Unit 3: Rearing of Silkworms

Selection of Mulberry Variety and Establishment of Mulberry Garden, Rearing House and Rearing Appliances

Sericulture is an agro-based industry. It involves cultivation of host plants and rearing of silkworms for the production of cocoon to produce raw silk. The major activities of sericulture comprises of food-plant cultivation to feed the silkworms which spin silk cocoons and reeling the cocoons for unwinding the silk filament for processing and weaving to produce the valuable products.

Sericulture plays a major role in rural employment, poverty alleviation and earning foreign exchange. A lot of entrepreneurial opportunities are available in various fields of sericulture. It is practised in various states *viz.*, Karnataka, Andhra Pradesh, Jammu & Kashmir, West Bengal and states like Madhya Pradesh and Maharashtra have also started practising Sericulture. The non-mulberry (also called Vanya silk) sericulture is practised in Assam, Jharkhand, Orissa and Madhya Pradesh. More than 6 million people are involved in sericulture activities. It is necessary to upgrade the skills of the sericulturists to use the full potentialities of sericulture to produce qualitatively superior cocoons and to earn profitable income.

India is blessed with cultivation of all the four commercial varieties of silks *viz.*, mulberry, tasar, eri and muga and their food plants. Mulberry silk is considered to be superior in quality as compared to other varieties. *Bombyx mori*, the mulberry silkworm feeds on mulberry leaves (Fig.). About 92 per cent of the total production of the country consists of mulberry silk. Mulberry sericulture is practised in Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Maharashtra, West Bengal and Jammu & Kashmir.

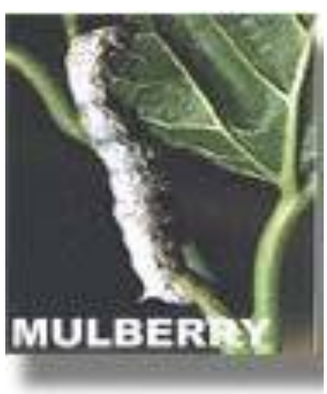

Fig.: Mulberry Silkworm

SELECTION OF MULBERRY VARITIES

Mulberry varieties vary in their production of leaf. So, it is clear that choice of mulberry varieties has an immense role in boosting the leaf production and improving the production of quality silk. A suitable mulberry variety can be listed as the one, which has following characters in addition to production of quality leaf:

1. Should be a good rooter, early sprouted and fast growing.
2. Should respond well to the application of manures and fertilizers.
3. Should be tolerant to diseases and pests.
4. Should be able to produce palatable leaf for silkworm rearing.
5. Should be rich in nutrient contents.

Variety	Rooting (%)	Yield potential (MT/ha/year)	Recommended for
Kanva-2	80	32-35	Traditional variety of Karnataka state.
S-36	48	38-45	Karnataka and other Southern states especially for young age silkworm rearing.
V-1	>90	45-60	Southern states of India with assured irrigation.
S-13	>80	12-15 under rainfed 38-45 under irrigated	Andhra Pradesh, Maharashtra and hotter region of Karnataka.
S-34	>75	12-15 under rainfed 38-45 under irrigated	North Karnataka region and parts of Tamil Nadu having black cotton soil.
MR-2	>80	35-40 in plains	Plains of Tamil Nadu

Table shows the list of mulberry varieties suited to different climatic conditions. Also, it can be seen that developing high yielding mulberry varieties have a significant role to play in the success of mulberry cultivation.

Fig.: V-1 mulberry variety & Large scale mulberry plantation.

Victory-1 : It is also popularly known as V-1. It is a selection from cross-pollinated hybrids of S-30 and Ber. C-776. The variety is characterized by high, erect branches with grayish stem colour. Leaves are succulent, thick large, entire and ovate with truncate base. Leaves are smooth and glossy. It possesses good agronomical characters like high rooting ability, fast growth and high yield. Under irrigated conditions with recommended package of practices, it yields more than 60 MT/ha/year with excellent leaf quality.

S-36 : The variety S-36 was evolved from Berhampore Local by chemical mutagenesis. It is characterized by short internodes, semi-erect and medium branching with grayish pink stem colour. Leaves are unlobed, glossy, pale green with smooth surface. It is recommended for assured irrigated conditions and especially for rearing chawki worms. With recommended package of practices, it yields
40-45 MT/ha/year. Because of high succulence and nutritive quality, it is more suitable for young age silkworm rearing.

S-13 : It is a selection from open pollinated hybrids of Kanva-2. The variety is characterized by short internodes and high branching. Leaves are thick and dark green, unlobed with smooth surface. This variety is recommended for rainfed areas with red loamy soils and also for water scarce areas of the State having high temperature. With recommended package of practices, it yields about 12 MT/ha/year under rainfed conditions and 35-40 MT/ha/year under semi-irrigated conditions.

M-5 : The M-5 or Kanva-2 is a an open pollinated hybrid selection from the seedling population of Mysore Local variety. It grows vigorously and responds well to agronomic inputs. It can be grown under varied agro-cilmatic conditions with suitable system of planting. Leaf yield is 10-12 MT/ha/year under rainfed conditions but an yield of 30-35 MT/ha/year can be obtained with assured agronomic inputs including irrigation once in 8-10 days. This variety is cultivated in almost all the Indian states and recently introduced to some South-East Asian countries like Sri Lanka, Bangladesh, Philippines, Thailand and Vietnam.

ESTABLISHMENT OF MULBERRY GARDEN

Mulberry is cultivated for its leaf to feed silkworm. It is equally important to know that mulberry leaf is the sole food for silkworm and the cocoons produced by the silkworm is the raw material for the silk. Among the different activities involved in the production of cocoon like mulberry cultivation, silkworm rearing practices etc., production of good quality mulberry leaf in large quantity ranks first for the successful production of cocoons. For establishing a mulberry garden and maintaining, the aspects such as soil and climate suited to mulberry plant, preparation of land, mulberry varieties, and types of plantation, planting systems, preparation of nursery and method of propagation one should understood.

SOIL AND CLIMATE

Mulberry is a deep-rooted perennial plant. Therefore, the soil on which mulberry garden is established should be able to supply air, water and nutrients to the plant even from deeper layers. So, it is very easy to understand that preferably soil of mulberry should be *deep* and *fertile* to support the proper growth of plant. Mulberry is a hardy plant and accordingly it can be grown in a wide range of soils. Though, mulberry can be grown in different soils, the clayey loam to loam soils are much preferred. Also, for normal and luxuriant growth of the plant, soil having a pH ranging from *6.2 to 6.8* (slightly acidic) is ideal. Mulberry is affected by hot and cold temperatures. Temperature ranging from 20º– 30ºC suits the growth of mulberry plant. However, temperature below 13ºC and above 40ºC affects the growth of the plant. Mulberry requires a good amount of water for its growth. The optimum rainfall (1,000-1,500 mm) of even distribution is known to help in suitable growth of the plant. Mulberry prefers sunshine, and shade affects the growth of the plant. Sunshine ranging from 9 to 13 hours per day is suitable.

PREPARATION OF LAND

The preparation of land is the first step in planting a crop, so is with mulberry. Land can be prepared by thoroughly ploughing the land with a tractor or power tiller or with the help of bullock drawn plough or manually. The mulberry is a deep rooted plant and it is simple to understand that deep ploughing at *30-40 cm depth is essential* as it will help to loosen the soil and make soil powdery. This can help in eliminating the weeds as well.

TYPES OF PLANTATION AND PLANTING SYSTEMS

Classification of the types of plantation is based on the height at which the plant is pruned or cut. Moreover, once the plant is cut, a crown develops on the plant from where shoots (branches) develop. Figure shows the formation of a *crown.* Formation of the crown is an essential aspect in the establishment of a garden. It has a significant role to play for the shape of the plant and leaf yield. On the basis of the stump height from which the crown is developed, plantations can be classified as:

a) Low cut (bush): Crown height - 20-25 cm
b) Medium cut (dwarf): Crown height - 60-70 cm.
c) High cut (tree): Crown height - 150-175 cm.

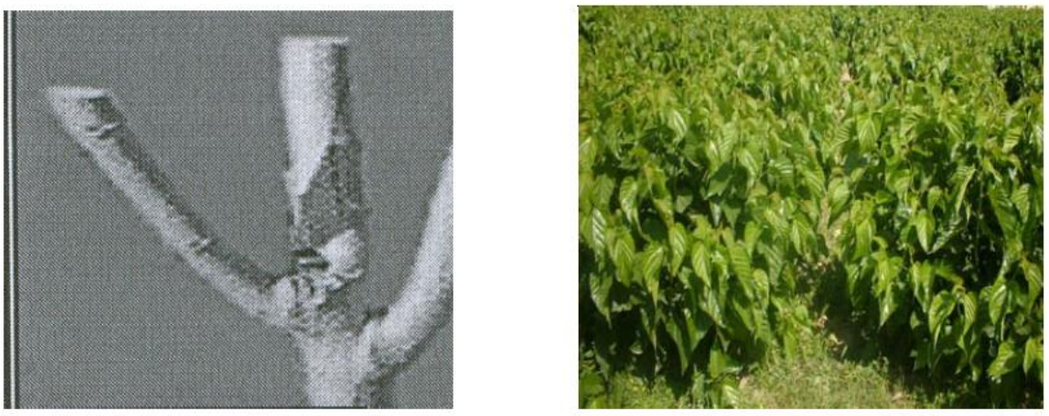

Fig.: Crown formation & A view of bush type of plantation.

The mulberry is being cultivated both under *irrigated* and *rainfed* conditions. Under rainfed condition, it is entirely dependent on rainfall. There are two systems namely *pit system* and *row system* of plantation are being followed in South India. Under irrigated conditions, mulberry is planted either in "pit system" with wider spacing or in "row system" in very close spacing. Under rainfed condition, only pit system of plantation is followed.

Fig.: Paired row system & Garden raised in Paired row system.

METHODS OF PROPAGATION AND PREPARATION OF NURSERY

Mulberry is propagated by asexual methods. Among the asexual methods, vegetative propagation is easy and mostly used in South India. The various procedures for vegetative propagation are stem cuttings, grafting and layering.

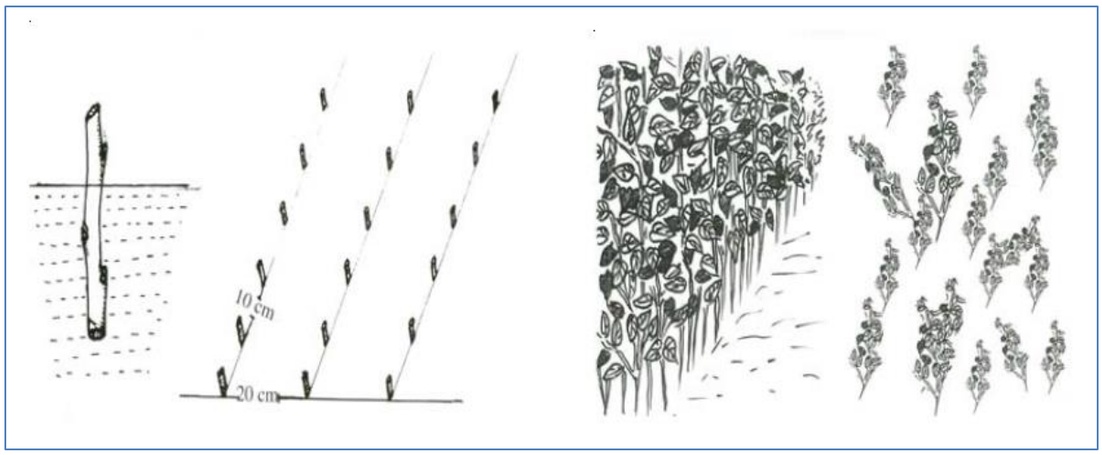

Fig.: Plantation of cuttings in nursery & a comparative view of uniform & un-uniform saplings raised in nursery.

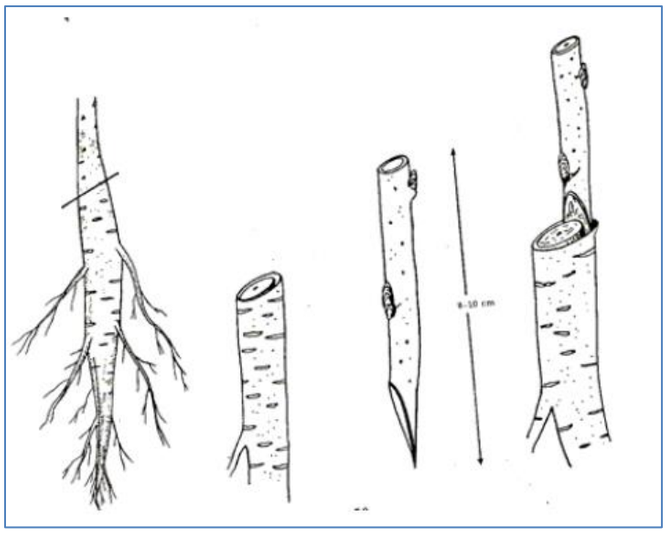

Fig.: Process of Root grafting

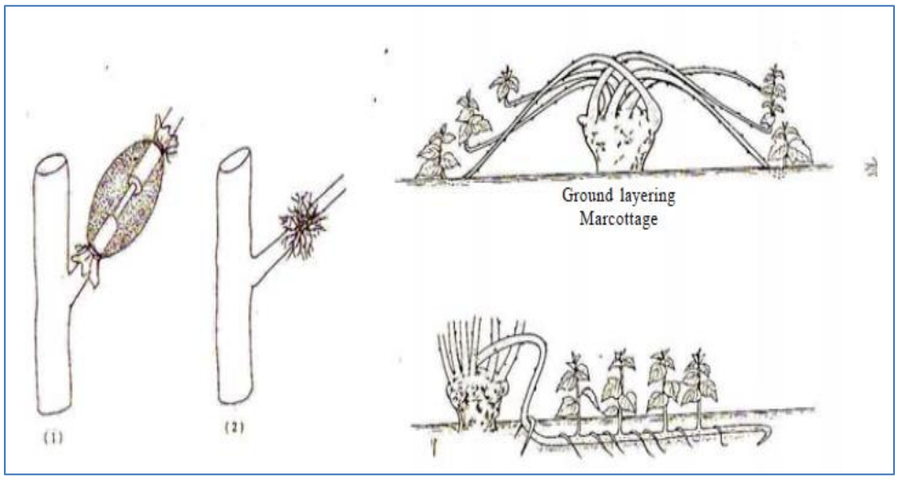

Fig.: Air layering & Trench or Ground layering

Preparation of Nursery

Nursery is a piece of well ploughed and manured land where mulberry cuttings are planted in a proper space to get well developed young rooted plants called saplings. It is made with an intention of establishing mulberry plantation by using saplings to get a uniform plantation with less mortality. Since, direct plantation of mulberry with the cuttings have a high rate of mortality, especially in a place with lack of irrigation facility, the use of mulberry saplings is encouraged. Hence, raising a nursery before taking up a plantation has a very significant meaning. To raise a nursery, it is highly essential to prepare the land with a lot of care. The land must be ploughed deep (> 30cm) with tractor drawn mould board plough two times depending upon the soil texture.

SILKWORM REARING HOUSE

Mulberry silkworm is a domesticated insect which cannot live without sufficient human care. It is also sensitive to high temperature and relative humidity. Besides good feed, a temperature range of 23°C to 28°C and relative humidity of 75-80% is ideal for silkworm. Though, there are a number of modern gadgets to regulate the temperature and relative humidity, investment on them is uneconomical. Therefore, mulberry sericulture is practiced only in those areas where the climate is congenial and the crops scheduled is so regulated to avoid seasons with extreme climate. Besides, the silkworm rearing house is constructed to provide sufficient ventilation and keep the ambiance sufficiently cool.

CHARACTERISTICS OF REARING HOUSE:

A rearing house should essentially provide sufficient bed space for silkworms and working space for the workers attending the rearing operations, good ventilation to replace ammonia, carbon dioxide and other noxious gases released by the silkworms during respiration, excretion, etc. There should be space for leaf preservation, storing other appliances and chemicals or disinfectants used in rearing. The rearing house should be provided with mesh or nylon net all around to prevent entry of uzifly, the most dreaded pest of silkworm. An ante-chamber is necessary to avoid the entry of uzifly, so that the workers can watch, if the fly enters along with them. Lizards and rats are the common predators and therefore construction of a rat-proof sill around the rearing house is necessary. The rearing house should facilitate making it air tight for fumigation or disinfection to ensure

the fumes or vapours from the disinfectants remain inside the house till the germs inside are completely eliminated.

North or south facing of the rearing house is preferred as it provided good aeration since the wind blows either from the north-east or from the south-west. This also reduces the chance of direct sunlight falling on the rearing bed either in the morning or in the afternoon.

SELECTION OF SITE:

As we use pungent disinfectants, which may be hazardous particularly to those suffering from respiratory problems, it is ideal to have the rearing houses away from the thickly populated areas. It is also advisable to keep them off the places of livestock as the chemicals used may harm them. It is also necessary to avoid damp areas which facilitate easy multiplication of disease causing germs and spread of diseases.

Shaded areas under large trees are good for locating rearing houses as they provide cool environment and fresh and clean air in the areas where the temperature and humidity is high. It is ideal to have the rearing house closer to the mulberry garden as it will be convenient to feed fresh leaves with very little moisture loss that occurs during transportation.

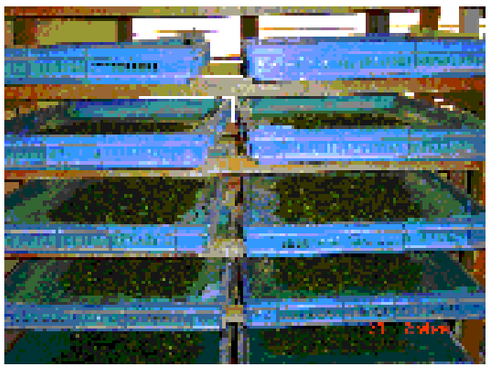

Fig.: Chawki Rearing

Fig.: Shelf Rearing & Tray Rearing

REARING APPLIANCES

Silkworm rearing requires a well-ventilated rearing house with an ante-room with nylon net enclosures to prevent the entry of uzifly, a rat-proof sill around the building. A verandah around the rearing room is preferred to prevent direct sun light into the rearing hall. It should be good enough to seal during disinfection or fumigation. The rearing appliances and consumables required to rear 100 disease free laying (dfls) is given in table.

Table: Rearing Appliances Required to Rear 100 Dfls

Table 2.1: Rearing Appliances Required to Rear 100 Dfls

Sl. No.	Item	Quantity
1.	Disinfection mask	1
2.	Sprayer	1
3.	Room heater with thermostat (2 KV) or charcoal stove	1
4.	Kerosene blow lamp	1
5.	Loose egg incubation frame (not mandatory)	2
6.	Feeding stand (Required for tray rearing)	4
7.	Ant well	2
8.	Leaf chopping board	1
9.	Leaf chopping knife	1
10.	Mat (6'x4')	1
11.	Bed cleaning net (3'x4', mesh size ¼ inch x ¼ inch)	8
12.	Litter basket	1
13.	Rearing tray (Bamboo 3.5' diameter for tray rearing only)	40
14.	Rearing stand (for tray rearing only)	4-5
15.	Feeding stand (For tray rearing only)	2
16.	Shoot rearing rack 5'x45'x3 tiers (for shoot feeding only)	1
17.	Bamboo mountages (6'x4')	40
18.	Plastic basin (Big, 18" diameter)	2
19.	Leaf preservation chamber	1
20.	Leaf basket (bamboo)	2
21.	Bed cleaning net (4'x4')	50

Table: Rearing Consumables Required to Rear 100 Dfls

Sl. No.	Item	Quantity
1.	Paraffin paper	10 meters
2.	Old newspaper	10 kg
3.	Bleaching powder	5 kg
4.	Lime	10 kg
5.	Bed disinfectant	4 kg
6.	Power and fuel	2 litres