
UNIT 2 MULBERRY CULTIVATION PRACTICES FOR EAST/NORTH EASTERN INDIA

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2.0 OBJECTIVES

After reading this unit, you will be able to:

- identify important mulberry varieties cultivated in Eastern and North-eastern regions of India;
- explain the mulberry cultivation practices followed in Eastern and North-eastern regions of India;
- compute the quantity of manures and fertilizers to be applied to mulberry; and
- determine the quality and quantity of leaf produced per unit area.

2.1 INTRODUCTION

The purpose of this unit is to make you understand the mulberry cultivation practices suitable for eastern and north-eastern regions of India. You have also learnt in Block 1, Unit 1 about factors responsible for getting higher yield of quality mulberry leaf suitable for silkworm rearing.

Eastern India comprises of Bihar, Chattisgarh, Jharkhand, Madhya Pradesh, Orissa and West Bengal States. All these states are located at different altitudes (heights) from sea level and have different types of soil and climatic conditions. These states come under tropical climate and most of the time in the year high temperature prevails. Out of these states, mulberry sericulture has been practised in West Bengal for centuries and hence it called as “traditional state”. The state produces about 11 % of raw silk in India.

Similarly, North-Eastern region of India comprises of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura States. These states have very wide variation in altitude (location from sea level), soil, temperature and rainfall. The temperature is moderate to low throughout the year; hence, called as sub-tropical to temperate region. The people of these states used to practise mostly the non-mulberry silk i.e. Oak Tasar and Eri culture since long, while Muga is being practised intensively and traditionally in Assam. Though the North-Eastern states are popular for non-mulberry silk production, mulberry silk is also produced in a limited scale particularly in Manipur and Assam.

Due to the highly variable agro-climatic conditions of Eastern and North-Eastern regions of India, mulberry cultivation has been broadly classified into irrigated, rainfed and hilly regions and improved mulberry cultivation package to produce high yield of quality leaf has been developed. Thus, it is necessary to define a proper package of practices of mulberry cultivation comprising of suitable pruning method, dose of organic manure and chemical fertilizers required for any mulberry variety in the concerned region.

2.2 MULBERRY VARIETIES AND SPACING

You have already learnt in Block 1, Unit 1, that the mulberry leaf is the only food of mulberry silkworm. Hence, to produce desirable quality and sufficient quantity of leaf, specific recommended mulberry variety for specific agro-climatic condition should be used. There are a number of varieties that have been identified for cultivation in these regions depending upon climatic conditions.

Under irrigated condition, S1635 mulberry variety is recommended for planting (Fig. 2.1). This variety needs good irrigation and sprouts quickly. Leaves are large, un-lobed, and dark green in colour. The variety is suitable for harvest five times a year. Another variety S₁ is also recommended for planting under irrigated condition (Fig. 2.2) which can be grown under limited irrigation also and produces broad, entire, dark green leaves suitable for 5 crop harvests per year.



Fig. 2.1: Mulberry variety - S1635



Fig. 2.2: Mulberry variety - S₁

Under rainfed condition with red lateritic soil, the varieties S₁ and C-1730 are recommended for plantation. The variety C-1730 produces entire, greenish leaf with smooth surface.

For hilly region, the varieties Tr-10 and BC-2-59 are recommended for plantation. The leaves of these varieties are greenish and broad. Recently, S-146, a mulberry variety is also found promising in foothills as high bush as well as for tree plantation. For flood prone area of Gangetic plains of West Bengal, C-2028 mulberry variety is found suitable and may be used for better survivability and growth.

The recommended spacing of mulberry plantation under irrigated conditions in plains of Eastern and North East India is followed as row system with a spacing of 60 cm from plant to plant and 60 cm from row to row. The recommended spacing of mulberry plantation under rainfed condition in hilly regions of Eastern and North East India is followed by terrace cultivation or planting in contour bunding at 90 cm × 90 cm spacing in pits during rainy season.

Activity 1
Visit a mulberry farm and find out the differences between the high yielding mulberry varieties and local mulberry varieties. Also, find out different mulberry varieties which are recommended for irrigated and rainfed conditions.

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) Name any two mulberry varieties recommended for irrigated condition.

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2) Which are the varieties recommended for rainfed conditions?

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3) Which are the varieties recommended for hilly region?

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2.3 PRUNING

You have already learnt in Block 2 Unit-1, the importance of pruning as one of the cultural operations in mulberry cultivation. It is an important practice, which helps in the proper maintenance of the garden and also to produce suitable quality of leaf for different instars of silkworm rearing. Thinning and removal of unwanted branches as well as dead stumps, helps in vigorous growth of mulberry plants and assures high yield of quality leaf. Under irrigated condition, the pruning is resorted to after every crop harvest at 20-30 cm above the ground level with the help of Secateur or by pruning saw (Fig. 2.3 & 2.4).



Fig. 2.3: Pruning by Secateur



Fig. 2.4: Pruning by Saw

In case of rainfed garden, pruning is done once in a year at 15 – 20 cm height from ground level during rainy season, while in hilly region, particularly in cold areas, pruning of mulberry is done two times a year at 40-50 cm height from ground level during the months of December and July. In flood-prone areas, mulberry plants are pruned at 30 – 40 cm height from the ground level before the onset of flood to improve survivability of plants.

Activity 2

Visit different mulberry gardens and study the different methods of pruning followed.

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) In rainfed condition, how many times mulberry plants are pruned in a year?

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2) In hilly region, how many times mulberry plants are pruned in a year?

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2.4 MANURE AND FERTILIZER APPLICATION

No living things can survive without food. Mulberry plants also require proper nutrients to produce higher quantity of good quality leaf. Hence, to achieve high quantity of good quality leaf, application of both organic and chemical fertilizer is very much important. Since mulberry removes nutrients from soil very fast due to its rapid growth, the application of organic manure and chemical fertilizers in time and in proper dose is very essential to obtain consistent yield of good quality leaf. You have learnt in Block 1 Unit 2 about the importance of application of manures and fertilizers. You shall now focus on the application of manure and fertilizer in mulberry cultivation followed in Eastern / Northern India.

a) Farm Yard Manure

Farm Yard Manure (FYM) is one of the very important organic inputs in mulberry cultivation. Its application improves the soil fertility and enhances the water holding capacity and microbiological properties of soil. Thus, FYM is applied by broadcasting

in between rows of mulberry at the rate of 20 MT/ ha/ yr, in 2 equal doses (10 MT/ hectare /application) during May-June and Sept-Oct under irrigation condition. The FYM is then properly mixed in the soil by ploughing. In case of rainfed mulberry or mulberry growing in hilly regions, the recommended dose of FYM application is 10 MT/ ha/ yr. It is applied in pits between mulberry rows and closed during rainy season only.

b) Vermicompost

The use of organic manure like Vermicompost is also advocated in mulberry cultivation. It can be produced in any sericultural farm by recycling all the organic residues including silkworm rearing residue and farm weeds (Fig. 2.5). Since vermicompost is eco-friendly and contains much more nutrients specially NPK in comparison to FYM, its application can curtail the requirement of FYM by 50 % besides encouraging the growth of beneficial micro-organisms and improving the soil fertility rapidly. The details of vermicomposting have already been discussed in Unit 2 of Block 1.



Fig. 2.5: Production of Vermicompost in tanks

c) Green Manuring

Besides, growing of green manuring crops like *Sun Hemp/Dhaincha/ Cowpea/ Rice bean* etc. at the rate of 30 kg seeds / ha in between mulberry once or twice during rainy season is also recommended to improve the soil fertility. These plants are generally known as leguminous plants and produce root nodules containing a bacterium called **Rhizobium**, which helps in nitrogen fixation. When these plants are grown and are mixed in the soil by ploughing they improve the soil organic carbon content and also help in weed control. This further increases water-holding capacity of soil and maintains soil moisture during dry season. The details of green manuring have already been discussed in Unit 2 of Block 1.

d) Bio-fertilizers

Further, bio-fertilizers are one of the very good sources of plant nutrients, especially nitrogen and phosphorus. Bio-fertilizers are produced by using live or latent cells of micro-organisms mixed with carrier material like lignite or charcoal. The use of bio-fertilizer like "*Nitrofert*" that contain bacteria called *Azotobacter chroococcum* at the rate of 20 kg /ha/year in irrigated mulberry cultivation can save the application of chemical nitrogen fertilizer by 50 % besides keeping the soil free from chemical pollution (Fig. 2.6). However, in case of rainfed and hilly regions the recommended dose of "*Nitrofert*" is 10 kg/ ha/ yr. This may be applied at the root zones of individual mulberry plant, half in rainy season and the rest half in post - rainy season.



Fig. 2.6: Application of Nitrofert bio-fertilizer in mulberry

Besides, the use of VA-mycorrhizal (VAM) bio-fertilizer called “*Phosphofert*” is also highly useful in mulberry cultivation (Fig. 2.7). It helps the plants to absorb phosphorus rapidly from the soil through the symbiotic association of mulberry roots with certain fungi. By use of this, it is possible to reduce the application of phosphorus by 60- 80%. The use of VAM also improves the root growth of mulberry, thereby enhancing the water absorption leading to increased uptake of phosphorus and various micronutrients.



Fig. 2.7: Improved root growth of mulberry by using Phosphofert application

The dose of phosphofert recommended for irrigated mulberry is 75 kg / ha/ 4 years. It must be applied in rows at root system of mulberry after pruning and soil preparation. Under rainfed and hilly condition, the dose is recommended to be 38 kg/ ha/ 4 years and applied at the root zone of the individual plant. The details of various bio-fertilizers for mulberry have already been discussed in Unit 2 of Block 1.

e) *Chemical Fertilizers*

You have already got an idea about the importance of chemical fertilizer application in mulberry cultivation in Unit 2. Chemical fertilizers are not only used as plant food, their application provides vital growth and strength to the plants and keeps the leaf lush green in colour which becomes more palatable to the silkworms.

The recommended dose of chemical fertilizers is given in detail in Table 2.1. It is to be applied in five equal split doses in case of irrigated mulberry, whereas, it is applied in two equal split doses for rainfed gardens / hilly regions. In irrigated mulberry gardens, the fertilizers, in general, are applied by broadcasting in between mulberry rows and mixed with the soil for proper utilization. The spot application of fertilizers can also be done by opening small pits in between mulberry rows to avoid loss of fertilizers due to direct exposure to sunlight and water. In rainfed mulberry gardens or in hilly region, the fertilizer is applied by making basins around the plants. However,

irrigation should invariably be followed immediately after fertilizer application in case of irrigated mulberry garden, while, fertilizer application in rainfed mulberry or in hilly region should be done only during rainy season. The details of various chemical fertilizers and their application in mulberry cultivation have already been discussed in Unit 2 of Block 1.

Table 2.1: Recommended Dose of Chemical Fertilizers

Name of Fertilizer	Dose of Chemical Fertilizers (kg/ha/yr)
Under Irrigated Condition	
Nitrogen	336
Phosphorus	180
Potassium	112
Under Rainfed Condition / Hilly Region	
Nitrogen	150
Phosphorus	50
Potassium	50

f) Spraying of Plant Growth Regulator

Spraying of “*Morizyme-B*” a plant growth regulator can also be done on mulberry leaf by dissolving 1 ml of it in 1 litre of water (0.1 %) during sunny days twice for better quality of leaf production particularly during winter under irrigated as well as in rainfed conditions. The first spray is done after 15 days of pruning and the second spray after 15 days of first application. About 525 litres of spray solution is required for 1 hectare of mulberry garden.

The details on spraying growth promoter in mulberry cultivation have already been discussed in Unit 2 of Block 1.

Check Your Progress 3

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

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

- 1) Which are the different organic manures applied in mulberry cultivation? What are Green manures? Why are they important in mulberry cultivation?

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- 2) What are different types of bio-fertilizers used in mulberry cultivation?

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2.5 IRRIGATION/SOIL MOISTURE CONSERVATION AND WEEDING

You have already learnt that manures and fertilizers are essential for mulberry plants as food for their vital growth and quality leaf production. But, how do the plants utilize this food? The answer is through water, which transports all the food to the

plants by a mechanism called absorption and it is possible only when irrigation is done or if rain is there. Without irrigation the food from the applied manure and fertilizers cannot be transported to the plants. Thus, regular irrigation in irrigated mulberry and practice of soil moisture conservation in rainfed mulberry or in hilly region is very important.

a) *Irrigation*

Irrigation is an important activity in mulberry cultivation. Of all the inputs taken together, it is irrigation which plays a significant role in the production of mulberry leaf. Since mulberry is grown as foliage yielding crop, irrigation is required once in every 10-15 days. In general, about 2 lakh litres of water per hectare is required for irrigation at every 10-15 days interval during non-rainy periods to supplement the requirement of water for mulberry. Irrigation is done through the furrows prepared in between two rows of mulberry (Fig. 2.9). For rainfed mulberry and mulberry growing in hilly regions, basins are made around each plant to retain rainwater both during pre and post-monsoon showers. These basins are also used for the application of manure and fertilizer from time to time.



Fig. 2.8: Furrow irrigation

The details on irrigation in mulberry cultivation have already been discussed in Unit 2 of Block 1.

b) *Soil Moisture Conservation*

Soil moisture conservation is an important aspect of mulberry cultivation especially under rainfed conditions or mulberry growing in hilly regions. If soil moisture is conserved properly during rainy season or immediately after cessation of monsoon the plants will be able to absorb nutrients efficiently. Thus, soil moisture should be conserved by covering the mulberry field with the help of any organic residues like dry grass / straw / coconut leaves/ water hyacinth / mulberry branches immediately after cessation of monsoon (Fig. 2.10). Making basins around the plants or raising bunds within the plots for retention of rainwater may be practised particularly during dry / winter seasons. These covering materials may be mixed with the soil in the next rainy season to be decomposed as manure.

The details on soil moisture conservation in rainfed mulberry cultivation have already been discussed in Unit 2 of Block 1.

c) *Weeding*

Unwanted plants that grow along with the main plants are called **weeds**. Weeds are the enemies of mulberry. The weeds take a lion's share of the food of mulberry from the soil. Therefore, weeds should be removed from mulberry garden from time to time by manual weeding or by ploughing the mulberry garden or by spraying weedicide (Glycel) or with any good weedicide used locally. The details of using weedicides in mulberry cultivation have already been discussed in Unit 2 of Block 1.

Check Your Progress 4

Note: a) Use the spaces given below for your answers.
b) Check your answer with those given at the end of the unit.

1) Define furrow or channel irrigation?

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2) How do you conserve the soil moisture under rainfed condition?

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3) Why is weeding essential in mulberry cultivation?

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2.6 LEAF HARVEST, TRANSPORTATION AND PRESERVATION

2.6.1 Leaf Harvest

Leaf harvest is a very important aspect of mulberry cultivation as mulberry leaf is the primary food of silkworm. The requirement in quantity and quality of leaf to the silkworm varies during different stages of growth. Leaf harvest from an irrigated mulberry garden is done from 45 days onwards after pruning and is completed by the end of 65 days. Thus, it is possible to harvest 5 crops in a year under irrigated condition. For young age silkworm rearing, upper young and tender leaves (Chawki leaves) are plucked without harvesting the top most leaf. For medium age silkworm, leaf from middle of the branches (medium leaf) may be cut and fed while for matured silkworm (late age), leaves from lower portion of the plants excluding soiled and yellow leaves are harvested with branches. Leaf harvesting should invariably be done during cool hours of the day (morning). However, for any adverse climatic conditions, leaf can be harvested in evening hours also. In rainfed mulberry garden or mulberry growing in hilly regions, leaf is harvested only during rainy season by individual leaf picking method and thus only 3-4 crops can be harvested in a year.

2.6.2 Leaf Transportation and Preservation

You have learnt already that how and when the leaf harvest can be made for silkworm rearing. Now, we will discuss how the harvested leaf is to be transported and preserved. For this reason, primarily, the rearing house should be located near the mulberry garden as far as possible. Short distance between rearing house and the mulberry garden helps to maintain the freshness of leaf and transporting fresh and nutritive leaf is highly preferred by silkworm. Harvested leaves should be covered with 2 layers of wet gunny cloth before transportation to the rearing house. Transported leaves should be used fresh for feeding and remaining quantity can be preserved in well aerated leaf chamber / basket made up of bamboo covered with

2 layers of wet gunny cloth. In case of shoot feeding, the cut shoots or branch of mulberry may be kept loosely and vertically over the floor with the support of the wall and covered with wet gunny cloth. It should never be dumped over the floor without covering with wet gunny cloth. Water should be sprayed from time to time on gunny covers to keep leaf fresh and cool.

Check Your Progress 5

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

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

1) What time is preferred for leaf harvesting?

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2) What types of leaves are required for young, medium and late age silkworms?

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3) How is leaf transported to the rearing house after harvest?

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2.7 LEAF YIELD AND QUALITY ASSESSMENT

The assessment of leaf yield and leaf quality is a very important parameter to understand the production capacity of a mulberry variety under a particular climatic situation. Hence, leaf yield and leaf quality should be assessed during each crop harvest to understand the impact of mulberry cultivation package followed by the sericulturists, which determines the cocoon production. You have already understood that one of the main objectives of mulberry cultivation is to increase the leaf yield and quality so as to get increased cocoon production with minimum cost of cultivation. This is totally dependent on proper maintenance of soil health and environmental factors. The volume of silkworm rearing depends upon the total quantity of quality leaf production. Leaf production also varies from season to season. In winter, leaf production decreases due to slow growth rate of mulberry, while in summer, the leaf yield remains below optimum level of yield due to increased soil moisture loss and in rainy season again the leaf yield increases and reaches its maximum level. Therefore, it is important to estimate the quantity of silkworm eggs (dfIs) to be brushed and reared on the basis of leaf availability.

Earlier, low yielding multi-voltine silkworm breeds were widely used due to low risk of crop failure. However, at present due to the introduction of high yielding multi-voltine and bi-voltine silkworm breeds as well as due to the introduction of high yielding mulberry varieties the scenario of sericulture in North and North East India has changed significantly.

Under irrigated condition, the leaf yield has reached to the tune of 35-40 MT/ ha/ year due to the introduction of the variety S1635 and following improved package

of mulberry cultivation. Similarly, due to the introduction of the varieties S₁ and C1730 in rainfed areas, the leaf yield has been increased to 11- 13 MT/ ha/ yr from a meagre yield of around 5-6 MT /ha/yr earlier.

In hilly areas, the leaf yield has gone up to 19 MT/ ha/yr due to the introduction of BC259 mulberry variety, 17 MT/ha/yr by the introduction of Tr10 and 22 MT/ha/yr by the introduction of the variety S146.

The leaf quality is assessed by chemical analysis as well as by silkworm rearing. Among the chemical parameters of leaf, the assessment of NPK content, protein content, sugar and leaf moisture content are highly important, while rearing parameters like cocoon yield and cocoon quality assessment are very vital.

Check Your Progress 6

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 is assessment of leaf yield important in sericulture?

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2.8 LET US SUM UP

The influence of various agro-climatic conditions and package of practices of mulberry cultivation related to leaf yield and leaf quality in the context of Eastern and North-Eastern India has been explained in this unit. The quantity and quality of leaf have a direct impact on cocoon production as well as profit as it accounts for about 60% production cost of silk. Cultivating high yielding mulberry varieties and adopting suitable cultivation practices ensures high yield of quality leaf. Though mulberry is cultivated both under rainfed and irrigated conditions, production and quality of leaf is always higher in irrigated condition. At present, mulberry varieties *viz.*, S-1635 and S-1 are recommended under irrigated conditions. Under rainfed conditions, variety C-1730 and under hilly regions variety TR-10 and BC-2-59 are recommended. Mulberry is generally raised as bush plantation under 60 x 60 cm and 90cm x 90cm spacing. To get high leaf yield continuously for many years, it is very essential to maintain the soil fertility status of the mulberry garden. Timely application of recommended dose of manure and fertilizers in every year is very essential to maintain the consistent leaf yield. Soil fertility can be improved effectively by application of compost or vermicompost. Application of bio-fertilizers is highly useful and eco-friendly and also helps to decrease the dependency on chemical fertilizers and reduce the cost of cultivation. Irrigation water is the most vital input for consistent leaf yield and quality. Efforts should be made to save water by adopting drip irrigation system and in-situ soil moisture conservation practices.

2.9 GLOSSARY

- Alluvial Soil** : These soils are formed from the sediments deposited by the rivers. They are coarse to medium textured.
- Bivoltine** : Two silkworm crops are produced during the year.

Compost	: Process of conversion of any organic residue into manure through decomposition.
Early Sprouter	: Which sprouts early after pruning.
Frost Resistance	: Which is less affected by winter frost.
Resistant	: Which are less affected by diseases and pests.
Seedling	Plants raised by seeds.
Vermicompost	: Process of conversion of organic residue into manure by earthworm.

2.10 SUGGESTED FURTHER READING

Anonymous. 1975. *Text Book of Tropical Sericulture*. Japan Overseas Cooperation Volunteers, 4 -2-24 Hiroo, Sibuya-Ku, Tokyo, Japan. pp. 1-194.

Dandin, S.B., Jayaswal, J. and Giridhar, K. 2003. *Handbook of Sericulture Technologies* (3rd Edn.). Central Silk Board (Ministry of Textiles – Govt. of India, BTM Layout, Madiwala, Bangalore. pp. 1-277.

Das, B.C. 1989. *Instructional-Cum-Practical Manual on Moriculture*, NCERT, NewDelhi.

Kawakami, K. and Yanagawa. 2003. *Illustrated Working Process of New Mulberry Cultivation Technology* (English – Kannada). JICA, India Project for Strengthening Extension System for Bivoltine Sericulture in India. pp. 1-78.

Rangaswamy, S. and Jolly, M.S. 1976. *Sericulture Manual 1-Mulberry Cultivation*, FAO Publication.

2.11 REFERENCES

Kawakami, K. and Yanagawa. 2003. *Illustrated Working Process of New Mulberry Cultivation Technology* (English – Kannada). JICA, India Project for Strengthening Extension System for Bivoltine Sericulture in India. pp. 1-78.

Rangaswamy, S. and Jolly, M.S. 1976. *Sericulture Manual 1 - Mulberry Cultivation*, FAO Publication.

2.12 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

- 1) S 1635 and S-1
- 2) S-1 and C1730
- 3) Tr10 and BC-2-59

Check Your Progress 2

- 1) Once a year.
- 2) Twice a year.

Check Your Progress 3

- 1) Farm yard manure, Vermicompost, Green manure. Green manure are crops like Sun Hemp, Dhaincha, Cowpea and Rice bean which helps in weed control as well as improving the soil fertility by nitrogen fixation.
- 2) Nitrofert, VA- Mycorrhiza and Phosphofert.

Check Your Progress 4

- 1) Providing irrigation through furrows prepared between two rows of mulberry plants.
- 2) By covering the mulberry field with organic residue like dry grass etc.
- 3) Weeds compete with mulberry for food and space.

Check Your Progress 5

- 1) Leaf harvest should be done during cool hours of the day.
- 2) Tender, Medium and Coarse leaf is fed to young, medium and late age silkworms, respectively.
- 3) Leaves should be transported by covering with wet gunny cloth.

Check Your Progress 6

- 1) To assess the quantity of layings to be brushed.