AgriCos e-Newsletter
ISSN: 2582-7049
AgriCos e-Newsletter
Open Access Multidisciplinary Monthly Online Magazine
Volume: 05 Issue: 05 May 2024 Article No: 15

The Agro-Industry Crop – Shahtoot (*Morus alba*)

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SUMMARY

Mulberry (*Morus alba*) belongs to family Moraceae. The various parts of the mulberry plant find use in ayurvedic preparation. These are used to control blood pressure. Mulberry trees are perennials, attains a height of 20-25m. Leaves are simple, alternate and stipulate. Inflorescence is catkin. Fruit type is sorosis. Cross pollination takes place and varieties like V1, Anantha, G-2 and G-4. Production requires red loamy soils, PH 6.2-6.8, rainfall about 600-2500mm. It is propagated by cuttings which yields good growth. Mulberry is cultivated under rainfed and irrigated conditions. In rainfed conditions pit system, whereas in irrigated conditions ridges and forrow method are followed. Timely split doses of fertilizers were given and pruning should be done based on the requirements and method of cultivation. Harvesting done by three methods namely leaf plucking, branch cutting and whole shoot harvests.

INTRODUCTION

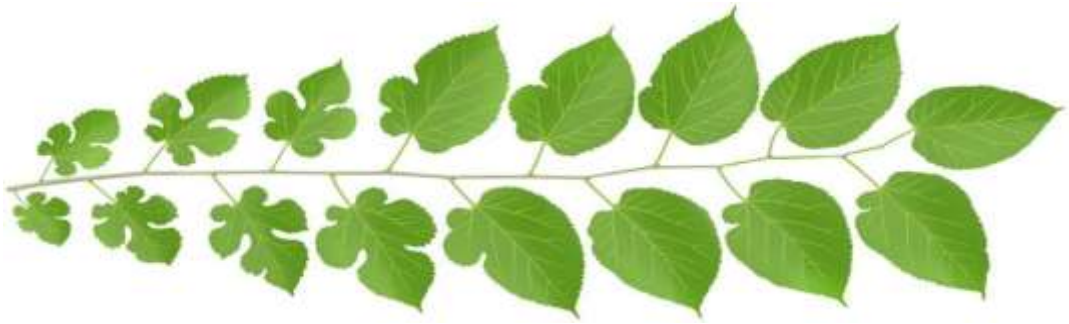
The various parts of the mulberry plant find use in Ayurvedic preparations. The leaves have diaphoretic and emollient effects and are used for making a decoction that can be used as a gargle throat inflammation. The fruits are used to treat sore throat, depression, high fever and are both a coolant and laxative. The root extract has hypoglycaemic properties. The root bark is used as an anthelmintic, purgative and vermifuge. Mulberry root juice is administered to patients with high blood pressure. The Chinese use the leaf tips from young leaves to boil with tea to control blood pressure. The milky latex is used as a plaster for sores and for the preparation of dermal creams.

Botany: Mulberry leaves belong to the genus MORUS. The plant is perennial one, living for a number of years either cultivated or in wild state. The plants are allowed to grow as trees attain a height of 20-25m with a girth of the trunk about 8m in the case of Morus serrata. In some areas the plants are allowed to grow as middlings, i.e,they are pruned at a height of 45-90cm from the ground level every year.

Stem: *Morus indica* species are white to greyish white in color, Japanese varieties like shimonuchi and mizusawa are reddish brown in color. The Mysore local, kanva-2 and behrampur of *Morus indica* are white to greyish white in color.

Bud: The mulberry of tropical climate sprouts throughout the year. In mulberry generally one bud is found in the axil of leaf. sometimes two more independent buds on either side of the main bud are also found. These are called accessory buds. Mulberry varieties are grown in Mysore a West Bengal sprout throughout the year. The vegetative buds give rise to vegetative parts like leaves and branches. Reproductive buds produce male and female inflorescence in addition to leaves.

Leaves: The leaves are simple, alternate and stipulate. The size of stipule varies with variety, such as 1.5-2.0 cm in *Morus nigra* and chinar variety of Kashmir. Mulberry is unique in processing both lobed and unlobed leaves. The lamina of leaves is usually glabrous but may vary with the variety. The leaves of variety kairio-Nizumageshi are coriaceous and of Ichehai are hirsute. The size of the lamina nearly measures 30 cm in length along the midrib and about 25 cm breadth at the widest region. The thickness of the leaves is about 100-200mm.The shape of the leaf is decided by the main, side and bottom veins. The venation of mulberry leaf is multicostate reticulate. The leaf base is generally three nerved as in the case of *Morus alba.*



Infloroscence: The infloroscence of mulberry is catkin with its drooping peduncle, bearing unisexual flowers. The plants are generally dioecious. The flowers of mulberry are small, usually sessile or infrequently shortly pedicellate, regular and unisexual. The male catkin is usually longer than female catkin measuring 2.5-5cm long. The female catkin is auxilary in position in measuring 1.5-3.5cm long.

Flower: The male flowers are loosely attached to the peduncle. The flower consists of four perianth leaves arranged in two whorls with imbricate aestivation. The stamens are four, arranged opposite to perianth leaves. The filaments of the stamens are bent inward in bud condition. Anthers are dithecous with longitudinal dehiscence. The pollen grains are round, dry, light and dust like smooth exine. In female flower, the ovary is superior, bicarpellary, syncarpous, oval, unilocular with a single pendulous ovule attached to the margin of the ovary and has a bifid stigma. After pollination and fertilization the entire inflorescence becomes a multiple fruit.

Fruit and Seed: Cross pollination takes place and fruit type is Sorosis. The fruits are avoid to sub globular in shape measuring 5cm in length. Mulberry seed is oval in shape with a nearly flat surface at the micropylar region. On one edge found an elongated streak with hilum. The seed coat consists of two layers, the outer hard and brittle layer testa and inner thin papery and slightly brownish layer tegmen. The seeds contain 25-30 percent of a yellow drying oil. Liquid fatty acids constitute the major part of the total fatty acids of the oil.

Varieties:

1.**Victory** (**V-1**): It is diploid variety obtained from the cross between S-30×C-776 in F1 generation evolved from CSTRI. Leaves are broad, thick, glossy, smooth, succulent, oval dark green with a thickness of 135-140mm with erect branches. The variety is most suitable for young age silkworm rearing.

2.**Anantha**: It is a diploid and a clonal selection from BFS-135 by Regional Sericulture Research Station, Ananthapur. Leaves are large in size with light green color and it is drought resistant.

3.G-2: Developed during 2003, cross hybrid of Morus multicaules and S-34. The leaves are large, entire cordate in shape with wavy margin.

4.**S-54**: Bushes are open type, branches are simple, vertical rough and greenish grey with short internodes. Lower branches are spreading type. Leaf yield is about 46000kg/ha/year under the irrigated conditions.

Brandis described four species,

Morus alba - cultivated in Punjab, northwest Himalayas ascending to 3500m. The trees grow to a height of 10-15M and are wild and cultivated for their fruit and timber. Bark is greyish brown in colour. Leaves are thin, integral and lobate. Idioblasts are small in size.

Morus indica- Most of the Indian varieties belongs to this species. They are moderate sized deciduous trees, distributed in the lower Himalayan and sub-Himalayan tracts from Kashmir to Sikkim, ascending to an altitude of about 2500m.

Morus serrata -These species grow as trees up to a height of 20 -25m with a trunk girth of about nine m in temperate Himalayas from Kumaon hills westward up to an altitude of 3000m

Morus laevigata - This species is distributed in tropical and sub-tropical regions from Indus valley to Assam, wild and cultivated ascending to 1500 m. Scaly buds are brown and triangular in shape. Leaves are thick, dark green, integral or lobate. Leaf surface is scabrous. Idioblasts are large in size.

Production technology of mulberry:

Soils: The soil should be deep, fertile, well drained, clayey loam to loam in texture, friable with porous and with good moisture holding capacity. Slightly acidic pH (6.2-6.8) soils which are free from injurious salts are ideal for good growth of mulberry. Red loamy soils are suitable for the growth.

Atmospheric temperature: An atmospheric temperature, ranging from 24 -28 c is found to be optimum for good growth of mulberry. In the tropics, growth of mulberry is continuous throughout the year. In temperate regions mulberry leaves are available for rearing purposes only during May to October.

Rainfall: Mulberry can be grown in a range of rainfall range about 600mm to 2500mm.

Atmospheric humidity: Humidity range from 65 to 80 percent is considered ideal for the growth.

Sunshine: In temperate countries, mulberry grows with a range of 5-10 hours a day while in the tropics, it grows well with a sunshine range of 9 to 13 hours a day.

Propagation:

Mulberry is propagated either through seeds or vegetatively. The latter is the most common method of propagation because of various advantages like maintenance of particular characters of the plant, relative speed in raising saplings in large numbers for plantation, to develop resistance to pests and diseases.

In India the most common method of propagating mulberry is through cuttings in multi-location regions like Karnataka and west Bengal. Many of the indigenous varieties and well acclimatized exotic varieties are propagated through cuttings.

Preparation of the cuttings:

Plants which confirm to the qualities chosen for multiplication such as nutritious leaf, higher yield, quick growth, resistance to insect pests and diseases and drought resistance are selected. Shoots of proper maturity and thickness with active and well developed buds are cut from the selected varieties. Generally, cuttings taken from the young seedlings root more rapidly and profusely than those taken from the old mature plants. Cuttings of 7-10 cm usually of pencil thickness with three or four active buds are prepared out of the central portion of the clone with the slanting cut. These cuttings are planted in the field directly or in the nursery beds. Adventitious roots develop from the basal end of the cutting as also from the root analogues of the buds.

Mulberry under irrigated conditions:

In irrigated conditions, Ridges and furrows and pit method of planting is followed. FYM applied @20 tons/ha in irrigated and 10 tons/ha in rainfed conditions.

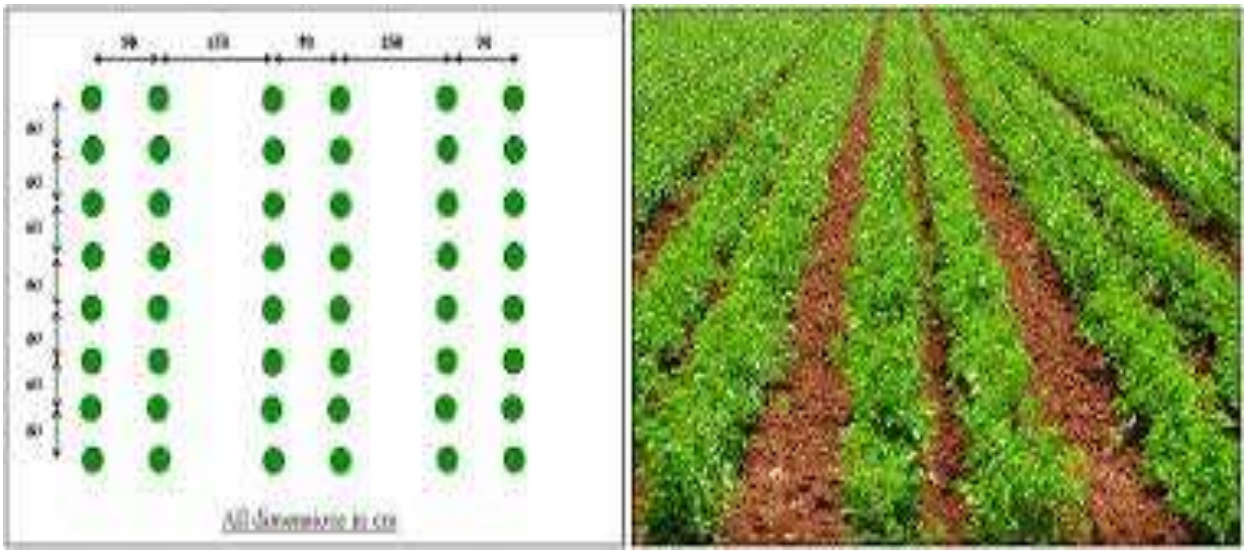
Preparation of Ridges and Furrows:

Mulberry is a subsidiary crop, plants are raised along the boundary of the field. About 400 plants are required to cover the boundary of one hectare of area. The land is prepared into ridges and furrows by ridge former and prepared manually. The cuttings are obtained by shoot of lower shoots, which are having vigorous rooting habit. The branches which are 6-8 months old, dark brown in color, with a pencil thickness of 10-12 mm in diameter are selected. They are cut into bits of 15-18 cm length, with3-4 healthy buds.

Rows are made 60 cm apart and plant to plant distance is 22-25cm apart. Two cuttings are planted at each slot along the margins of the ridges.

Paired row system:

This system followed by commercial farmers who rear silkworm on larger scale, cuttings are planted with a spacing of (90+90+120)×(90+90+120). Spacing between two paired rows facilitates the use of power tiller for intercultural operations and transportation of leaves. It also facilitates the use of drip irrigation system. Accomodates more number of plants/acre, Saves labour upto 40% due to shoot harvesting.



Intercultivation: After 2 months of planting, light hoeing or weeding is done. After 2-3 months second weeding is done.

Irrigation: As the plantation is taken during monsoons there is a advantage of receiving the rain from June to November, when there is no rain it is supplemented by every 10 -12 days required irrigation. But during dry conditions it should be irrigated regularly once in a week.

Mulberry cultivation under Rainfed system: When the mulberry is raised as a rainfed crop, the pit of 35×35×35cm are made by spacing of 90cm.It is recommended to fill the pit with red earth, manure and sand @ratio of 2:2:1 which is applied at the bottom of the pit. The cuttings are planted in a pit leaving only one bud above the surface of the soil, 3 cuttings are planted in each pit in a triangular form with a spacing of 15 cm.

Fertilization: The total dose of fertilizer to be applied in the first year is 100 N: 50 P: 50 K/kg/ha/year. This is applied in two doses. The first dose is applied when the plantation is about two months old at the rate of 50 N: 50 P: 50 K/kg/ha. The second dose is applied after leaf harvesting at the rate of 50 kg N/ha. In rainfed, the total annual requirement of plant nutrients is roughly about 300 kg Nitrogen,120 kg phosphorus,120kg potassium per hectare.

Pruning. After six months of planting, mulberry attains a height of 1.5 to 1.75 m and is ready for harvest. The first harvesting is by bottom pruning. The second leaf harvesting is 12 weeks from the first leaf harvest and the third harvest 12 weeks from the second harvest by shoot harvest. From the second year onwards, harvesting is done at an interval of 70 days by the shoot harvest method. In rainfed conditions, Bottom pruning should be done. In irrigated conditions, plants are pruned at a height of 10-15 cm from the ground level at a time rearing i.e,5-6 sharp harvests corresponding to 5-6 rearings are carried.

Harvesting of leaves:

There are three methods of harvesting mulberry leaves i.e.

1. **Leaf picking**: leaves are picked individually from the plant. In India leaf picking starts about 10 weeks after bottom pruning and the subsequent pickings at an interval of about 7-8 weeks, this obtaining 6-7 harvests in a year.
2. **Branch cutting**: The entire branch with leaves is cut and fed to the worms after third moult. In Kashmir it goes under the name of Batchi system. It saves labour in collection of leaf, distribution of feeds, bed changing and spacing.
3.**Whole shoot harvest**: This system is practiced in Kolar region of Karnataka and Malda district of West Bengal in India

CONCLUSION

Mulberry leaves possess various beneficial effects against cardiometabolic risks, including antihyperglycemic, antihyperlipidemic, antiobesity, antihypertensive, antioxidant, anti-inflammatory. Mulberry provide high employment potential and women friendly occupation as mulberry garden management maintained by women workers mostly. It provides raw material for silk industry for the formation of coccon formation. Mulberry leaves are harvested at six months period for feeding of silk worms

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