig.1.1: Different species of Oak Tasar Host Plants

1.2 DEVELOPMENT OF PLANTATION

1.2.1 Selection and Preparation of Land

For systematic plantation, flat or slightly sloppy, fertile, porous, loamy, sandy loam or clay loam land is selected. It should be accessible throughout the year at least by foot. It should be free from animal grazing and other agricultural activities. The land for developing the plantation needs clearance of all legal issues. Then, it is cleaned of weeds, unwanted trees, boulders and other stony materials.

Before establishment of garden, the soil testing should be taken up while the pH of soil should be 6.5 to 7.5. The land is divided into suitable compartments/plots. Land is prepared by deep hoeing/ploughing 2 to 3 times up to a depth of 30 to 40 cm in the month of February - March in order to loosen the soil and to make a fine tilth. The soil is exposed to sunshine in order to kill the soil-borne insects and weeds. Water conservation methods are adopted by providing bunds in the field. The distance between bunds depends on the slope of the land. Lands with steeper gradients should have closely spaced bunds. Plan for development of systematic plantation is laid out.

Soil correction is also taken up wherever necessary. The acidic soils (pH below 6.8) are corrected by adding naturally available materials like Dolomite, Burnt lime or hydrated lime in two or more split doses followed by ploughing. For correcting the alkaline soils (pH above 7.2), gypsum is added at the rate of 2 to 4 Metric tonnes per hectare and mixed properly with top soil followed by light ploughing and the plot is flooded with irrigation. Later, the water is removed or leached out through the channel/ trench after few days. After that, one or two crops are taken for green manuring and ploughed down into the soil at the pre-flowering stage. Areas with atmospheric temperature of 20°C-30°C and 50 mm rainfall, once in fortnight and a sun shine of 9 to 13 hours a day are ideal for good growth of the plantation.

Pits of size 30 cm (Length) x 30 cm (Breadth) x 30 cm (Depth) with a closer spacing of 1.22 m (between plants) x 1.22 m (between rows) for Arjun plantation are dug before the onset of monsoon and a wider spacing of 1.83 m x 1.83 m or 2.40 m x 2.40 m for Asan.

1.2.2 Preparation of Nursery

The nursery raising should be in high and dry land without water logging and should have proper shade. The soil is ploughed twice or thrice up to 30 cm depth and levelled properly. Ideal beds of size of 5 m length, 1.50 m width and 15 cm height with a 60 cm all round working space are convenient for maintenance. It is better that the nursery site is nearer to the water source for irrigation, if required. The soil of the nursery bed is mixed with 50 kg of well decomposed cow-dung manure with an equal quantity of sand and 200 g of Forate (insecticide).

The seeds of Arjun and Asan have low germination quality. In order to overcome these problems and to increase the germination percentage and produce healthy seedlings, the following nursery technique has been developed.

1.3 RAISING OF NURSERY

1.3.1 Collection and Selection of Seeds

Tasar host plants are propagated through seeds. Ripened and mature seeds are collected from the plant before natural shedding during April- May. They remain

viable for about one year, but often the nursery is raised from the freshly collected seed only. Seeds of *Shorea robusta* are short lived and collected during May-June only. Therefore, the Sal nursery is prepared immediately after collection of seeds. Seeds of all oaks are generally collected during October-November months and the nursery is raised during February-May. Mechanically scarified seeds yield more than 90 % germination.

1.3.2 Seed Soaking and Heap Making

Seeds are soaked to soften their hard skin before sowing. They are soaked in plain water for 96 hours (Arjun) and 48 hours (Asan). Seeds of oak plants require 2-4 days for soaking. They are packed in a gunny bag and sunk in a pit or pond containing water. For perfect soaking, the seed bags may be kept immersed with some weight on it.

The soaked seeds are removed from gunny bags and heaped under a tree shade and is covered with wet gunny cloth/bags. Water is sprinkled daily on the heap to maintain the required humidity till germination, heaping of 1,500 to 2,000 seeds is ideal generally. Oak seeds are also heaped and covered by moist gunny bags or thatch grass. The heaping of seeds is done to allow them to germinate under the maintained humidity.

1.3.3 Seed Germination and Sowing in Polythene Tubes

The seed germination in polythene tubes provides better transplantation of seedlings. Normally, germination starts after 6-8 days and continues up to 3 weeks. Sorted germinating seeds are sown in the polythene tubes of 25 cm x 11 cm size containing the growing medium. The growing medium is a mixture of Farm Yard Manure (FYM): Soil: Sand in the proportion of 3:2:1 for Arjun and 1:3:1 for Asan seeds.

In case of oak, the germinating seeds are dibbled horizontally in the growing mixture of soil, sand and FYM at 1:1:1 ratio contained in perforated polythene tubes. Irrigation is done regularly at 4 to 5 days interval without stagnation. The seedlings are protected from sunlight and hail storm by a shade. But, soon after the monsoon, the shade is removed.

1.3.4 Maintenance of Seedlings

The seedlings raised in polythene tubes are maintained for about 2 to 3 months. Regular sprinkling of water is done to maintain the required moisture.

Seedlings of Oak (*Quercus serrata*) are allowed to grow for about three months in the nursery until the onset of monsoon. Hoeing and weeding is done in the polytubes regularly. Nursery of *Quercus griffithi*, and *Q. incana* is propagated through air layering. For higher rooting performance, 250 ppm of Indole Butyric Acid is also used for *Quercus incana* seedlings.

Chemical like Endofil-M 45 (1 g) is mixed with NPK for controlling fungal diseases. Also, sprays of Carbendazim (0.01%) and Dimethoate (0.02%) are done on the seedlings against damping off disease and other pests during maintenance.

1.3.5 Transplantation of Seedlings

Two to three months old seedlings are transplanted to the plantation site when it attains a height of 1.50 m. The polythene tubes are removed off by making a side slit with blade before planting seedlings into the field. They are planted in the prepared pits of 30 cm x 30 cm x 30 cm size in the field. The soil taken out from the pit is mixed with 2 kg FYM and treated with 10 ml of 0.065% Dursban. The spacing for

plantation at 1.20 m x 1.20 m are found to be ideal for Arjun (approx. 6,724 plants/hectare) and 1.80 m x 1.80 m for Asan (Approx. 3,025 plants/hectare). Basins are prepared around the transplanted seedling to harness rainwater. Transplantation and maintenance of Oak plants is similar to that of Tropical Tasar. Four years old plantation may be used for Tasar silkworm rearing purpose. The gestation period for normal forest plantation is six years. However, well-maintained systematic plantations will be ready for rearing in 3 to 4 years.

Check Your Progress 1

Note: a) Use the spaces given below for your answers.

b) Check your answer with those given at the end of the unit.

1) Why seed soaking is necessary in Tasar? Describe seed soaking process.

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2) Describe transplantation of seedlings into a field.

.....

1.4 PLANTATION MAINTENANCE

The Arjun and Asan plants are grown under rain-fed conditions and the dry farming techniques are normally adopted for increasing the soil moisture and fertility. Pruning of plants is one of the important aspects that make the plants grow better. Pruning is taken up after the gestation period. It helps in increase of foliage, removal of dead or diseased parts, maintaining desirable height and shape of the plant and establishing a functional relationship between different organs of the plant.

Plants are heavily pruned at 1.80 m height, once in two years, during the month of February. Light pruning is done to the shoots of 2.50 cm diameter in alternative years during the month of February. Application of fresh cow dung and soil mixed with the fungicide Bavistin is recommended at the cut ends of the plant to protect the tree from dying. In chawki gardens, Asan or Arjun plants are pruned at 1 m height. This helps to maintain the plant height at 1.80 m as per the requirement.

1.4.1 Soil Moisture and Weed Management

Maintenance of soil moisture and weed management are the important aspects of plantation maintenance. To enhance rainwater retention for a longer period in the plot and to increase its percolation to the deeper layers of the soil, contour bunds are prepared to check the run-off rain water. This allows maximum percolation also. Regular digging and loosening of soil is necessary around the base of the plants before and after monsoon during June/July and August/September, respectively. Weeds are also removed while digging.

1.4.2 Management of Soil Fertility

Soil fertility is automatically maintained if the normal practices like hoeing and weeding are regularly taken up (3-4 times a year). Such practices also check the growth of

pest population in the field. In addition, both organic and chemical fertilizers are applied in Arjun and Asan plantations to replenish the nutrients. Farmyard manure is applied @ 2 kg per plant during November-December in alternate years by making rings or holes around the plant in the form of circular trenches (15 cm depth). The chemical fertilizers are applied every year through 3-4 holes of 22.50 - 30.00 cm depth, around the plants and the holes are covered. The fertilizer requirement is N:P:K @ 75:25:25 for plants of 2-3 years old, 100:50:50 for plants of 4-10 years old and 150:50:50 for the plants above 10 years old. They are applied during the onset of monsoon, Potash and Phosphate (single dose) and nitrogen (two split doses) during June/July and August/September months.

For Oak plants, NPK is applied @ 75:25:25, 100:50:50 and 150:50:50 kg/ha in two split doses to 2-3, 4-10 and above 10 years old plants, respectively. FYM is applied @ 45,000, 30,000 and 27,000 cm³/ha/ year to *Q. serrata*. Alternatively, NPK @ 75:25:35 along with Azatobacter or Azospirillum @ 10 kg and Phosphobacterium @ 20 kg/ha can be applied. Irrigation is necessary when there are no rains.

In addition to the fertilizer application, the plantations are sprayed with 1.5% Urea solution before 15 days of starting silkworm rearing, for better nutrition.

1.4.3 Management of Plant Size

Management of plant size is done through pruning and trimming of the host plants. This regulates the shape, growth and vigour of the plants and produces desired quantity of quality leaves.

Initially, the tasar (Asan and Arjun) host plants are trained through clipping, light pruning and thinning to streamline growth and improve their branching pattern. After the gestation period, the pruning of plants is adopted by 'Open Centre System' where the main trunk is allowed to grow up to 1.50 m in *T. arjuna* and 1.80 m in *T. tomentosa*. After heavy pruning, when sprouting is initiated, allow only 8-10 healthy shoots to grow. Nip-off the unwanted buds. In light pruning, only the branches of 2 cm diameter or less are cut. The light and heavy pruning are taken up during alternate years. After every pruning, sufficient nutrients are given to the plants.

In the case of Oak plants, the pruning operation taken up in September ensures leaf sprouting by the end of February or first week of March at low altitude (750 m) and ten days later at middle and higher altitude (1200 m and above). For second crop rearing, pruning may be given one month earlier to onset of rearing.

1.4.4 Plant Diseases and Pest Management

Regular and clean cultural practices not only protect the tasar host plants from pests and diseases but also provide a healthy place for plant. It is also advisable to ignore rearing of silkworm if damage caused by pests is vigorous. The host plants, Arjun and Asan are infested by a number of pests like Ash Weevil, Leaf Gall, May-June Beetle, Stem Borers and Tussock Moth. Similarly, there are a number of diseases like Black Nodal Girdling, Leaf Curl, Leaf Spot and Powdery Mildew. The management practices are detailed in Course 4.

Check Your Progress 2

Note: a) Use the spaces given below for your answers.

b) Check your answer with those given at the end of the unit.

- 1) How is soil fertility maintained for Tasar food plantation?
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- 2) What do you mean by Pruning? Describe a pruning process of Tasar food plant.
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1.5 LET US SUM UP

Tasar silkworms are generally wild. They feed on a wide variety of food plants available in the forests. Based on the geographic locations, the Tasar silkworms are classified as Temperate and Tropical Tasar. Tropical Tasar silkworms are reared generally on *Terminalia arjuna* (Arjun), *T. tomentosa* (Asan) and *Shorea robusta* (Sal) called as primary food plants. The other food plants are *Lagerstroemia parviflora* (Sidha), *L. speciosa* (Jamun), *L. indica* (Saoni), and *Zizyphus mauritiana* (Ber). The temperate tasar silkworm commonly feeds on Oak plants. The host plants of Temperate Tasar are namely, *Quercus serrata* (Uyung), *Q. semiserrata*, *Q. dealbata*, *Q. grifithi*, *Q. incana* (Banj), *Q. semicarpifolia* (Kharshu), and *Q. himalayana* (Moru).

Propagation of *Shorea robusta*, the tropical Tasar primary host plant is not possible through seedlings because of its slow growing nature and it is propagated only through natural regeneration in the forest. However, the other primary host plants of Tropical Tasar namely, Arjun and Asan plants are raised through seeds and maintained for suitable foliage for silkworm feeding outside the forest areas also. Suitable nursery and plantation techniques and package of practices for plantation development and maintenance, developed by the R&D Institutes of CSB help in strengthening and contribute in increasing the productivity by way of increased quality production of foliage.

1.6 GLOSSARY

Germination	: The process of development of a seed to give rise to plumule and radicle.
Maintenance	: Taking care of plants through different methods for obtaining desired growth of the plants.
Nursery	: An area where the young plants are allowed to grow and are taken care-off before transportation for plantation.
Plantation	: A group of cultivated trees or plants in an area under cultivation.
Pruning	: Pruning is a process to cut the plant above the ground level for regulation of shape, growth and vigour of trees to produce leaves of desired quality.
Seedling	: A young plant propagated through seed.

1.7 SUGGESTED FURTHER READING

Anonymous. 2003. *Integrated Package for Tasar Silkworm Rearing - A report by CTRTI, CSB, Ranchi.*

FAO. 1987. *FAO Manuals on Sericulture.* Reprinted by Central Silk Board, Bangalore.

Thangavelu, K. 2000. *Lessons on Tropical Tasar* (Ed). CTRTI, Central Silk Board, Ranchi.

1.8 REFERENCES

Anonymous. 2003. *Integrated Package for Tasar Silkworm Rearing- A report by CTRTI, CSB, Ranchi.*

FAO. 1987. *FAO Manuals on Sericulture.* Reprinted by Central Silk Board, Bangalore.

Thangavelu, K. 2000. *Lessons on Tropical Tasar* (Ed). CTRTI, Central Silk Board, Ranchi.

1.9 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

- 1) Seeds of tasar food plant are quite hard. Due to hard skin, it takes more time for sprouting. So, for propagation, it is essential to soften the hard skin (known as pericarp) to facilitate the germination of seeds before sowing into soil for proper and effective growth of plants.

Seeds of tasar and oak are collected, soaked and packed in gunny bags. They are sunk in pits or ponds containing clean water for 96 hours (Arjun), 48 hours (Asan) and for 2-4 days (Oak). For perfect soaking, weights are put on the gunny bags containing the seeds.

The soaked seeds are removed from the gunny bags and heaped in tree shade and the heap is covered with wet gunny cloth/bags. Water is sprinkled regularly on the heap to maintain the required humidity till germination. Each heap ideally contains 1,500 to 2,000 seeds.

- 2) Two to three months old seedlings are transplanted to the plantation site when it attains a height of 1.50 m. The polythene tubes are removed off by making a side slit with blade before planting seedlings into the field. They are planted in the prepared pits of 30 cm x 30 cm x 30 cm size in the field. The soil taken out from the pit is mixed with 2 kg FYM and treated with 10 ml of 0.065% Dursban. The spacing for plantation at 1.20 m x 1.20 m are found to be ideal for Arjun (Approx. 6,724 plants/hectare) and 1.80 m x 1.80 m for Asan (Approx. 3,025 plants/hectare). Basins are prepared around the transplanted seedling to harness rainwater. Transplantation and maintenance of Oak plants is similar to that of Tropical Tasar. Four years old plantation may be used for Tasar silkworm rearing purpose. The gestation period for normal forest plantation is six years. However, well-maintained systematic plantations will be ready for rearing in 3 to 4 years.

Check Your Progress 2

- 1) Soil fertility is maintained by applying the chemical and organic fertilizers and through clean cultural practices. In order to replenish the nutrients in the soil, both organic and chemical fertilizers are applied to Arjun and Asan plantations. Farm yard manure is applied at the rate of 2 kg per plant during month of November- December in alternate years by making either trenches of 15 cm deep around the plant. Apply chemical fertilizers by 'deep placement method', by making 3-4 holes of 30.00 cm depth around the plants. Cover the holes well with soil after application of fertilizers. The normal practices like hoeing and weeding 3-4 times a year not only maintain soil fertility but also check the growth of pest population in the field.

Chemical fertilizers, NPK is applied in the proportions of 75:25:25, 100:50:50 and 150:50:50 kg/ha in two split doses to 2-3, 4-10 and above 10 years old plants, respectively. Potash and Phosphate are applied in a single dose during monsoon while the nitrogen is applied in two split doses during June/July and August/September months. FYM is applied @ 45,000, 30,000, and 27,000 cm³/ha/yr to *Q. serrata*. Alternatively, NPK @ 75:25:35 along with Azotobacter or Azospirillum @ 10.00 kg and Phosphobacterium @ 20 kg/ha can be applied. After NPK application, irrigate the plot if there is no rain. A foliar spray of 1.5% Urea is also taken up on the plantation just 15 days before silkworm rearing for stabilizing the nutrients in the leaf. Apply 1 g Endofil-M 45 along with NPK for controlling termite attack and fungal diseases.

- 2) Pruning means to cut-off plant parts in a systematic manner and to make it to grow better. It helps in increasing the foliage, removing the dead or diseased parts, maintaining the desirable height and shape of the plant and establishing a functional relationship between different organs of the plant. The method is, initial training by clipping, light pruning and thinning and then pruning when the plants are 4 to 5 years old only. Prune Arjun and Asan plants following the open centre system, where the main trunk is allowed to grow up to 1.50 m in *Tarjuna* and 1.80 m in *T. tomentosa*. A mixture of soil and fresh cow dung is applied on the open cut ends of the plant to protect the trees from drying. After heavy pruning when sprouting is initiated, allow only 8-10 healthy shoots to grow. Nip off unwanted buds. In light pruning, only the branches of about 2.00 cm diameter or less are cut. Light and heavy prunings are done during alternate years. Sufficient nutrients are applied after pruning to keep the plants growing for nutritious leaves.

In case of Oak, pruning in September ensures leaf sprouting by the end of February or first week of March at low altitude (750 m) and ten days later at middle and higher altitude (1,200 m and above). For second crop rearing, pruning may be done one month earlier to onset of rearing.