

## SILKWORM REARING PRACTICES IN RURAL PAKISTAN

Faiz Ur RAHIM, Muhammad Farooq HYDER, Madiha ASMA

International Institute of Islamic Economics (IIIE), International Islamic University Islamabad (IIUI), Sector H-10, 44000, Phone: +92-300-5101013, E-mails: faiz.rahim@iiu.edu.pk; farooqhyder9@gmail.com; madiha.asma.vt7716@iiu.edu.pk

**Corresponding author:** faiz.rahim@iiu.edu.pk

### Abstract

*Silkworm rearing practices can play an important role in the well-being of deprived rural populations and boost the growth of economy. It is a simple and short tenure process and contains a sensitive series of activities. Silkworm rearing practices made marvellous progress in early eras of liberation. Currently, however, this industry is almost obsolete. The present study explores the silkworm rearing process, practiced by Pakistani farmers. This study is purely based on primary data and was also supported by secondary data from literature. Results of the study indicate that although Pakistani silk farmers have sufficient knowledge and experience but they need a proper support and assistance from state department to convert the sericulture industry into a profitable industry.*

**Key words:** silkworm rearing, rural development, sericulture, employment activities

### INTRODUCTION

Sericulture has been practiced as a cottage industry in Pakistan since its independence in 1947. It was firstly practiced in Punjab in 1947, in fact Punjab was the first province to start sericulture instantly after independence. Then later on sericulture department was established in Khyber Pakhtunkhwa (KPK) in 1952, in Baluchistan in 1959 and in Sindh in 1975 [10].

Sericulture industry revolves around silkworm rearing and it is an exercise of around 40 days. During this short series of procedure, fulfilment of several technical aspects is an essential requisition [7]. For optimum and healthy production regarding sericulture relevant factors are 'good quality silk seed, well equipped rearing rooms, well trained farmers and backup support of state sericulture department [9].

Standard silkworm rearing process contains; disinfection of rearing rooms, uniform hatching, cleanliness, maintenance of temperature, humidity, light, ventilation, spacing, feeding patrons, care during mounting, molting and cocoon collection stages, precautionary measures against diseases and coping strategies against rapid changes in climate [10].

In silk advanced countries, massive importance is given to these factors. All these technical factors have equal importance and negligence in any of them may cause a serious and negative impact on quality and yield of silk cocoons [6]. Regarding adoption and fulfilment of these technical aspects several types of irregularities are being observed in Pakistan. Due to these irregularities, Pakistan is far behind in silk worm rearing practices and its average cocoon yield has been abridged up to zero. Pakistan's sericulture industry is a spectator of very outstanding past. But now days it has lost its attraction. Major reasons of downfall of this industry are 'ignorance about real potential of sericulture industry, absence of serious backup support of government department and substandard methods of silkworm rearing [1].

In silk advanced countries, several governmental and non-governmental organizations (NGOs) are performing their duties with professional attitude for sericulture promotion but in Pakistan, government sericulture department is just a name of formality and wastage of capital in the name of heavy salaries of un-visionary officials [10].

For progress of Pakistan's sericulture industry, relevant experts recommend that it is

high time to increase the quality and availability of silk seed, increase in mulberry cultivation, application of standard rearing technology, provision of proper assistance to farmers, close coordination between government and NGO's with a visionary and corruption free administration [5].

The main objective of the study is to explore the silkworm rearing practices in Pakistan. Pakistan is a country where unemployment rate is high on the other hand, this industry is providing millions of jobs in Bangladesh, China and India but currently in Pakistan only few hundred families are practicing it as a part time occupation. Unfortunately, Pakistan is far behind from its neighbouring countries in terms of generating employment from sericulture.

In Pakistan large numbers of rural communities are living below the poverty line. Due to more suitable climate, demographic and geographical conditions, Pakistan has a great scope and potential of rural development but there are many obstacles in the way of sustainable rural development in Pakistan [1].

## MATERIALS AND METHODS

The present study is both qualitative and descriptive where primary data was composed through an arranged questionnaire by key informant interviews (KIIs) in 2017. These KIIs were led with sericulture officials, silkworm rearing experts and farmers currently linked with silkworm rearing practices. Several sessions were conducted with relevant stakeholders of sericulture industry including silkworm rearing experts, officials and farmers involved in the sericulture. Primary data collection of KIIs was collected and is shown in Table 1.

Table 1. Respondents of primary data

Respondents	KIIs
Silkworm rearing experts	10
Sericulture officials	20
Farmers currently involved in sericulture	80
Total	110

Source: MS thesis of the author, Muhammad Farooq Hyder.

In this study, ten KIIs were conducted with silkworm rearing experts and twenty with relevant sericulture officials. These KII's were conducted from six localities of Pakistan including Muzafarabad (Azad Jammu and Kashmir, AJK), Peshawar, Lahore, Changa Manga, Sarai Alamgir and Faisalabad. 80 KIIs were also conducted with the farmers currently involved in silkworm rearing activities. Due to least availability of farmers, from 80 questionnaires, 40 interviews were conducted from Changa Manga, 15 from Faisalabad, 10 from Mandi Bahauddin, 5 from Sarai Alamgir and 10 from Muzafarabad (Azad Jammu and Kashmir, AJK).

## RESULTS AND DISCUSSIONS

### *Silkworm Rearing Process*

To understand the importance and impacts of factors involved in silkworm rearing process a brief overview of silkworm life cycle and cocoon production is described below. Mulberry silk is produced by silkworm specie named *Bombyx mori*. Silkworm life consists of five stages i.e., ova, larvae, pupa, imago and adult moth. After hatching from eggs, fresh mulberry leaves are served to silkworms. Silkworms grow rapidly and their hunger increase day by day. During life, a silkworm takes four sleeps and after each sleep it removes its old skin and produce larger one. Before final sleep, silkworm spins a cocoon around it and emerges as an adult moth. After emergence male and female moths met with each other and female moth lays about 300-500 eggs [14].

### *Technical Aspects: Steps taken in Pakistan*

The present study is about to explore the silkworm rearing practices in Pakistan and also to examine the technical aspects of silkworm rearing process. Standard silkworm rearing process contains; 'disinfection of rearing rooms, uniform hatching, cleanliness, maintenance of temperature, humidity, light, ventilation, spacing, feeding patrons, care during moulting, molting and cocoon collection stages, precautionary measures against diseases and coping strategies against rapid changes in climate [10].

During research it is observed that in Pakistan most of the farmers know about the importance of above mentioned factors but due to several reasons they are not capable to maintain these standards and it is also observed that sincerity of officials of government sericulture department is just with their heavy salaries and not with their responsibilities.

#### *Rearing Rooms*

Rooms fulfilling the standard conditions for silkworm rearing are one of the basic pre requisitions for silkworm rearing. Generally, in world, silk worm rearing is practiced at home level and in silk advanced countries with collaboration of relevant departments farmers construct such standard rooms which are capable for silkworm rearing as well as other income generating activities during out season [3].

In Pakistan, farmers do not have such standard rearing rooms and during rearing season they spare any domestic room at home, fully or partially. During research it was observed that 92 percent of those rooms were not up to the standard. Climate of AJK, KPK and Baluchistan is more intensive and there is also a great difference between day and night conditions during rearing season, that's why proper rearing room arrangements are most important and critically required in those regions.

A standard silkworm rearing room requires that it should be capable to maintain the temperature and humidity, having proper light and ventilation windows. Roof of room should be high up to 10 feet and design of room should be in such manner that fluctuation in external environment cannot affect internal conditions.

Table 2. Rearing Rooms

Standard Rearing Rooms	Tarries or Open Type	Close Rooms having less facilities of Light and Ventilation
17 %	28 %	55 %

Source: MS thesis of the author, Muhammad Farooq Hyder.

In fact, fulfilment of such ideal conditions is not a difficult task and this could be done by using effective and low cost tactics i.e., special mud rooms which have very low cost and are most effective to maintain the internal conditions.

Currently, Sericulture is a part time activity in Pakistan, due to low productivity; most of the farmers do not rear the worms with keen interest.

These farmers are poor and do not have sufficient and proper rearing space. Results of the study show that only 17 percent farmers have standard rooms for rearing, 28 percent use their tarries or open ended rooms having less control over rapid changes in climate and 55 percent have close rooms but have not proper arrangements of ventilation or light and direct sunlight on rooms increases the internal temperature of such close rooms made with concrete.

#### *Disinfection of Rearing Rooms*

Diseases are serious issue and in silkworm rearing, it is easier to prevent the occurrence than trying to cure them when they occur.

So, before starting the rearing of worms, disinfection of rearing room is essential. For effective disinfection, all rearing appliances should be kept inside the rearing room.

Walls, doors, windows and appliances should be sprayed with 2 percent formalin solution. After spray, room should be air tightened for 24 hours and then should be opened with full ventilation of air for 24 hours [13].

Table 3. Rearing Room Disinfection

Proper Disinfection	Partially Apply	In Some Extent	Do not Apply
14 %	37 %	40 %	9 %

Source: MS thesis of the author, Muhammad Farooq Hyder.

In Pakistan, most of sericulture farmers know about disinfection but are not much aware about the benefits of disinfection and only 14 percent farmers properly disinfect their rooms, 37 percent of farmers partially disinfect the rooms and appliances, 40 percent apply in some extent and 9 percent do not apply any method of disinfection before rearing.

*Hatching*

After preparation of rearing rooms, hatching of silkworm eggs is the next step. For high production, maximum and uniform hatching is necessary. Ideal temperature for hatching is 24C°- 27C° [4]. Although farmers do not have standard rearing rooms to maintain the required temperature but results of the study reveal that they are well aware about the importance of hatching process. To maintain the temperature during hatching process, farmers use different techniques. Most of the farmers put silk seed packets in cotton envelops and these cotton envelops are a good tool for ideal hatching.

Table 4. Hatching Table

Maximum Hatching	Good Hatching	Average hatching
92 %	6 %	2 %

Source: MS thesis of the author, Muhammad Farooq Hyder.

Results of the table show that 92 percent farmers are able to get maximum hatching, 6 percent farmers responded that they are able to get good hatching results and only 2 percent claims about average hatching.

*Rearing Beds and Spacing*

Silkworms grow rapidly and for moving and eating, each requires proper space. In silkworm rearing, overcrowding effects inadequately and spacing from day first to till end is compulsory. For one packet of 40,000 silk seeds, required space starts from two squared feet and at the end required area is about 360 square feet [6]. With rearing stands this space could be arranged easily in a 12×12 feet room.

Table 5. Rearing Bed Types

Bamboo Stands	Charpoy	Tables	Iron Stands
55 %	38 %	6 %	1 %

Source: MS thesis of the author, Muhammad Farooq Hyder.

In Pakistan, 55 percent farmers make bamboo stands having three or four racks and these stands are effective for maximum utilization of room space, 38 percent use the charpoy putting them one onto other, 6 percent use tables and only 1 percent use iron stands.

Results reveal that majority of farmers try to adjust more worms in less space.

*Cleaning*

Whole process of silkworm rearing requires a continuous cleaning of rearing rooms, beds and trays. Cleaning of wastage of worms and mulberry leaves is not a complex task because silkworms automatically transfer to fresh mulberry twigs which could be shifted to already clean trays. This fact reveals that cleaning could be done more conveniently if farmers have reserve space in their rearing rooms. Results show that farmers are conscious about cleaning and try their best but it is also observed that farmers, who have less space availability in their rearing rooms, face difficulties and unable to fulfil the measures of merit.

Table 6. Cleaning

Consecutive cleaning	Cleaning after 1 day	Cleaning after 2 days	Cleaning after 3 days
12 %	47 %	38 %	3 %

Source: MS thesis of the author, Muhammad Farooq Hyder.

For healthy growth of silkworms, consecutive cleaning is a key but only 12 percent of farmers are able to fulfil this condition, 47 percent clean their rearing beds completely after one day and 38 percent clean after two days but they remained in touch with partial cleaning. More old waste is not good for silkworms and there are only 3 percent farmers who delayed the complete cleaning process for third day.

*Maintenance of Internal Conditions*

Maintenance of internal conditions of rearing rooms like temperature, humidity, ventilation and light are necessary and rapid changes in these may cause bad impact on health and growth of silk worms. Ideal temperature for silkworm rearing is 24C<sup>0</sup> - 27C<sup>0</sup> and required humidity is about 70 - 85 % [3]. Normally silkworms are reared in spring season and it is a blessing of nature that spring season circulates in different localities of Pakistan throughout the year. Although during spring season natural conditions are supportive for silkworm rearing yet proper arrangements for maintenance of such conditions are also

essential. Pakistan is situated in sub-tropical region where temperature and climate vary from place to place. Fluctuations in temperature may also be due to rotation of day and night, due to wind, rain and direct sunlight on rearing room. It is also a fact that in northern areas of Pakistan, at night time temperature drops below 20C<sup>0</sup> and in southern areas, at day time temperature increases to above 30C<sup>0</sup>.

Maintenance of rearing room climate is a serious issue in Pakistan. Farmers apply different techniques to maintain these conditions. Although these techniques are effective but due to unavailability of proper rearing rooms these techniques brought fewer impacts.

Table 7. Maintenance of Internal Conditions

Full Capability	Good Capability	Average Capability	Low Capability
19 %	22 %	52 %	7 %

Source: MS thesis of the author, Muhammad Farooq Hyder.

Results indicate that only 19 percent farmers have full control and capability to maintain the required climatic conditions, 22 percent have good capability to maintain these conditions, 52 percent have average capability and 7 percent have low capability to maintain the standard climatic conditions of their rearing room.

*Moulting*

During larval growth phase silkworm moults four times. After achieving the maximum growth in one stage, worm stops to eat and takes a 20 to 30 hour sleep.

After awaking worm removes his existing skin and put on a new and elastic skin which allows him for further growth.

Before moulting, cleaning and drying the bed is important so that worms could settle uniformly and conveniently.

During moulting worms should not be disturbed and feed should be given when more than 90 percent worms come out from moult [2].

Table 8.Moulting

Fully Aware	Sufficient Knowledge and Experience	Less Knowledge and Experience
81 %	13 %	6 %

Source: MS thesis of the author, Muhammad Farooq Hyder.

Results from the above table show that in Pakistan 81 percent farmers are well aware about moulting, 13 percent have sufficient knowledge and experience about moulting while, 6 percent have less knowledge and experience about moulting.

*Mounting*

After fourth moult, silkworms stop feeding and get ready for mounting. In mounting, silkworms seek some specific frames to settle for cocoon spinning. For mounting, timely support of worms is a key of healthy cocoons. Mounting requires specific branch frames having space of 40-50 worms per square feet. Silkworms spin cocoons in 2-3 days and these cocoons should be collected efficiently [12].

Table 9. Mounting

Fully Aware	Sufficient Knowledge and Experience	Less Knowledge and Experience
76 %	17 %	7%

Source: MS thesis of the author, Muhammad Farooq Hyder.

Results of the study reveal that 76 % farmers are fully and well aware about mounting, 17 percent have sufficient knowledge and experience and 7 percent have less experience about mounting techniques.

*Mortality*

In silkworm rearing mortality ratio of worms is a critical factor. Low or normal mortality is considerable but in Pakistan mortality ratio is very high. Although availability of insufficient rearing rooms is also an issue but main reason of mortality is poor quality of silk seed.

*Cocoon Production*

The main Purpose of all previous mentioned efforts is to achieve the good cocoon production. Findings of study indicate that in Pakistan, cocoon production results are very poor and disappointing. Although, lack of standardized conditions have also a role but

main reason behind low productivity is low quality of silk seed.

Currently, in Pakistan there are two government departments where silk seeds are prepared and distributed i.e., department of sericulture, Punjab and directorate of sericulture, AJK. Production result of both silk seed providers are mentioned in separate tables.

*Productivity of Punjab Silk Seed*

Including other factors, main reason of low cocoon productivity in Pakistan is its lack of advancement in silk seed varieties. Currently, Punjab’s sericulture department does not have any reliable silk seed variety and productivity of Punjab silk seed varieties are almost zero. During observations, rather responding on cocoon production, sericulture farmers responded about mortality of worms.

Table 10. Mortality

100 % Mortality	95 % Mortality	90% Mortality
90 %	7 %	3%

Source: MS thesis of the author, Muhammad Farooq Hyder.

About all farmers responded that silk seed packets distributed by Punjab’s sericulture department were very poor in quality. They claimed that during first four stages i.e., from hatching to fourth instars their silkworms remained healthy and grew well but at final stage worms started to change their color and swelling appeared on their body, after this, silkworms started to die. About 90 percent farmers claimed that before reaching the mounting stage, almost 100 percent worms died, 7 percent responded that they lost about 95 percent and 3 percent responded that their 90 percent worms died and they got small and low quality yield.

During an interview, Shakeel Khan, senior research officer, Punjab department of sericulture conferred that Punjab silk seed has damaged and remained not capable to produce further. So there is a great need to generate some new and reliable silk seed varieties. He also claimed that Punjab sericulture department is trying to import some reliable foreign silk seed varieties which would be

used in further research and development of new varieties.

*Productivity of AJK Silk Seed*

Productivity of AJK silk seed varieties are comparatively better than Punjab silk seed. AJK silk seed packets are mostly distributed in AJK localities. Some farmers from Punjab who are still engaged in sericulture with enthusiasm and they also have good rearing room arrangements, responded that for silk worm rearing they only prefer AJK silk seed. Most of AJK farmers responded that in past, AJK silk seed was more productive then present. They also argued that currently resistance of AJK silk seed against severe climatic conditions is decreased many times.

Table 11. Cocoon Production of AJK Silk Seed

0-5 Kg	5-10 Kg	10-15 Kg	15-20 Kg
12 %	47 %	32 %	9 %

Source: MS thesis of the author, Muhammad Farooq Hyder.

From the above mentioned results, it is clear that 12 percent farmers obtained 0 to 5 kg of cocoons, 47 percent farmers produced five to ten kg cocoons, 32 percent produced ten to fifteen kg and 9 percent got the production of fifteen to twenty kilograms cocoons. During an interview, Sardar Muhammad Shafiq Khan, Director General of AJK Directorate of Sericulture, assured that in standardized rearing conditions, AJK silk seed is capable to produce up to twenty five kilograms of silk cocoons. He also accepted that due to lack of advancement in innovation and technology, production results of AJK silk seed varieties have decreased but still these varieties have capability of advancement and further research could make them more productive.

*Silkworm Feed*

Mulberry leaves are the feed of silkworms and they eat them with eagerness and their hunger never ends. Ideally one packet of 40,000 silkworms requires about 800-1,000 kilo grams of mulberry leaves [6]. In Pakistan rearing activities are mostly performed near forest localities. In past, those forests were filled with huge number of mulberry and other trees but massive cutting demolished these forests badly [8]. For promotion of sericulture, enhancement in mulberry forest

areas is equally important as provision of quality silk seed and standard rearing conditions.

#### *State and NGOs Support*

Various countries of the world had made a significant improvement in silk production. In those countries, state sericulture departments and NGOs have a strong collaboration and they are facilitating the farmers through different schemes and programs [11].

During survey almost 100 percent farmers and sericulture staff responded that since a long time, not even a single promotional program is initiated by state and there is not even a single NGO which is interested to promote sericulture in Pakistan.

## CONCLUSIONS

Results show that Pakistan's sericulture industry is near to end and the main reason behind this is negligence of the state. Results of the study also indicate that although Pakistani silk farmers have sufficient knowledge and experience but they need a proper support and assistance from state department to convert the sericulture industry into a profitable industry. The present study suggests that it is need of the hour to explore and promote sericulture industry by improving silkworm rearing practices in Pakistan in a better way hence employment opportunities can be created for a large number of poor and deprived rural populations.

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