



# **Animal production Level NTQF Level -II Learning Guide 39**

**Unit of Competence: Contribute sericulture development**

**Module Title: Contributing sericulture development**

**LG Code: AGR APR2 M12 L02 LG39**

**TTLM Code: AGR APR2 TTLM 0919v1**

**LO2: undertake sericulture work**



<b>Instruction Sheet</b>	<b>Learning Guide 39</b>
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This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- Following supervisor instructions and directions
- Undertaking Sericulture activities in a safe and environmentally appropriate manner
- Carrying out positive interaction with other staff in sericulture development areas
- Reporting problems or difficulties in work place

This guide will also assist you to attain the learning outcome stated in the cover page.

Specifically, upon completion of this Learning Guide, you will be able to –

- Follow supervisor instructions and directions
- Undertake Sericulture activities in a safe and environmentally appropriate manner
- Carry out positive interaction with other staff in sericulture development areas
- Report problems or difficulties in work place

### **Learning Instructions:**

1. Read the specific objectives of this Learning Guide :
2. Follow the instructions described in number 1 to 8.
3. Read the information written in the “Information Sheet (1, 2,3 and 4) in page 3,5,17 and 19 respectively
4. Try to understand what are being discussed. Ask you teacher for assistance if you have hard time understanding them.
5. Accomplish the “**Self-check 1, Self-check 2, Self-check 3” and Self-check 4** in page 4, 16, 18 and 20 respectively.
6. If you earned a satisfactory evaluation proceed to “the next topic”. However, if your rating is unsatisfactory, see your teacher for further instructions or read back the Learning guide information sheets 1-4. Submit your accomplished Self-check. This will form part of your training portfolio.

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7. Read the “Operation Sheet 1-3” in page 21 and try to understand the procedures discussed.
8. Do the “LAP test” in page 22 (if you are ready). Request your teacher to evaluate your performance and outputs. Your teacher will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your teacher shall advise you on additional work.



<b>Information sheet-1</b>	<b>Following supervisor instructions and directions</b>
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### **Following Instructions and directions provided by supervisor**

Instructions and directions provided by supervisor are followed and clarification is sought when necessary. Any employee who works in sericulture development industry or any farmer who develops his own stock must follow the following instruction and direction:-

#### **Manufacturer instructions**

##### **Material safety data sheets (MSDS)**

The MSDS is a detailed informational document prepared by the manufacturer or importer of a hazardous chemical. It describes the physical and chemical properties of the product.

MSDS's contain useful information such as:

- Flash point,
- Toxicity,
- Procedures for spills and leaks and
- Storage guidelines.

Information included in a Material Safety Data Sheet aids in the selection of safe products, helps you understand the potential health and physical hazards of a chemical and describes how to respond effectively to exposure situations

#### **OHS standards and procedures**

##### **Specifications for tools, equipments and materials**

##### **Standard Operating Procedures (SOP)**

It is a set of step-by-step instructions compiled by an organization to help workers carry out complex routine operations. SOPs aim to achieve efficiency, quality output and uniformity of performance, while reducing miscommunication and failure to comply with industry regulations

#### **Verbal directions from manager or supervisor**

##### **Work instructions and standards**

##### **Work notes.**

Instructions and directions provided by supervisor must be followed and if we have any question we can ask when necessary. And also employee must observe and follow Enterprise policies and procedures in relation to workplace practices in the handling and disposal of materials.



<b>Self-Check -1</b>	<b>Written Test</b>
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1. **Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:
2. List down 5 instructions and directions provided by supervisor to be followed by an expert in sericulture development (5pts)
3. Write the useful information contained in material safety data sheet.(5pts)

**Note: Satisfactory rating – 10 points      Unsatisfactory - below 10 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = \_\_\_\_\_

Rating: \_\_\_\_\_

Name: \_\_\_\_\_

Date \_\_\_\_\_

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<b>Information sheet- 2.</b>	<b>Undertaking Sericulture activities in safe and environmentally appropriate manner</b>
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### 3.1. Undertake Feed Plant Propagation:

There are many plants which are basic food for silkworm rearing. Some of feed plants are caster, Mulberry, Kesserua, cassava papaya and etc. Among the above mentioned the common food of silkworm is Mulberry and caster. They are propagated by different methods

#### **Mulberry propagation**

There are two methods of mulberry plant or feed plant propagation methods. It can be

1. Sexual propagation propagated by seeds or
2. Asexual, or propagation by cuttings, grafting, and budding

##### **1. Sexual propagation**

In sexual propagation, mature seeds are collected, washed and dried. An area under shade is dug, manure and prepared for seedling nursery. Then viable seeds soaked in hot water for a day to soften a hard test for easy and successful germination are sown in rows. Seedlings are thinned when they grow to a height of 3.5 to 5 cm. They would be subject to sun light during cool hours. Transplanting is done with a distance of 22.5 cm three months after sowing. These seedlings grow for one to two years are then transplanted to field or used for grafting.

##### **2. Asexual propagation**

This can be done by cutting, grafting or budding.

#### **Cutting:**

- Cuttings are most commonly used in the asexual propagation of mulberry.
- Nutritious, high yielding, fast growing, pests, diseases and drought resistant leaf cuttings should be used.
- . Cutting should be done from matured and thick shoots with active and well-developed buds
- Cuttings of 7-10cm long, slant cut with three to five active buds should be produced.

#### **Grafting:**

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- It is inserting rooted plant in to the same or allied species to bring about organic uniformity or union between the two species and finally make them grow as one.
- The branch that is inserted is known as scion and the plant in to which another plant is inserted is stock.
- The stock is usually an indigenous plant that is well acclimatized to the local conditions. Selection of stock and scion is very important.

There are three types of grafting:

- Shoot grafting,
- Root grafting and
- Bud grafting.

**Budding:** Budding involves removing one bud from stock and putting in to another stock. It is used only when the material is scarce. In addition to grafting and budding, air and ground layering are used to propagate mulberry plants.

## 2.2. Rearing house construction

A rearing house should essentially provide sufficient bed space for silkworms and working space for the workers attending the rearing operations

**Site selection:** - silk worm rearing house site should be

- Away from the highly populated areas.
- Far from livestock farming area.
- Avoid damp areas which facilitate multiplication of germs and spread of diseases.
- Not advisable around excessive pesticides spraying fields
- locating shaded areas under large trees are good for provide cool
- Closer to the mulberry garden as it will be convenient to feed fresh leaves with very little moisture loss that occurs during transportation.

### Characteristics of Rearing House

- Design of the rearing house should meet the biological needs of the silkworm.
- Should provide adequate space for working.

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- Should have good ventilation.
- Should have facilities for controlling temperature, humidity, ventilation etc.
- Should be convenient to clean, disinfect and maintain hygiene conditions.
- Should prevent infestation of pests like lizard, ants, birds and rats etc.
- Should have sufficient place for leaf preservation and mounting of silkworms

### **Orientation of Building**

The orientation of the room should be such that the interior is protected from the direct sunlight.

The best direction of the building will be north-south/longest side with doors and windows on north-south walls and the shortest sides of the building in east-west direction, avoiding the direct sunlight into the rooms.

### **3.2. Preparing for rearing /room, house, shade/**

A silkworm rearer aims for a good yield of best quality cocoons, which have the best market value. All techniques and practices are aimed at obtaining this result with minimum labor and expense.

#### **The health of worm influenced by**

- Leaf quality,
- Environmental conditions, and
- General hygienic conditions

It is important to rear young silkworms in a very clean environment and to feed them with adequate quantities of fresh, tender, and nutritious leaves. Therefore, we have to consider all these during our preparation for silkworm rearing.

Rearing rooms/halls are constructed to accommodate the rearing stands or rearing racks lengthwise, one set on either side of the room with a reasonable working space. Late age rearing is done in two methods, viz., tray (leaf) feeding associated with leaf plucking and shoot feeding associated with shoot harvest. In case of leaf feeding,





around 38 m<sup>2</sup> of bed area is required for rearing 100 lying. Since the rearing is done in rearing trays placed on rearing stands in tiers each with 10-12, it requires a rearing house with a smaller floor area (around 20m<sup>2</sup>). However, it requires a higher manpower for feeding operation

It is advised to have a small disinfection tank to dip the rearing trays and mountages in the disinfectant solution so that their disinfection shall be complete.

## 2.4 Apply silkworm feeding and preservation of feed

### Steps of feeding silk worm

- Prepare the bed
- collect worms and the mulberry leaves together using a feather
- bed is spread uniformly using chopsticks
- paraffin paper sheet is spread on the rearing tray
- Chopped mulberry leaves are sprinkled on the sheet
- hatched larvae are brushed on to the leaves
- A second paraffin paper sheet is spread over the first bed
- In between two sheets water soaked foam rubber strips are placed to maintain humidity
- Silkworms undergo 4 moultings (instars) in the larval stage and are fed according to these instars.
- **1<sup>st</sup> stage (1<sup>st</sup> Instar)** - the young worms should be fed with young tender leaves;
- 2<sup>nd</sup> and 3<sup>rd</sup> leaves from the tip of the shoot.
- These are chopped into small pieces and fed to worms for 4 days at least twice a day in the morning and late afternoon. After the 4 days the worms go in to moult (sleep).

Once the worms come out of moult, spread them out evenly to enhance dryness in the bed and to increase the bed space to match with their increasing body size. Feed the worms when all of them have come out of moult. **2<sup>nd</sup> stage (2<sup>nd</sup> Instar)** - feed 3<sup>rd</sup> and 4<sup>th</sup> young glossy leaves. Continue feeding chopped leaves for 4 days. After this period the worms go into moult again. **3<sup>rd</sup> stage (3<sup>rd</sup> Instar)** - continue feeding the silkworms

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on good leaves harvested from the green part of the stem/shoot for three days. After this period silkworms go into moult. **4<sup>th</sup> stage** - feed worms on whole shoots for 6 Days. **5<sup>th</sup> stage** - feed on whole shoot for 7/8 days. During feeding always maintain a single layer of shoots. Avoid over mature, yellow and diseased leaves.

### **Silk worm feed preservation**

It is important not only to produce highly nutritious and succulent leaves but also to preserve them fresh till they are consumed by silkworms. The environmental condition required for leaf preservation is different from the silkworm rearing. Hence, separate room is required for preserving the leaf/ shoot. After harvest, moisture loss is very rapid, and this affects the edibility or palatability of leaves for silkworms

It is suggested to have a leaf preservation room with each rearing house as the leaf has to be preserved without moisture loss and free from contamination from the rearing bed refusal.

To increase relative humidity in the rearing house and prevent withering of leaves, sprinkling water in the rearing house; using ventilators and fans; soaking sacks in water filled pails and hanging them on the windows are advisable. Fresh & succulent leaves harvested from the plants should be collected in wet sacks or in bamboo baskets lined inside and covered with wet unstitched sack materials.

These leaves are transported to the rearing house where they should be immediately preserved under a wet cloth which should be kept wet all the time by sprinkling water on it repeatedly at intervals.

### **2.5. Provide daily care for silkworm**

- Store in a cool, dry, quiet, covered place, not in sunlight.
- Newspaper at the bottom of the box which should be renewed daily to remove droppings.
- Silkworms – around 10 per box.
- Take care removing the silkworms when the leaves and newspaper are being renewed.
- Remove old leaves from box.



- Replace with moist leaves (dampened with water) daily when silkworms are small, replace twice or more daily when they are larger.
- Moist fresh leaves can be stored in a zip lock bag in the fridge for one week and used as required.
- Silkworms eat a lot and then slow down just before they spin their cocoon.
- lightly spray leaves with water at least twice per day to keep leaves moist using water sprayer.
- Use fresh water in sprayer twice per week.
- When the silkworms emerge from their cocoon they require no food or water.

## 2.6. Mate and monitor reproduction of moth

Once the moths emerge, **their sole mission is to breed and lay eggs**. They cannot fly, do not eat, and they do not drink. Females are larger than the males and have very round abdomens which are full of yellow unfertilized eggs. Males will frantically flap their wings and spin in circles once they sense the presence of a female; flapping continues until they meet and the male attaches to the female. Most pairs typically copulate for over 12 hours.

Males are persistent and if given the chance will attempt to continuously mate. In order to let the female lay her eggs, separate the pair and place the females in a separate container, a paper lined container is ideal for her to lay her eggs on. She will lay between 100-400 yellow eggs. If the eggs are fertilized, over the next few days the eggs will change from yellow to black. If they are not fertile they will remain yellow.

### Life cycle of a Silkworm

As in the case of a typical Butterfly (Lepidoptera) insect, the silkworm passes through 4 distinct stages i.e. egg, larva, pupa and adult during its life cycle. The duration may last for 6-8 weeks depending on the prevailing climatic conditions. The egg period for the incubated eggs may last for 11-14 days, the larval period 24-30 days, the pupal period 12-15 days and the adult stage 6-10 days. This means that a farmer who receives hatched silkworms can rear, harvest and sell cocoons in about 5 weeks unlike majority of other enterprises that take much longer production period.

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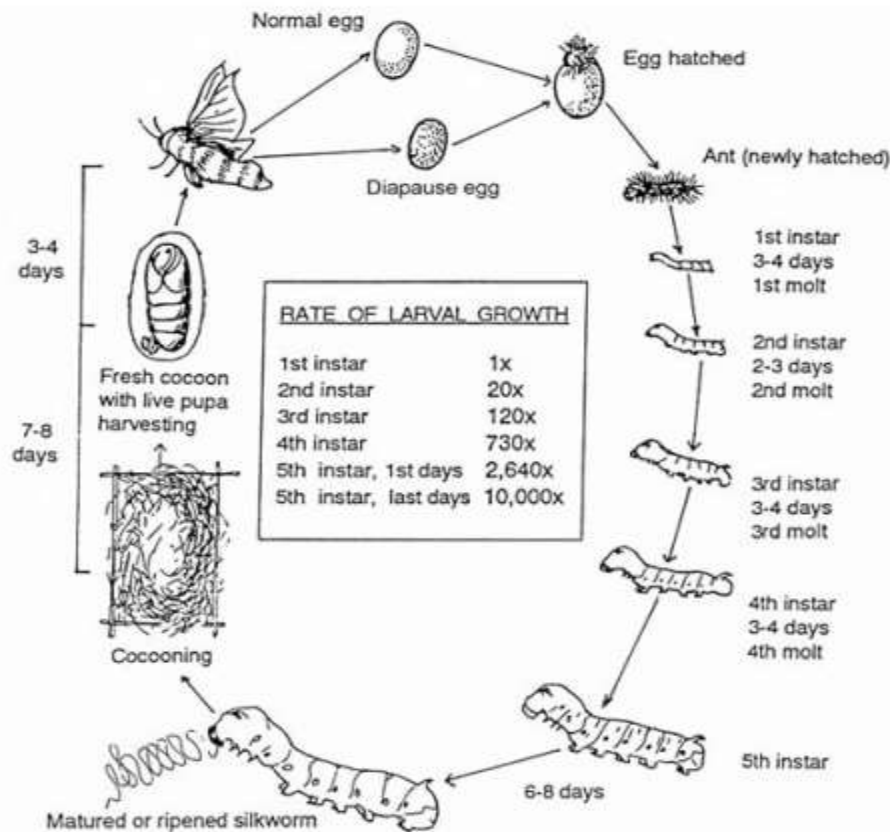


Fig. 1.

## 2.7. Carrying out sorting and treatments on of silkworm's eggs

The eggs stored are taken out and subjected to incubation to achieve uniform hatching on a desired day. The hibernating eggs are commonly treated by hydrochloric acid to stop them from entering in to diapauses. Egg treating in about 20 to 24 hours after laying when kept at 25<sup>0</sup>c. it is important the treating temperature to the younger eggs. Hydrochloric acid must be pure, and free from impurities.

Sorting of silkworm eggs depend on:

- Cleanliness of eggs
- Contaminants
- Defects
- Color of the egg



## 2.8. Incubating eggs/drainage

Incubation is an important step for rearing. Incubation also: seed warming” by which the developing silkworm eggs (embryos) are provided with proper environmental condition so that the embryos can develop normally and the eggs hatch uniformly.

Silkworm rearing starts with silkworm egg incubation. For healthy development and uniform hatching; eggs are incubated under optimum temperature 25<sup>0</sup>C and humidity 80% - 85% under these conditions eggs are expected to hatch within 10 - 12 days. When the newly hatched larvae appear they should be gently and carefully transferred to the rearing bed and covered with paraffin paper or clean old newspapers.

### Important points that considered in the incubation period of silk worm egg

- Covering preserves leaf moisture Cold stored eggs are gradually brought to normal room temperature.
- Temperature, humidity, light are equally important during incubation of eggs.
- Keep eggs under a photoperiod of 16 hours daily until 30-40% of the eggs reach blue egg stage.
- Blue egg stage eggs are kept in dark/black boxes for more uniform hatching on the next day.
- Hatching can be delayed at blue egg stage by cold storing for about a week at 9<sup>0</sup>C.
- Incubated eggs are handled properly for good hatching percentage.

## 2.9. Undertake silkworm cocoon collection, prepare moutage,

Cocoons are harvested on the 7<sup>th</sup> to 8<sup>th</sup> day from the inception of spinning. By this time the worm will have completed spinning of cocoon and transformed into pupa. To confirm this, cut 2 or 3 cocoons to check whether pupae are fully formed. The optimum time for harvesting is when the pupae turn brown in color and become hard. **De-flossing** - After harvesting all loose fiber on cocoons surface is removed, giving it a clean look, ready for the market. Failure to de-floss cocoons lowers the marketability of the cocoon.

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**Sorting;**-Selecting of normal cocoons from these defectives for more processing is called sorting. This process greatly affects the price of cocoons. To increase reeling efficiency only good cocoons should be selected for sale.

Removal deformed flimsy and dead cocoons before harvesting. These types of defective cocoons means which not selected for more processing and removed are;-

- **Double cocoons:** - A double cocoon is spun by two worms, producing a filament, which does not unwind smoothly and tangles easily. double cocoons may be caused by crowded mounting conditions, high temperatures, high humidity and mutation of silk species.
- **Inside stained cocoons:** dead cocoons are also known as melted cocoons. In this case, the pupa is dead and sticks to the inside shell of the cocoon causing a stain
- **Outside stained cocoons:** These are recognized by a rusty color spot on the cocoon shell caused by absorption of intestinal fluid/urine of the mature worm formed during mounting. Reliability is very poor in this case.
- **Printed cocoons:** This defect may happen due to improper mounting frames; these are also called scaffold pressed cocoons.
- **Malformed cocoons:** These are abnormally shaped cocoons, which may arise from species variation. This defect may be due to racial characteristics and breeding with mulberry leaves stained with agrochemicals.
- **Flimsy cocoons:** here, the shell is loosely spun in layers and has a low silk content. These cocoons are easily overcooked and produce waste.
- **Thin-end cocoons:** One or both ends of the cocoon are very thin and risk bursting when processed. The cause of this defect may be attributed to species characteristics or improper temperature and humidity during rearing and mounting.
- **Pierced cocoons:** This happens when a moth has emerged, been eaten by beetles or in the case of the emergence of a parasite. Pierced cocoons are unfit for reeling and can be used only for hand spinning or as raw material of machine spun silk yarn.



## Factors Influencing Cocoon Quality

1. Temperature and humidity during mounting
2. Mounting devices
3. Harvesting and handling of fresh cocoons
4. Transportation of fresh cocoons

## Mounting

Mounting is transferring mature silkworms from rearing beds to mountages to start spinning. Spinning starts 8 days after worms get in to fifth (5<sup>th</sup>) stage.

### Signs of Maturity

- Larvae cease to feed and crawl restlessly in search of a corner to attach themselves for spinning.
- They move to corners of the rearing beds ready to spin
- If picking of mature silkworms is delayed the worms spin on the bed and silk fiber is found on the bed
- The worms appear cream white as they are full of silk
- They appear shrank in length

### Process of mounting

The mature worms are picked from the rearing beds and transferred to mountages. Care should be taken to put the right number of worms on the mountages to avoid overcrowding and formation of double cocoons.

## 2.10. Reel and spin cocoon to produce silk

**Reeling:** - The removal of silk yarn from the cocoons is called reeling. This is done by first cooking them in water to remove the gum, which holds it together, and then unwinding the filaments (reeling). Usually 8-10 cocoons are reeled together. There are three methods for reeling: the charkha, the slightly more advanced cottage basin and the costly automatic machines.

### Re-reeling of reeled thread

Re-reeling is done to make raw silk skeins of standard size and weight and is done to get a firm and strong yarn

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Generally, the re-reeling machine is constructed with iron and wooden component with “U” brackets for large reel, fitted with traversed mechanism, reel drive arrangement and silk drying facility.

### **Spinning of cocoon to produce silk**

The larva takes about a month to get big enough to spin a cocoon. It like to spin cocoons in toilet paper tubes (slice them in half like Life Savers), paper towel tubes (cut into six slices), or in egg carton bottoms.

The cocoon-spinning process takes about three days. When they are spinning, try not to disturb their threads or they will have to start all over again. Once the cocoons are all spun, remove dried-up leaves to prevent mold from forming. The silk is actually hardened silkworm saliva. It comes out of the mouth, not out of the rear end like a spider. When the silkworm ate great quantities of mulberry leaves, they were digested and nutrients were sent into the bloodstream. The silk glands absorbed these nutrients. The larva has a small spinneret on its lip, through which the silk emerges. The single strand of silk that forms the cocoon is about one mile long.

The silkworm moves its head as it spins the cocoon. When the cocoon is partially made, you can see the head moving around inside if you hold it up to the light.

### **2.11. Recording production data**

The production data in sericulture development farm is the most crucial activity to analyse the profitability of the production. The most common production data includes:

- Silk worm feed plant production
- Types of silkworm
- Egg production
- Cocoon yield
- Silk quality and quantity produced etc should be recorded and availed in the farm.





<b>Self-Check -2</b>	<b>Written Test</b>
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**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention the stages that silkworm passes through its life cycle (4pts)
2. Define the term reeling (2pts)
3. Mention the two common types silk worm feed plants (2pts)
4. Write the two methods of silkworm feed plan propagation. (2pts)
5. Describe factors influencing cocoon quality (4pts)

**Note: Satisfactory rating – 14 points      Unsatisfactory - below 14 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = \_\_\_\_\_

Rating: \_\_\_\_\_

Name: \_\_\_\_\_

Date \_\_\_\_\_

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<b>Information Sheet 3</b>	<b>carry out positive interaction with other staff in sericulture development areas</b>
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For successful production and profitability of the farm, the person in charge of the farm has to have positive relationship with staff members, with the owners, stake holders and customers.

Some of the positive personal interaction includes:

- Attending social events like funerals, marriage ceremonies, and other social gatherings.
- Respecting religious events and festivals;
- Respecting women (special respect);
- Recognizing suggestion of elders;
- Giving adequate time to listen the community;
- Keeping promises fulfilled;
- Respecting appointments;
- Greeting community members warmly;
- Handling conflicts carefully (work for reconciliation);
- Avoiding evil personalities (intoxication with alcohol, etc);
- Treating all people equally.



<b>Self-Check -3</b>	<b>Written Test</b>
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**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. Mention at least 6 positive personal interaction in sericulture development areas (6pts)

**Note: Satisfactory rating – 6 points                      Unsatisfactory - below 6 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____
Rating: _____

Name: \_\_\_\_\_

Date \_\_\_\_\_

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<b>Information Sheet 4</b>	<b>Reporting problems /or difficulties in work place</b>
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There are many difficulties that may encounter in work place /sericulture development farm

Some of them are:

- Temperature –too cold and too hot temperatures require modification
- Disease out breaks/ disease transmission
- Insufficiency of working facilities
- Contaminations (feed, water and feeding leaves and etc)
- Mal factions of machines and equipment like reeling and spinning/weaving materials,
- Predator's problem like birds, lizards
- Disposed materials and dead larvae, defected cocoons
- Theft and the others should be properly reported.



<b>Self-Check -4</b>	<b>Written Test</b>
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**Directions:** Answer all the questions listed below. Use the Answer sheet provided in the next page:

1. What are the problems/difficulties that is reported in sericulture development farm/work place (8pts)

**Note: Satisfactory rating – 8 points                      Unsatisfactory - below 8 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

Score = _____
Rating: _____

Name: \_\_\_\_\_

Date \_\_\_\_\_

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<b>Operation sheet -1</b>	<b>Mulberry cultivation and management</b>
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**Steps**

1. Site selection
2. Preparation of nursery- preparation of cutting and grafts(mulberry propagation)
3. Planting them in nursery
4. transplanting
5. Apply recommended farm management practices( agronomic practices)
6. Pruning
7. Harvesting and preservation leafs

<b>Operation sheet -2</b>	<b>Moulting</b>
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**Procedure**

- Stop feeding moulting worms,
- Hold their head & thorax vertically and wriggle out of their old skin.
- Arrange temperature and RH should be about 23°C and 65%
- Spreading of rearing bed
- Dust the bed with lime powder to keep the bed dry.
- Segregated late or early moulted larva in separate batch.
- Apply anti muscardine bed disinfectant powder after each moult 30 minutes before they resume feeding.

<b>Operation sheet -3</b>	<b>Reeling of cocoon</b>
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**Procedure**

- Storing after stifling the cocoon and steam drying.
- Sorting: - to reeled uniform cocoons at a time
- De flossing
- Riddling: - separating the cocoon according to size so to facilitate easy reeling in automatic reeling unit.
- Cocoon cooking
- Cocoon mixing or blending:
- Brushing: - after cocoon are cooked thoroughly.
- Reeling

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LAP Test	Practical Demonstration
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Instructions:** Given necessary templates, tools and materials you are required to perform the following tasks within 8 hours.

Task 1. Cultivate Mulberry

Task 2. Perform moult

Task 3: reel cocoon



## References

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