
UNIT 2 CHAWKI REARING

Structure

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2.0 OBJECTIVES

After reading this unit, you will be able to:

- explain the importance of caring the young silkworms;
- assess the needs of young silkworms; and
- discuss the method of caring the young silkworms.

2.1 INTRODUCTION

In the previous unit, you have learnt about how to take care of the silkworm eggs while handling, incubation, hatching and transferring the newly hatched larvae to the rearing trays. We all understand how delicate the young ones are, whatever animal it may be and so is the silkworm. As we take care of the young kids, we have to take care of the young silkworms to ensure a better crop which you will learn in the present unit.

2.2 CHARACTERISTICS OF CHAWKI WORMS AND THEIR REARING

The young silkworms, usually up to the end of second instar are called 'chawki worms'. To naked eye, they look like tiny ants. As they are tiny and delicate, the chances of damage are much higher during handling. They also require highly nutritive and easily digestible food. At this stage, they require a slightly higher temperature (around 28°C) and relative humidity (around 80%) than their latter stages. Their growth rate is also slightly higher.

Chawki rearing involves providing the young silkworms tender succulent leaves cut to size, maintaining their freshness by preserving the leaf moisture content, providing its required environment during feeding and moulting and sanitation.

2.3 LEAF QUALITY FOR CHAWKI REARING

Being too small and tender, the young silkworms feed on the surface of the mulberry leaves. They require tender, soft and succulent leaves with around 80% moisture and high nutritive value. Mulberry leaves having 27% protein, 11% carbohydrates, minerals and vitamins are considered good for rearing. On a mulberry shoot, four leaves below the largest glossy leaf are well suited for the first instar larvae and the next four leaves for the second instar (Fig.2.1). Such tender leaves are fed to silkworms each time they resume feeding after moult also.

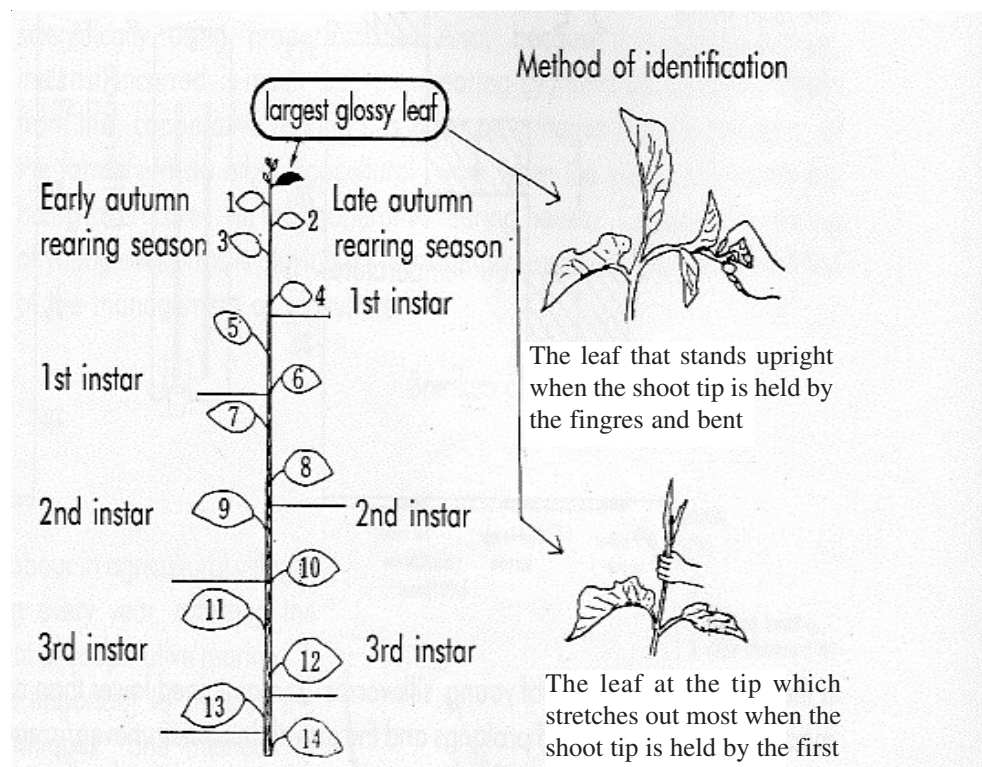


Fig.2.1: Selection of leaf for feeding chawki worms

Activity

- 1) Select a mulberry shoot in the garden. Identify the largest glossy leaf and the leaves suited for different stages of the silkworms.

HARVESTING, TRANSPORTATION AND PRESERVATION

Silkworms, particularly the young ones, need to be fed with fresh succulent leaves. This is more so in the case of young larvae which feed on the surface as it would be difficult to scrap the surface without succulence and softness. Higher temperature and dry atmosphere cause withering faster. Therefore, the leaves should be harvested during cooler hours of the day, i.e., either early in the morning or late in the evening. The leaves plucked from the garden should be brought to the rearing house in baskets covered with wet gunny cloth to maintain freshness. Transported leaves are immediately preserved in suitable containers like leaf preservation chamber and covered with gunny cloth to maintain its moisture content (Fig. 2.3).



Fig. 2.2: Harvesting of leaf from Chawki garden



Fig.2.3: Leaf Preservation

2.4 CHAWKI REARING PRACTICES

Chawki rearing starts after brushing of silkworms into the rearing trays. The tiny worms which feed on the surface of the leaves should be able to reach the surface of the leaf easier and speedier. To facilitate this, we provide them chopped leaves of about 1cm² size. Chopping of leaves also helps in loosening and spreading the bed when the bed is required to be dried which helps in killing the pathogens on the bed. As the worms grow in size, the size of the chopped leaves can be increased. Silkworms are fed three to four times a day depending on the climate. During rainy seasons with cooler climate, even two feedings would be sufficient while in hot and dry climate, the number of feedings is higher. The current general practice is three feedings per day (8.00 am, 2.00 pm and 8.00 pm). Around 20 kg of tender leaves are required for rearing 100 dfls of the first two instars of larvae and quantum varies from breed to breed depending upon the size of the worms and the fecundity. The ideal temperature and humidity are 28°C and 85-90% for the first instar and 27°C and 85% for the second. To prevent loss of moisture from the leaves and maintain them fresh, the worms are maintained on a paraffin paper in the rearing tray and after feeding, the bed is covered with another sheet of paraffin paper and the edges of both sheets folded together and this is called 'wrapping up' (Fig. 2.4). Wherever paraffin paper is not available, polythene sheets of 400 guage thickness can be used.



Fig.2.4: Wrapping up the rearing bed



Fig.2.5: Box Rearing



Fig.2.6: Stand Rearing

Before each feeding, the paraffin paper cover is removed and the bed gently spread and the left-over leaf is allowed to dry. The fresh chopped leaves are then fed and covered with paraffin paper again. The rearing trays after feeding are usually piled up one above the other on small stand altogether looking like a box and therefore called "Box method of Chawki rearing" (Fig. 2.5).

If the trays are kept in the rearing stand, it is known as 'stand rearing' (Fig. 2.6). About 100 dfls of crossbreeds require around 15 ft² bed area at the end of 1st instar and 45 ft² at the end of second instar; and bivoltines require 24 ft² and 65 ft², respectively.

As the silkworm grows in size, its body becomes too tight and brittle to hold the body. As a result of this, its movement becomes difficult and the mouth parts look small compared to its head. At this stage, the silkworm stops feeding and movement and sheds its old skin. The process of shedding its old skin is known as 'moulting' (Fig.2.7). The first moult occurs three days after brushing and the second one after another 3-4 days. Moulting lasts for 20-24 hours. As the larva approaches moulting stage, its body becomes lustrous and shining; pro-thoracic segment becomes bulged; head becomes narrow, pointed and black; and loses appetite and becomes weak.



Fig.2.7: A moulting larva

As the worms prepare for moult, the leaves are cut into smaller size and thinly spread to meet the requirement of the fewer feeding worms. Paraffin paper and wet paper, if any, are removed. When over 85% of the worms settle for moult, feeding is stopped and slaked lime is sprinkled over to dry the rearing bed (Fig.2.8) and adequate ventilation is provided. When over 95% of the worms come out of moult, the bed disinfectant (Vijetha/Ankush/Resham jyothi) is dusted and fed after half an hour gap. The moulted larva looks ash coloured with broader mouth portion and feed actively.



Fig.2.8: Dusting of slaked lime



Fig.2.9: Bed cleaning using bed cleaning net

As the left over leaf accumulates, the rearing bed thickness increases resulting in its increased thickness which facilitates the multiplication of various pathogens. Therefore, the silkworms have to be transferred to a clean tray and the bed refuge discarded. This process is known as 'bed cleaning'. Bed cleaning is done by spreading a net of mesh size of 1 cm² on the rearing bed followed by feeding and transferring the worms along with the net after one more feeding (Fig.2.9). Cleaning too many times during young stages result in unconscious discarding of worms

left-over in the bed which were unable to move over the net. Usually, one cleaning is done during the entire chawki stage, i.e., after second moult.

Check Your Progress 1

1) What is chawki rearing?

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2) What types of leaf is selected for feeding chawki worms and why?

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3) List out symptoms of under-moult and out-of-moult larvae.

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4) Which are the different methods of chawki rearing?

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2.5 COMMERCIAL CHAWKI REARING

Silkworms not reared properly in younger stage are prone to diseases leading to losses or even crop failure. Facilities for maintenance of required temperature and humidity, supply of suitable leaves and appropriate handling of delicate worms, demand technical skills which may not be available with all rearers. Further, small scale silkworm rearers cannot afford the equipments necessary to provide the ideal condition for young age worms. In order to overcome the difficulties, commercial chawki rearing centers are must. As the farmers have now realized the advantages of buying chawki worms, there is more scope for entrepreneurs to set exclusive chawki rearing centers in prominent sericulture areas.

SUITABLE LOCATION FOR CRC

- Select a place closer to the cluster of villages with large number of rearers.
- The choice of location shall also take into an account to tie up with reputed grainage for sourcing quality eggs.
- The location shall be conducive in terms of isolation being at a safe distance from a commercial rearing house.

- It would be better to avoid vicinity of factories.
- Choice of location shall also take into account the access and road links to the service area.

2.6 TRANSPORTATION OF CHAWKI WORMS

In case of mass chawki rearing in commercial chawki rearing centres, the worms have to be transported to the rearers' rearing houses. The worms are transported after resumption from the second moult. They are transported in the rearing trays in case of short distances. In case of longer distances and larger quantities, the rearing bed along with a fresh feed and the paraffin paper is rolled and then transported. Transportation of the chawki worms should be done during cooler hours of the day (early morning or evening) to prevent damage from the heat of the sun.

2.7 ECONOMICS OF CHAWKI REARING

For better understanding of the chawki rearing on commercial scale, a model calculation is given below:

Area under mulberry	: 1 hectare
Mulberry variety	: V1
Spacing	: (150 + 90) cm. × 60 cm. (paired row system)
Leaf yield	: 29,000 kg/ha/year
No. of batches for rearing	: 2 batches per month
No. of Dfls reared per batch	: 5000 Dfls
Leaf requirement per batch	: 1000 kg

A. Establishment Cost of Chawki Mulberry Garden (1 year)

Sl. No.	Particulars	Cost (Rs.)
1.	Tractor tilling (10 hr.), harrowing (6 hr.) @ Rs.250/hour	4,000
2.	Final land preparation (10 pairs of bullock) @ Rs.100/pair	1,000
3.	Farm Yard Manure (20 MT) @ Rs.500/MT	10,000
4.	Farm Yard Manure application (20 mandays) @ Rs.80/manday (broadcasting)	1,600
5.	Planting preparation : Ridge-furrow 75 mandays	6,000
6.	Planting material (10 cartloads) @ Rs.100/cartload	1,000
7.	Cutting preparation - 8 mandays (20,000 @ Rs. 2,500 cuttings/mandays)	640
8.	Planting (50 mandays)	4,000
9.	Hoeing/weeding 3-4 times (125 mandays)	10,000
10.	Miscellaneous expenditure	1,000
	Total	39,240

Considering the life span of mulberry as 15 years, apportioned cost of mulberry garden establishment works out to be Rs.2616.

B. Maintenance Cost of Chawki Mulberry Garden (per ha/year)

Sl. No.	Particulars	Cost (Rs.)
1.	Farm Yard Manure (40 MT) @ Rs.500/MT	20,000
2.	Fertilizer (NPK-225:150:150 kg/ha/year), i.e. Ammonium Sulphate @ 1240 kg/ha/yr, Single Super Phosphate @ 952 kg/ha/yr and Muriate of Potash @ 256 kg/ha/yr	10,230
3.	Manure and fertilizer application (40 + 30 mandays) @ Rs.80.00/mandays	5,600
4.	Irrigation (365 mandays)	29,200
5.	Inter-cultivation 20 mandays & 8 pairs of bullock–8 times per year @ Rs.80 manday and Rs.100/- per bullock pair	19,200
6.	Leaf harvest (290 mandays @ 100 kgs leaf per manday)	23,200
7.	Pruning (20 mandays)	1,600
8.	Land revenue	250
9.	Rent on land	5,000
Total		1,14,280.00

C. Investment on Rearing Building and Equipments (for 5000 Dfls)

Sl. No.	Rearing building/ equipment	Number/ Quantity required	Rate (Rs.)	Cost (Rs.)	Life Span (years)
1.	Rearing house for chawki worms (1800 sq. ft.)	1	300/ sq.ft.	5,40,000	25
2.	Plastic rearing tray (3'x4')	250	500/unit	1,25,000	10
3.	Wooden chawki stand	20	600/unit	12,000	10
4.	Feeding stand	4	250/unit	1,000	5
5.	Leaf chopping board	4	250	1,000	5
6.	Knife	4	50	200	2
7.	Generator	1	1,00,000	1,00,000	10
8.	Room Heater	2	8,000	16,000	5
9.	Humidifer	2	8,000	16,000	5
10.	Power sprayer with mask	1	20,000	20,000	10
11.	Room cooler	2	2,000	4,000	5
12.	Microscope	1	1,000	2,000	5
13.	Wet & dry thermometer	2	1,000	2,000	5
Total cost				8,39,200	

D. Average Annual Production Costs and Returns:	Cost (Rs.)
Chawki mulberry leaf production	: 1,14,280
Apportioned cost of establishment of mulberry garden	: 2,616
A. TOTAL FOR LEAF PRODUCTION	: 1,16,896
Disinfectants in rearing	: 48,000
Labour for silkworm rearing @ 2 mandays	: 58,400
Miscellaneous	: 10,000
Interest on fixed investment	: 84,970
B. TOTAL FOR SILKWORM REARING	: 2,01,370
C. TOTAL FOR CHAWKI PRODUCTION	: 3,18,266
D. TOTAL RETURNS	: 4,80,000
(By selling chawki worms @ 400/100 Dfls)	
NET RETURNS	: 1,61,734
Cost-Benefit ratio	: 1:1.51

Check Your Progress 2

1) Describe the advantages of CRC.

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2) What are the criteria to be considered for establishment of CRC?

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2.8 LET US SUM UP

In this unit, we have highlighted the importance of chawki rearing, characteristics of chawki worms, importance of leaf quality, quantity, bed area, environmental conditions required for chawki worms, importance of chawki rearing centers, requirement for establishment of CRC and economics of chawki rearing.

Many useful conclusions can be drawn from the unit.

- Chawki rearing is a vital aspect of silkworm rearing and proper chawki rearing ensures successful cocoon crops.

- Different chawki rearing methods are aimed at preventing leaf damage and maintenance of optimum temperature and humidity.
- Mulberry leaves are the sole food source for silkworms and the quality and quantity of leaves fed during rearing decides the fate of silkworm crops.
- Small scale farmers cannot afford the equipments necessary to provide the ideal conditions and supply of suitable leaves for chawki rearing. Hence, chawki rearing centers are important to stabilize cocoon crops.

2.9 GLOSSARY

Chawki Rearing : Rearing of silkworms up to second moult (first 8 days).

CRC : Chawki Rearing Center.

Incubation : Care taken from egg laying till hatching.

Mulberry Leaf Storage Room : The place where mulberry leaf is preserved.

Rearing Room for Young Age Silkworm : The place where silkworms are reared up to second moult (first 8 days).

Rearing House : The place where silkworm rearing is conducted.

Wrap-up Rearing : Folding the seat and cover paraffin paper in all four sides.

2.10 SUGGESTED FURTHER READING

A Guide for Construction of Silkworm Rearing House - Published by Member Secretary, Central Silk Board, Bangalore, 1999.

Benchamin, K.V. 1990. *A Handbook for Sericulture Extension Workers*, Published by Director, CSRTI, Mysore.

Dandin, S.B., Jayant Jayaswal and Giridhar, K. 2000. *Handbook of Sericulture Technologies*, Published by Central Silk Board, Bangalore.

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Hicks, P.K. 1990. Report on Round-table on Standardization of Design, *Principles for Silkworm Rearing House & Instruments for Sericulture Development* - Published by Regional Office for Asia and Pacific, Bangkok, Thailand, 1990.

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2.11 REFERENCES

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Rajan, R.K. and Himantharaj, M.T. 2005. *A Text Book on Silkworm Rearing*, Published by Central Silk Board, Bangalore. pp. 61-90.

Seri-business Manual - A User's Guide Farm Sector, 2003, Published by Central Silk Board, Bangalore. pp. 29-50.

2.12 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

- 1) Rearing of young silkworms from brushing of silkworms in the rearing trays up to the end of second instar is called chawki rearing.
- 2) The young silkworms feed on the surface of the mulberry leaves, hence, they require tender, soft and succulent leaves with around 80% moisture and high nutritive value. On a mulberry shoot, four leaves below the largest glossy leaf are well suited for the first instar silkworms.
- 3) Symptoms of silkworm under-moult are:
 - Larval body becomes lustrous and shining.
 - Prothoracic segment becomes bulged.
 - Head become narrow, pointed and black.
 - Appetite weak.

Symptoms of silkworm out-of-moult are:

 - Larval body is ash in colour.
 - Mouth portion is broader.
 - More active.
- 4) The most popular and common methods of chawki rearing are:
 - Box rearing.

- Stand rearing.
- Wrap-up rearing.

Check Your Progress 2

- 1) Advantages of CRC are Small scale farmers cannot afford the equipments necessary to provide the ideal conditions and supply of suitable leaves for chawki rearing. Hence, chawki rearing centers are important to stabilize cocoon crops.
- 2) Important criteria to be considered for establishment of CRC are:
 - Select a place closer to the cluster of villages with large number of rearers.
 - The choice of location shall also take into an account to tie up with reputed grainage for sourcing quality eggs.
 - The location shall be conducive in terms of isolation being at a safe distance from a commercial rearing house.
 - It would be better to avoid vicinity of factories.
 - Choice of location shall also take into account the access and road links to the service area.