
UNIT 1 MULBERRY CULTIVATION PRACTICES FOR NORTH INDIA

Structure

- 1.0 Objectives
- 1.1 Introduction
- 1.2 Mulberry Varieties
- 1.3 Manure and Fertilizer Application
- 1.4 Pruning
- 1.5 Leaf Harvesting
- 1.6 Leaf Transportation and Preservation
- 1.7 Yield and Quality Assessment
- 1.8 Let Us Sum Up
- 1.9 Glossary
- 1.10 Suggested Further Reading
- 1.11 References
- 1.12 Answers to Check Your Progress

1.0 OBJECTIVES

After reading this unit, you will be able to:

- identify the type of mulberry plantations and important mulberry varieties available in North India;
- compute the quantity of manures and fertilizers to be applied to mulberry plants;
- explain different methods of pruning and leaf harvest followed in North India;
- assess the quality of leaf suitable for silkworm rearing; and
- indicate the ways by which mulberry leaves can be transported and preserved.

1.1 INTRODUCTION

Before you start studying this unit, please go through Unit 1, Block 1 once again to make yourself clear about various factors responsible for getting higher yield of quality mulberry leaf suitable for silkworm rearing and also how a mulberry garden is established in South India? In this unit, you shall focus on cultivation practices of mulberry for North India. You have learnt about the three types of plantations in mulberry viz., Bush, Dwarf (high bush) and tree. The plantations most commonly available in this region are tree plantation found on roadside (Fig. 1.1), river bunds, boundaries of agricultural fields, as block plantation in departmental farms etc. (Fig. 1.2).

You know that North Indian states have a traditional history of sericulture. Climatic conditions in this region are favourable for *bivoltine* sericulture to produce superior

Mulberry Cultivation for North, East and North-East India

quality silk. You have learnt about the three climatic zones. North Indian region has two main climatic zones, namely *temperate* and *subtropical*. Both these climates favour bivoltine sericulture. Sericulture is a subsidiary occupation in this region and mostly one crop during spring season is taken. You will be learning in this unit about the type of mulberry plants, popular mulberry varieties, quantity of manures and fertilizers to be applied to plants along with time of application, methods of pruning and shoot harvesting and how to assess the quality of leaf based on silkworm rearing. You will also learn about the way mulberry leaf is transported for long distances.



Fig. 1.1: A view of mulberry tree on the roadside



Fig. 1.2: Trained mulberry tree in block mulberry plantation



Fig. 1.3: Basin preparation for mulberry tree Plantation

The importance of preservation of leaf and the method to preserve leaf is also discussed in this unit. It is important to note that mulberry cultivation in North Indian states mostly survives in rainfed conditions. Proper attention is not given to maintenance of mulberry trees. It is easy to understand that for the success of any crop, it has to be

economically comparable with other crops of the region. In this contest, let us discuss the mulberry cultivation practices followed in the North Indian region.

1.2 MULBERRY VARIETIES

You have already learnt about the role of mulberry varieties in Block 1, Unit 1. Remember that there are specific mulberry varieties suited to different regions. So, specific mulberry varieties are to be used for sericultural activities in this zone. To simplify the whole process of learning, this region can be divided into two sericultural zones based on the prevailing climatic conditions as:

- (i) Sub-tropical Sericultural Zone
 - (ii) Temperate Sericultural Zone
- (i) **Sub-tropical Sericultural zone:** The area includes the whole of North Indian states with extremes of temperature. This comprises Jammu province of J&K state, which produces maximum cocoons in the state. The temperature ranges from 2 to 3°C in winter to about 24°C in summer. You may not be surprised to know that snowfall is not experienced in this zone. You may also remember that most of the cocoon production in North India is from the sub-tropical zone only.

The history of sericulture however, shows that sericulture was mostly practised in the temperate zone, which shall be dealt with after you learn more about the sub-tropical zone. Sericulture in the sub-tropical zone has survived on local/wild varieties of mulberry for a long time. A typical local mulberry is shown in Fig. 1.1, which is a poor yielder with small and thin leaves. Later on, improved varieties like *Sujanpur local* and other local varieties were identified and released for commercial cultivation. Since 1970's, many varieties from other parts of the country have been introduced. Among them, varieties S-146, Tr-10, and Chinese White are found more suitable under sub-tropical sericultural zone and have performed to the satisfaction of the sericulturists in this region. The desired characters of mulberry varieties under sub-tropical regions are:

- i. Suitability to train as tree
 - ii. Early sprouting nature
 - iii. Late leaf fall
 - iv. Less fruiting
 - v. Drought tolerance
 - vi. Resistant to diseases and pests
- (ii) **Temperate Sericulture Zone:** These areas experience snowfall during winter months. The major area of this zone is Kashmir valley, higher reaches of Jammu, Himachal Pradesh and Uttaranchal. However, most of the sericultural activities in this zone are confined to Kashmir valley only. You may recall Block 2, Unit 1, where you have learnt that the valley has been a traditional zone of sericulture, having a lot of potential. Sericulture in this region has also survived mainly on local varieties like *Chattatul*, *Botatul*, *Zagtul* etc.



Fig. 1.4: Luxuriant leaf of variety- Goshorami Fig. 1.5: Luxuriant leaf of variety - Ichinose

The process of bringing improvement in the introduction of mulberry varieties in this zone started in 1950's. You may remember that Japan has more or less similar climatic conditions. So, it was believed that the introduction of mulberry varieties from Japan may be useful. The belief proved correct. You have already learnt that the behaviour of the mulberry varieties is different under different climatic conditions. It may be interesting to note that about 60% of the total available mulberry wealth in this zone is from Japan. Japanese varieties which are popular in this region are *Goshorami*, *Ichinose*, *KNG*, *Kakuso-27* etc. Fig. 1.4 & 1.5 shows the luxuriant growth of leaf of improved mulberry variety – *Goshorami* and *Ichinose*. Wild mulberry also contributes to a considerable proposition of mulberry wealth in this zone.

The desired characters identified for mulberry varieties in temperate regions are:

- Fast growth
- Early sprouting
- Erect branching
- Frost resistant
- Acceptance with the farmers
- Less fruiting
- Suitability to train as tree.

Recall that in Block 1, Unit 1, you have learnt about the potential of mulberry varieties as regards to leaf yield in other regions of India. A substantial improvement has been achieved in these regions. Similarly, the improved varieties in temperate sericultural zones have also helped in improving the leaf yield and quality. Variety *Goshorami* can produce a leaf yield of 25-30 tonnes/ha/year under irrigated and bush type of plantation and 15-18 tonnes/ha/year under tree type of plantation under irrigated conditions. Similarly, the variety can yield 16 tonnes/ha/year and 8-10 tonnes/ha/year under bush and tree type of plantation under rainfed conditions, respectively. The yield of other varieties namely *KNG* and *Ichinose* is comparable with *Goshorami*.

Activity 1

Survey a mulberry farm and find out from the grower as to which variety they prefer for silkworm rearing. Also, find out, if the improved mulberry varieties yield more or less fruit than local varieties.

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) Where do you find mulberry trees normally in North India?

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2) Under what conditions are mulberry trees maintained in North India?

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3) Which are the main climatic zones in North India?

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4) What are two popular mulberry varieties in the subtropical region of North India?

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5) Which are the two main mulberry varieties grown in the temperate region?

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1.3 MANURE AND FERTILIZER APPLICATION

You have learnt in Block 1, Unit 2, about the importance of application of manures and fertilizers in mulberry cultivation. Due to the continuous harvesting of mulberry leaf, the soil gets depleted gradually of important nutrients and become poor in fertility. Hence, it is very essential to apply sufficient quantity of manure and fertilizer to maintain the yielding ability of plants and its quality. You may visualize the necessity of manures and fertilizers yourself for improving the status of soils. You may compare leaf harvesting from the mulberry plant with mining operation, where essential nutrients are continuously depleting from the soil. You must know the quality and quantity of fertilizers and manures to be applied to the plants and their method of application. Leaf yield varies from less than one kg to about 50 kg/tree/year or even more. Thus, application of manures and fertilizers for such trees is difficult. The quantity of fertilizers to be applied in tree plants can be calculated depending upon the age of the plant and leaf yield. From the Table 1.1, it will be easy to learn the dose of fertilizers to be applied based on the expected leaf yield.

Table 1.1: Quantity of Fertilizers to be Applied to Mulberry Trees with Time of Application

Age of Tree (Years)	Expected Leaf Yield/ plant (kg)	Requirement of Fertilizer (g) / plant				Requirement of FYM/ Compost (kg)/ Plant During July
		I Dose (February)			II Dose (Aug)	
		N	P	K	N	
1-5	1-10	5-50	5-50	5-50	5-50	4-20
5-10	25-125	25-125	25-125	25-125	25-125	5-20
10 & Above	100-250	100-250	100-250	100-125	100 -250	10-20

It is interesting to note that there are a number of government mulberry farms available throughout the North Indian states, for undertaking different sericultural activities. The plantation in these farms are mostly bush and dwarf types. The recommended dose of chemical fertilizer application for bush/dwarf gardens developed under rainfed conditions of sub-tropical zone are 150:75:75 kg NPK/ ha/yr in two equal doses. The first dose of nitrogen along with phosphorus and potassium (NPK) is applied in the month of February and second dose during August after 20 days before the initiation of silkworm rearing. The above dose of fertilizer is worked out to harvest approximately 15 MT of leaf /ha/yr. The recommended dose of chemical fertilizer application in mulberry garden of temperate belt of North is 250:100:100 kg NPK/ha/yr in two equal doses corresponding to two silkworm rearings. The first dose of nitrogen along with phosphorus and potassium is applied in the month of April and second dose during July / August. The above dose of chemical fertilizer application is worked out to harvest approximately 25 MT of leaf /ha/year. The method of application of fertilizer in mulberry garden is generally practised by broadcasting and spot application which are detailed below:

- i. Broadcasting:** The fertilizer is broadcasted in bush/dwarf type of plantation and mixed with the soil by digging or ploughing.
- ii. Spot Application:** In this case, three to four holes of 20 to 25 cm depth each are dug around each plant and fertilizer is placed in these holes near the root zone. This procedure helps in better uptake of the fertilizers and can be applied for bush, dwarf and tree type of plantations.

In Block 1, Unit 1, you have learnt about the importance of application of Farm Yard Manure (FYM) and compost to mulberry fields. Application of FYM and compost can go a long way for the better growth of mulberry. FYM is applied at the rate of 10 tonnes/hectare/year under rainfed conditions. It is applied in the month of August in the subtropical region and during the month of March in the temperate region.

The role of organic manures like FYM and compost is detailed below:

- It enriches the soil with organic carbon and several micro-organisms besides releasing NPK and micronutrients in the soil.
- It maintains and restores soil health.
- It helps in improving the leaf yield and quality.
- It checks soil erosion.
- It can also increase water holding capacity of soil.
- It also improves drainage of the soil.

It is highly beneficial for the farmers to prepare compost out of the sericultural farm waste (farm residues) which can economize mulberry cultivation.

Activity 2

Observe the difference in mulberry leaf between plants applied with chemical fertilizers and those without fertilizer application. You can do this activity by applying fertilizer to some trees and leaving the others without fertilizer application. Visit a mulberry garden and apply fertilizer by broadcasting method in some trees and by spot application in other trees and analyze yourself. Visit a Government sericulture farm and find out how bush and dwarf plantations are raised. Once you learn the procedure for raising bush and dwarf type of plantations, you can raise a garden confidently.

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) Name any two fertilizers used in mulberry cultivation.

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2) What does application of urea and Single Super Phosphate supply to the plant?

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3) Why are Farm Yard Manures and fertilizers applied to mulberry plant?

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1.4 PRUNING

You have learnt in Block 1, Unit 2 about the importance of pruning. Mulberry has to be shaped to suit management practices. Pruning operation helps in:

- i. Improvement in the leaf yield and quality.
- ii. Maintenance of the plant shape.
- iii. Adjusting the quality leaf availability to synchronize with silkworm rearing.

To simplify the learning on pruning, it would be better to study the methods of pruning under sub-tropical and temperate zones separately.

a) *Pruning under Subtropical Zone*

Recall Unit 1 of Block 1, where you have learnt that mulberry can be grown as bush, dwarf and tree type. You shall learn how bush/dwarf types can be pruned in subtropical zone. Probably you may ask a question to yourself as to why you should prune the plant? Pruning is done to synchronize the leaf availability for silkworm rearing. Mulberry plant is pruned twice, first during monsoon season and second during 3rd to 4th week of December (Autumn season). You may again put a question

to yourself, whether the two prunings carried out are similar. The answer would be that the pruning differs according to the seasons. The plants are pruned at bottom height (at crown height) about *45 days before* the onset of autumn rearing. Second pruning is carried at middle level (*80 cm above the crown level*). This helps to make the leaf available for silkworm rearing during the spring crop. You have learnt in Block 2, Unit 1 that spring is the main crop in North India. Also, you have learnt in Block 1, Unit 1, the meaning of crown in mulberry plant. So, it may not be difficult to know the height at which the two prunings are to be carried out.

Shootlets are harvested and fed to the silkworms of IV age during spring rearing (March – April). Thereafter, shoot harvesting is resorted to. The harvesting itself amounts to pruning. However, precautions are taken not to completely harvest the leaf from the plant. You may ask again a question to yourself as to what are the advantages in doing so. It helps in maintaining the growth of the plant.

Second pruning is carried out during autumn rearing (September- October). In this case only about *0.75 – 1.0 m* of the top portion of the shoots are harvested and utilized for rearing. You may put a question to yourself as to why only the top portions of shoots are used for silkworm rearing. The top position of shoots possess leaves which have more of moisture and are disease free. The bottom portion has old and mostly diseased leaves. Fig. 1.7 and 1.8 shows the stage of prunings during autumn season. Possibly the figures will help you in understanding how the pruning are carried out. Precautions needs to be taken not to damage the bark and shoots while pruning. Fig. 1.6, 1.7, 1.8 and 1.9 shows the sequence of steps for pruning of mulberry for harvesting second crop which otherwise is often less successful.

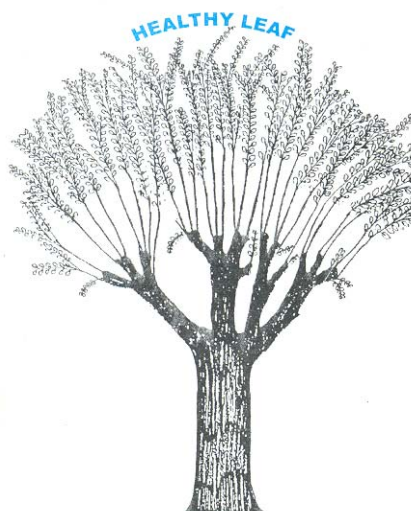


Fig. 1.6: Trained mulberry tree



Fig. 1.7: Mulberry tree before spring rearing



Fig. 1.8: Mulberry tree before
Autumn rearing

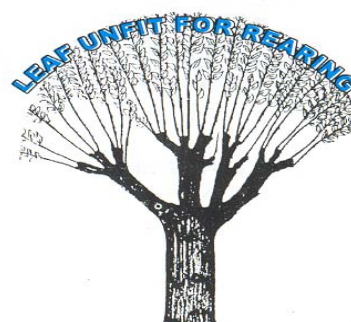


Fig 1.9: Mulberry tree after
Autumn rearing

b) Pruning under Temperate Zone

You have learnt in Block 2, Unit 1, that there are two sericultural zones in North India, viz. subtropical and temperate zone. You have dealt with pruning in subtropical zone above and now you shall learn about temperate zone. Plants which are maintained as Bush and Dwarf are pruned in a similar way. First pruning is carried in the month of *June* and second in the first fortnight of *March*. Mulberry trees are pruned at the stump height by way of shoot harvesting during May- June during spring rearing season.

Activity 3

- 1) Prune a bush mulberry plant at 40-80 and 120 cm from crown during the last week of December and find out the difference in the leaf yield.
- 2) Visit a mulberry plantation and identify two plants by labelling. Prune one plant and leave the other without pruning. Record the difference in the production of leaf.

1.5 LEAF HARVESTING

You have learnt in Block 1, Unit 1, that mulberry leaf is used as a feed for silkworm. Hence, leaf is to be harvested from the mulberry plant. You shall learn about the leaf harvesting for bush and dwarf plantation and for tree type. Under sub-tropical conditions, individual leaf picking is suggested. However, shoot harvesting could also be followed during final stage of spring rearing. You must keep in mind that harvesting of shoots should not be encouraged during autumn rearing. This will affect subsequent spring leaf production.

Leaf Harvesting from Tree Plantation

Our focus here would be to know about the leaf harvesting methods for tree type of plantation. You have learnt that the existing system of mulberry plantation available with the farmers in this region is the tree type. It is simple to visualize that harvesting the leaf from trees is a difficult operation. It may not be practically possible and economically viable to pick the leaf individually. Hence, with tree type of plantation, shoots are harvested and this takes care of pruning as well. The shoots are then carried/transported to the rearing rooms and fed to the silkworms. In short, the pruning operation and harvesting of leaf are clubbed together for its practical utility in the field. This method saves a lot of labour and is less time consuming which otherwise is a constraint in the sericulture occupation. The harvesting of shoots has already been discussed under Block 2, Unit 1 for both temperate as well as sub-tropical sericultural zones of North India.

Activity 4

Visit a mulberry farm where tree type of plantation is available. Harvest the top shoots approximately 1 m in length. Harvest the leaves from the bottom portion of the shoots and find out the difference in the leaf.

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 season crop is the main silkworm crop in subtropical regions?
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- 2) At what height should the mulberry be pruned during 3rd – 4th week of December?
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- 3) It is not practically possible to prune a mulberry tree available on the road side/ river bank: True/False
- 4) The top portion of the shoot has younger leaves than the bottom portion of shoots. True/False
- 5) How does ruthless chopping of old mulberry in North India affect the plant? How can it be avoided?
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- 6) List out two advantages of pruning.
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- 7) Harvesting shoots takes care of pruning of the mulberry tree. True/False
- 8) It is not practical to harvest the leaves from tree type of plantation. True/False

1.6 LEAF TRANSPORTATION AND PRESERVATION

You may recall that in Block 2, Unit 1, you have noted that shoots once cut are to be carried to the rearing rooms. The existing situation in this region reveals that these shoots are to be *carried over long distances*. You may remember that mulberry can be grown under intensive and extensive system of plantation. Extensive system, as you know, is followed in this region and therefore, it becomes necessary to carry the shoots over long distances. Mostly, silkworm rearers do not have their mulberry plantation near their rearing places. For transportation of shoots over long distances, different methods of transportation are employed which include: *bicycle, pony back, tongas, bullock cart, buses and tractors*. The transportation of leaf is also carried out as head load involving lot of time. The branches / shoots while being transported are generally carried as such (without covering) and are exposed directly to sunlight thereby affecting leaf quality. So, precautions, as you may have learnt through your experiences, have to be taken for retaining the maximum moisture in the leaf. For quick and efficient transportation of shoots, the following measures are very useful:

- Ensure availability of mulberry leaf close to the rearing places by growing more plants around, which will reduce transportation distance and time.
- While transporting, cover the branches /shoots with moist gunny cloth.

Remember, silkworm has a strong affinity for leaf with higher *moisture content*. You can yourself visualize the importance of retaining the moisture in the leaf while transportation. It may be simple to analyze how the driage of the leaf can be avoided. Recall that in our Block 2, Unit 2, you have learnt about the role of *wet gunny cloth* in avoiding the driage of cuttings. Same can be applied for preservation of leaf. Examine yourself, how the above practice of covering the mulberry shoots with wet gunny cloth can be followed.

The quality of leaf gets affected not only due to long distance transportation, but also, due to improper preservation of mulberry shoots/leaves, collected for silkworm rearing, as well. The leaf quality is primarily affected by loss of leaf moisture from the time it is harvested till it is actually fed to the worms. Subsequently, leaf preservation is another aspect which has to be closely looked into. Again, you may note that the shoots can be preserved by covering with wet gunny cloth in the rearing room. However, the better method of shoot preservation is by keeping harvested mulberry shoots in bundles and placing them in an upright position. Remember, keeping their *cut ends dipped in water* (20-25 cm), under wet gunny cloth coverage (giving some support to cloth which should not touch the leaf) can help in preservation of leaf.

Activity 5

- 1) Transport leaf from a distant place and find out how the leaf dries during the transportation.
- 2) Record the difference in the driage of the leaf, if leaf is transported in wet gunny bags.

1.7 YIELD AND QUALITY ASSESSMENT

You have learnt in Block 1, Unit 1, that leaf ranks first in its importance for the production of cocoons. But, you must be clear that only production of quality leaf can help in producing quality cocoons. Only quality cocoons can yield quality silk. You can imagine therefore, that it is important to produce mulberry leaf with high nutrient content. The quality of leaf can be assessed by feeding the silkworm. Nutritive leaf from improved mulberry varieties is likely to improve the quality of cocoons and silk. Please go through the chapter on “Assessment of leaf yield and quality” in Block 1, Unit 2 for more information on this topic. To understand the effect of feeding worms with quality leaf, you may feed the worms with good and poor quality leaf and the difference in the cocoon quality will itself speak about the importance of improved mulberry varieties.

Activity 6

Preserve shoots as detailed by keeping harvest shoots in bundles and place them in an upright position. Find out the difference of this method from a method where no precautions are used for preservation.

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) Leaf preservation is necessary for maintaining the quality of leaves for silkworm rearing.

True/ False

- 2) Use of wet gunny cloth while transporting of leaf can help in maintaining the quality of leaf. True/False
- 3) Quality of the leaf can be assessed by quality of cocoons produced by rearing. True/False
- 4) Improved mulberry varieties have more nutritive leaf. True/False

1.8 LET US SUM UP

North Indian states have a traditional history of sericulture. The climatic conditions of North India are very favourable for rearing bivoltine silkworm, which produce high quality silk. Hence, there is good scope for development of sericulture. North Indian region has two main climatic zones, namely temperate and subtropical. Mulberry is generally grown as trees or high bush. To achieve high leaf yield of better quality under the diverse climatic conditions of North India, it is essential to adopt suitable cultivation practices for mulberry like suitable varieties, manures and fertilizers, method of application, types of pruning, method of leaf harvest, leaf transpiration and preservation. Mulberry is mainly cultivated under rainfed conditions as rainfall is very high in this region. The technological practices discussed in this unit can help in updating the knowledge of extension workers in sericulture, since conventionally only the limited knowledge is translated for field utility.

1.9 GLOSSARY

Acidic Soil	: pH less than 7.
Alkaline Soil	: pH more than 7.
Alluvial Soil	: These soils were formed from the sediments deposited by the rivers. They are coarse to medium textured.
Bivoltine	: Two silkworm crops are produced during the year.
Compost	: A kind of organic manure.
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.

1.10 SUGGESTED FURTHER READING

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1.12 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

- 1) Mulberry in North Indian region is available on roadsides, on river bunds, and boundaries of agricultural fields.
- 2) Mulberry cultivation in North India is a subsidiary occupation and is mostly available as rainfed plantation.
- 3) The two main climatic zones are Temperate and Subtropical.
- 4) S-146 and TR-10.
- 5) Goshierami and Ichinose.

Check Your Progress 2

- 1) Urea and Single Super Phosphate.
- 2) Urea and Single Super Phosphate supply Nitrogen and Phosphorus to the plants.
- 3) They provide plant nutrients and other benefits for the better growth of plants.

Check Your Progress 3

- 1) Spring is the main silkworm crop in the subtropical regions.
- 2) Plants should be pruned at 80 cm from crown height.
- 3) True
- 4) True
- 5) It affects the growth of the plant. It can be avoided by following the pruning schedule.
- 6) Pruning improves the leaf yield and quality and helps in maintaining the shape of the plant.
- 7) True
- 8) True

Check Your Progress 4

- 1) True
- 2) True
- 3) True
- 4) True