



Tree Mulberry Cultivation: A Sustainable and Economically Viable Approach to Sericulture

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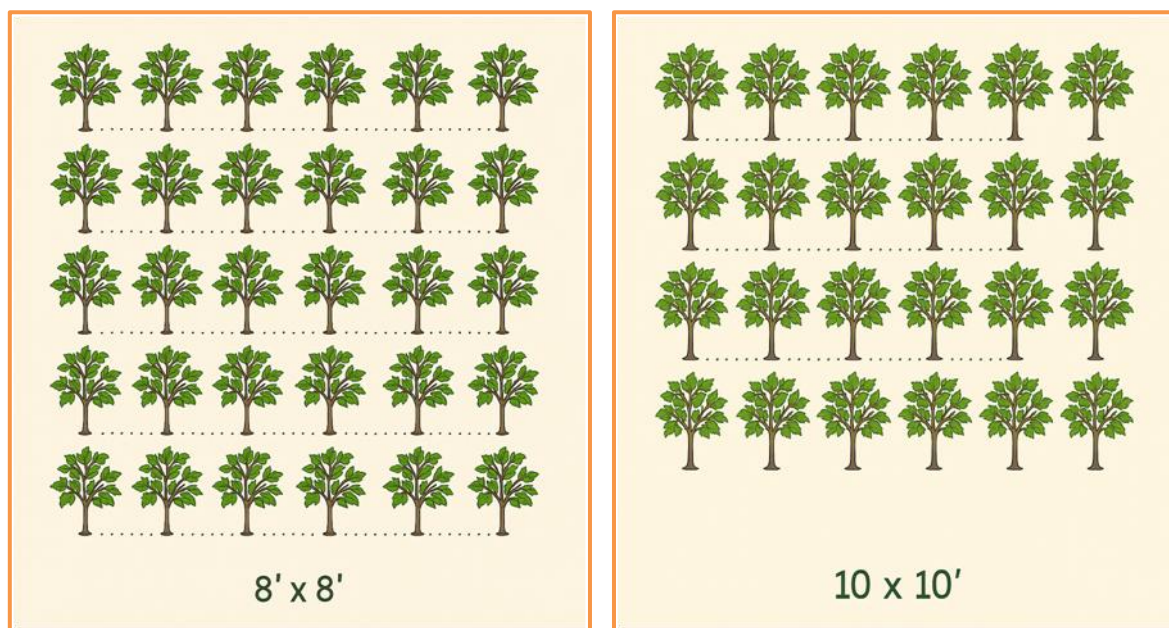
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Mulberry (*Morus* spp.) is the sole food plant for the silkworm (*Bombyx mori*) and forms the foundation of sericulture. It is a fast-growing, deciduous, perennial woody plant with a deep-rooted system, well adapted to a wide range of climatic conditions, from temperate to tropical regions. In India, mulberry is cultivated across various agro-climatic zones using region-specific methods. In the plains of Southern and Western India, it is commonly grown as a low bush with closer spacing (2'x6' to 3'x3') to facilitate intensive harvesting. In contrast, in the hilly terrains of Jammu and Kashmir, mulberry is cultivated as medium to large trees with wider spacing (5'x5' to 10'x10'), adapting to the topography. Recently, tree-type mulberry cultivation has gained popularity, especially in southern India, due to its many advantages. These include lower cultivation costs, ease of maintenance, and the ability to withstand water deficit conditions, which ensures a more sustainable and consistent leaf yield. The deeper and more extensive root system enhances nutrient and water uptake, while wider spacing allows farmers to utilize land more effectively by growing seasonal intercrops. Additionally, maintaining the tree crown at a specific height improves leaf quality by ensuring proper aeration and sunlight penetration. Given these benefits, tree-type cultivation is becoming an attractive option for seri-farmers. A techno-economic comparison between tree mulberry and the paired row system reveals a clear economic advantage for the tree system, with a benefit-cost (B:C) ratio of 1:3.71 against 1:2.88 in the paired row system. This underscores the long-term profitability and economic viability of adopting tree mulberry cultivation in sericulture. To fully realize its potential, a systematic package of practices needs to be developed and promoted among sericulturists to enhance leaf yield and quality in a sustainable and eco-friendly manner.

Mulberry varieties

In India, several high-yielding mulberry varieties have been developed for region-specific cultivation. In Southern India, varieties such as V-1, G-4, MSG-2, AR-12, and S-13 are highly recommended due to their adaptability and high leaf yield and are well-suited for tree plantation models. For Eastern and North-Eastern India, the varieties C-2058, C-2060, and C-1360 are preferred, as they perform well in the humid and hilly terrains typical of these regions. In Northern India, Goshorami, Chinese White, Chak Majra, and Sujampur are the commonly grown tree-type mulberry cultivars, favoured for their ability to withstand colder climates and their robust growth in the northern plains. Choosing the right variety based on regional suitability is crucial for successful mulberry cultivation, especially under tree-based farming systems.



Establishment of Tree Mulberry Plantations

Mulberry is a hardy plant that can be successfully cultivated across various topographies, including sloping terrains. It thrives best in soils with a pH range of 6.5 to 7.5. Before planting, the land should be thoroughly ploughed, preferably after receiving one or two pre-monsoon showers. Tree mulberry plantations should be established as block plantations, with recommended spacing of either 8 ft × 8 ft (accommodating approximately 680 plants per acre) or 10 ft × 10 ft (about 436 plants per acre). Following land preparation, organic manures such as farmyard manure (FYM), seri-compost, or vermi-compost should be applied at the rate of 10 metric tonnes per acre and mixed well with the soil. To conserve soil moisture, wide bunds should be constructed along the plantation boundaries to prevent runoff and facilitate rainwater percolation. Planting should be done using the pit system, with each pit measuring 4 ft × 4 ft × 4 ft, depending on the adopted spacing. Regular watering, at least once a week, is essential until the garden is fully established. For optimal growth and ease of maintenance, the crown height of the tree should be maintained at 4 to 5 feet above the ground level.

Garden Maintenance

Training of trees is a crucial phase in the establishment of a tree mulberry plantation, as the productivity of the plantation largely depends on the number of healthy branches per plant.

Proper care should be taken to ensure the development of a strong main stem and a well-formed crown with about 40–50 vigorous and healthy shoots per plant, which are essential for producing quality leaves. The training begins with the first apical cut to the sapling at a height of 4–5 feet from ground level, immediately after planting. During the initial nine months, all unwanted buds emerging from the lower part of the stem should be removed, allowing only 3–4 branches at the top to grow. The second pruning should be performed at a crown height of 4–5 feet, retaining 3–4 branches, each having 3–4 buds. Leaf plucking should be avoided during the first year of establishment to ensure robust growth. The third pruning, conducted after three months, involves selecting 5–6 shoots and pruning just above the previous cut, leaving 2–3 buds on each. Another three months later, the fourth pruning should be done by selecting 10–12 shoots and pruning in the same manner. After a further interval of three months, the fifth pruning can be carried out by selecting 20–24 shoots, again leaving 2–3 buds at the base of each branch. Maintaining this crown height not only supports the development of around 40–50 productive shoots per plant but also ensures the regular harvest of high-quality mulberry leaves.

Nutrient Management

During the establishment period of a tree mulberry plantation, nutrient management plays a vital role in ensuring healthy growth and long-term productivity. It is recommended to apply Farm Yard Manure (FYM) at the rate of 8 kg per plant along with NPK fertilizers in the ratio of 86:35:35 g per plant per year, split into two doses after preparing basins around the plants. Adequate irrigation should be provided during this period, either through a drip irrigation system or by pot watering, to support root development. Once the plantation is established, the application of 15 kg FYM along with NPK @ 258:103:103 g per plant per year is essential for sustaining leaf production and maintaining soil fertility. Continued irrigation is necessary and should be provided through drip or furrow irrigation methods, depending on water availability and soil conditions. The adoption of drip irrigation is especially beneficial, as it can save up to 70% of water compared to traditional methods. By following these nutrient management practices, an average leaf yield of 4 to 6 kg per plant per crop can be expected after the garden is well established. Leaf yield may vary based on the planting spacing adopted. Under irrigated conditions, up to five crops can be harvested annually, while under rainfed conditions, four crops are typically achievable.

Intercropping

Intercropping in tree mulberry plantations is a beneficial practice both for improving soil health and enhancing farmers' income. It is recommended to grow green manure crops as intercrops twice a year, using 10 kg of seeds per acre per crop, preferably sown at the onset of the monsoon. For red soils, Sunhemp (*Crotalaria juncea*) is advised, while for black soils, Dhaincha (*Sesbania aculeata*) is suitable. These green manure crops should be mulched back into the soil 30 to 45 days after sowing, just before they begin to flower, to enrich the soil with organic matter and nutrients. Once the mulberry garden is well established, intercropping with short-duration crops such as ragi, groundnut, cowpea, horse gram, spinach, and maize can be practiced to provide an additional source of income. However, intercropping with ginger and chilli should be strictly avoided, as these crops are not compatible with mulberry cultivation and may affect plant health and productivity.

Constraints in tree mulberry plantation

Despite its many advantages, tree mulberry plantation comes with certain constraints that need to be carefully managed for successful adoption. One of the primary challenges is the longer establishment period, as the trees typically take 12 to 15 months to mature and begin yielding harvestable leaves, unlike bush systems which provide quicker returns. During this period, leaf plucking is avoided to encourage proper crown development, resulting in a delay in income generation. The initial investment and labor requirement are also relatively high due to the need for pit preparation, staking, and formative pruning. Moreover, the system

demands technical knowledge for training and pruning; without proper skills, poor crown formation can significantly reduce productivity. Mechanization of operations such as pruning and harvesting is limited due to the tree structure and wider spacing. Pest and disease management can also become more complex in taller trees if routine monitoring is not practiced. While tree mulberry is drought-tolerant once established, young plants are particularly sensitive to water stress and require regular irrigation during the initial stages. Additionally, the tree system is not well-suited for intensive and frequent harvesting cycles, which can be a limitation in high-demand commercial sericulture operations. Addressing these constraints through proper planning, training, and support can help optimize the benefits of tree mulberry cultivation.