

METHODOLOGY

The study was carried out among the muga farmers of Golaghat district in Assam. The methodology followed for achieving the objectives of the study are presented under the following sub-heads.

- 3.1 Selection of study area
- 3.2 Selection of respondents
- 3.3 Selection of recommended technologies of muga culture
- 3.4 Research design
- 3.5 Methods used for measurement of dependent variables
- 3.6 Methods used for measurement of independent variables
- 3.7 Instruments used for data collection
- 3.8 Statistical methods used for data analysis

3.1: Selection of Study area

Present investigation was carried out in Golaghat district (Figure 3.1) of Assam purposively based on the existence of large number of traditional muga farmers. Besides, Central Muga Eri Research & Training Institute, Central Silk Board, Lahdoigarh, Jorhat, Assam adopted a large numbers of muga farmers providing with required assistance to adopt recommended technologies under different programme. Apart from this, different extension programme *viz.* technology demonstration, technology awareness programme, field day, training, etc. were being organized time to time by the institute in coordination with the department of sericulture to educate the farmers about improved technologies of muga culture. With the aim of enhancing muga raw silk production through adoption of improved technology package, the institute also established Seri Modal Village (SMV) in muga sector at the potential areas in the district. Golaghat district has four Sub-Division namely Golaghat, Dhansiri, Bokakhat and Merapani. The district headquarters is located at Golaghat town. The district occupies an area of 3502 km² and lies 100 m above sea level. It lies between 25°50 to 26°47 North Latitude and 93°16 to 94°10 East Longitude.

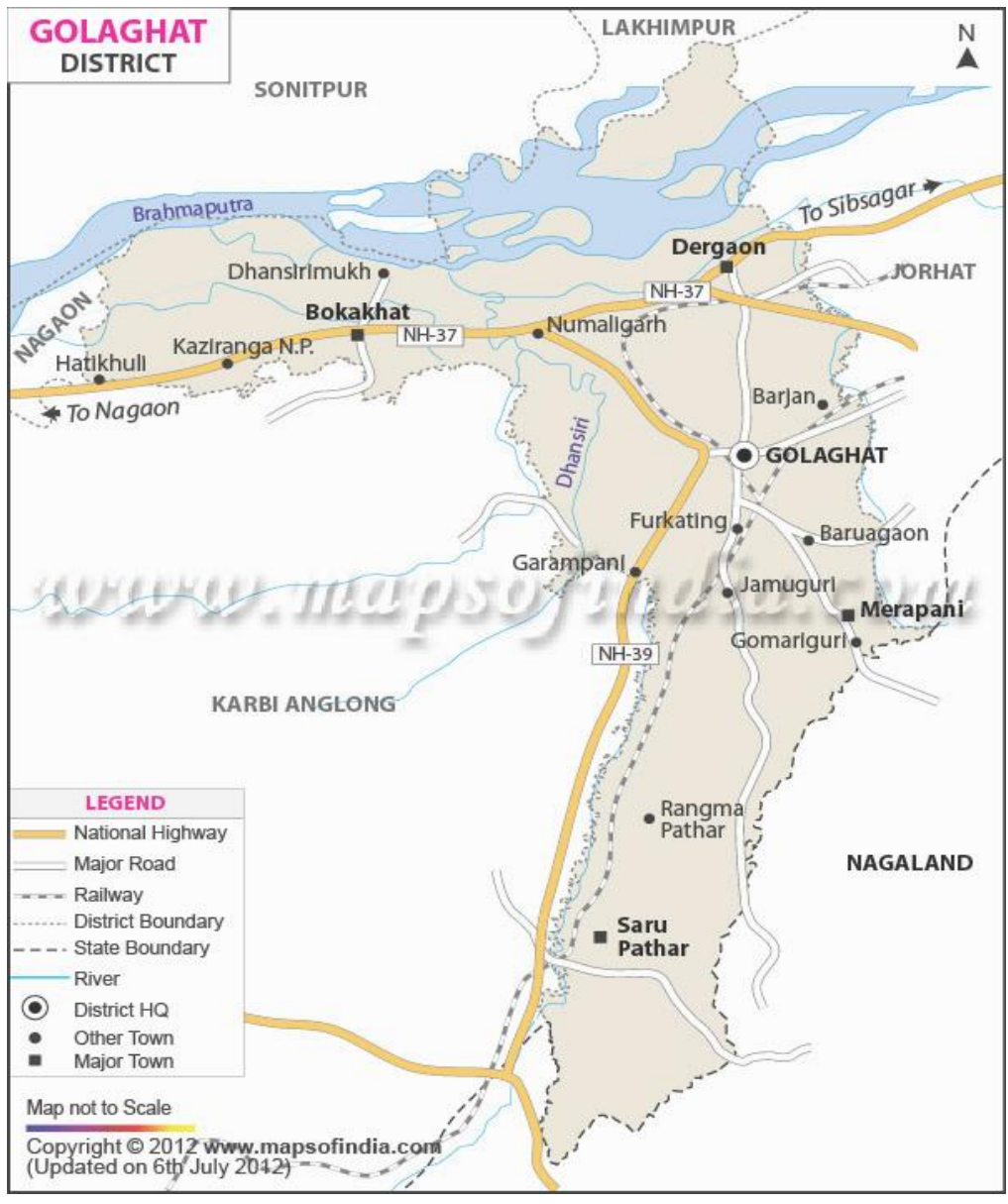


Figure 3.1: Map of Golaghat District, Assam adopted from google images (www.google.com/images)

3.2: Selection of respondents

The study was conducted in the 20 selected villages of Golaghat district of Assam, where muga silkworm crops are conducted regularly. Ten respondents from each identified village were selected based on random sampling. Altogether 200 respondents were selected from these villages covering all the Sub-Division of the district for the study.

3.3: Selection of recommended technology packages

The integrated technology package of muga culture recommended by Central Muga Eri Research & Training Institute, Central Silk Board, Lahdoigarh, Jorhat was considered for the study in consulting with the expert scientists of the institute and extension workers of sericulture department of the district. List of the technologies included in the integrated technology packages are given below.

- 1. Spacing of host plants :** In order to enhance carrying capacity of silkworm rearing through production of quality leaf yield and facilitate agronomical practices, erection of nylon nets for silkworm rearing, etc the ideal spacing for Som (*Persea bombycina*) and Soalu (*Litesa polyantha*) is 3 X 3 m (Plate 1).
- 2. Application of inputs:** Recommended doses for higher leaf yield of som and soalu is 5 Kg FYM with NPK (40g urea, 60g SSP and 15g MOP) to be applied per plant during April by making circular ring around the plant from 2nd year onward up to 5th year (Plate 2). After 5th years, the quantity of FYM and NPK is doubled and applied in split doses during April and September.
- 3. Pruning schedule of host plants:** Pruning methods of muga host plants (Plate 3) and its schedule for obtaining quality foliage for different crops has been recommended for production of quality leaf as shown in the Table 3.1.
- 4. Intercropping with muga host plants:** Suitable intercrops like Ginger (*Zingiber officinale*), Turmeric (*Curcuma longa*) and Colocasia (*Colocasia esculenta*) can be cultivated in the effective interspaces of existing som plantation without any adverse affect on growth and leaf yield of som plants. (Plate 4). Intercropping of ginger, turmeric and colocasia in one-hectare of Som

(*Persea bombycina* Kost) plantation can generate additional farm income by 47%, 55% and 85% over sole cropping of Som.

Table 3.1: Pruning schedule of muga host plants

Crops/Seasons	For early stage silkworm	For late stage silk worm
Aherua (June-July)	1 st week of March	1 st week of February
Bhodia (August-September)	1 st week of April	1 st week of March
Katia (October-November)	1 st & 2 nd week of July	1 st & 2 nd week of June
Jarua (December-February)	1 st week of September	1 st week of August
Chotua (February-March)	1 st & 2 nd week of October	1 st & 2 nd week of September
Jethua (April-May)	1 st week of December	1 st week of November

5. Control of stem borer of muga host plants: Stem borer (*Zeuzera indica*) is a most common and serious pest of som and soalu. The caterpillar feeds on the tissue of the tree trunk and make bores into the main trunk (Plate -5). Ultimately the plants are died. The number of holes per plant is ranges between 1-5 and size of holes are 0.5-2.0 cm. Technology has been developed to control the infestation of stem borer by mechanical means (Plastic wrapping on the main trunk or mud plastering of the tree trunk) up to 68 %, through botanical means (5-15% plant extract of Neem (*Azadirachta indica*), Posotia (*Budelia adciatica*), Titabahak (*Adhatoda vasica*) and Castor (*Ricinus communis*) up to 80% (Plate 6 & 7).

6. Disinfection of rearing fields: Pre-brushing care such as disinfection of rearing field with slaked lime powder and bleaching powder (9:1) and spray of Potassium hypochlorite in entire rearing field (Plate 8) prior to one week of brushing to reduce disease incidence of silkworm.

7. Early stage rearing of muga silkworm under nylon net: Rearing of early stage muga silkworm (1st-3rd instars) under the nylon net reduces early stages loss of silkworm and results in 42-60% gain in cocoon production (Plate 9).

8. Biological control of uzi fly: Among different pests, uzi fly is one of the major pests, attacking muga silkworm particularly during December-April causing 48 to 80 % crop loss in seed growing areas (Plate 10). Two biological control agents (hyper-parasitoid of uzi fly), viz. *Exoristobia phillipinensis* and *Nesolynx thymus* have been identified and recommended for controlling uzi fly infestation. Continuous release of these agents in a particular area can combat fly population and thereby saving muga silkworm crops to a considerable extent (Plate 11 & 12).

9. Lahdoi: An anti-muscardine formulation has been developed for control of Muscardine disease which causes heavy loss during winter muga seed crops (Plate-13). Application of 0.1% “*Lahdoi*”, a chemical formulation ensures 40-70% ERR against 93-100% mortality of worms due to the disease. The formulation is sprayed on the food plants 7 days prior to brushing and transfer of silkworm. The second spraying is done at 15 days after 1st application (Plate 14).

10. Improved mountage: Instead of traditional 'Jali' (dry leaf mountage) for spinning of muga cocoons, box type mountage has been fabricated for cocooning of muga silkworm. Box type bamboo mountage required less manpower (save 60% labour) and space (reduce 90% space), produced superior quality cocoons compared to cocoons formed in traditional Jali. Moreover, harvesting of cocoons from the box is easy (Plate 15). The box can be used for several times.

11. Mother moth examination: Pebrine is a serious disease of silkworm caused by protozoan. Technology for detection of pebrine spore by mother moth examination through microscope has been recommended to check the disease (Plate 16).

12. Egg surface disinfection: To make the harvested eggs free from diseases, eggs surfaces need to be disinfected through washing of eggs in 2.0% formalin solution for 2-3 minutes followed by washing in soap water for 2 minutes and finally by fresh water until disappearance of formalin smell and then keep the egg in a single layer on blotting paper and dry in shade (Plate 17).

3. 4. Research design: The research design adopted for this study was ex-post-facto technique, since the phenomenon has already started and is continuing. Ex-post-facto research is the most systematic empirical enquiry in which the researcher does not have control over the independent variable as their manifestation has already occurred or they are inherent and not manipulatable. Thus, inferences about relation among variables were made without direct intervention from concomitant variation of independent and dependent variables (Kerlinger 1973)

3.5 Methods used for measurement of dependent variables in the study

Variable	Measurement
1. Knowledge	Kunzru and Tripathi (1994)
2. Adoption	Karthikeyan (1994)

3.5.1 Knowledge: This refers to the factual information possessed by a farmer regarding improved technology packages of muga culture. Knowledge level of muga farmers was studied using the knowledge test developed by Kunzru and Tripathi (1994) based on the ‘correct’ and ‘wrong’ answer responded by the farmers with scoring of ‘one’ and ‘zero’ respectively. The mean was determined using the total score and number of total questions. A total number of 12 recommended practices covered under integrated technology package of muga culture recommended by Central Muga Eri Reseach & Training Institute, Lahdoigarh, Jorhat were selected. Following formula was used to measure the knowledge index (KI).

$$\text{Knowledge Index} = \frac{\text{Number of correct responses}}{\text{Total number of knowledge items}} \times 100$$

Based on the total scores, the respondents were grouped into three categories as low, medium and high using mean and standard deviation as a measure of check.

3.5.2 : Adoption : It refers to the adoption of all the recommended practices of muga culture by the fanners as recommended in integrated package by Central

Muga Eri Research & Training Institute, Central Silk Board, Lahdoigarh, Jorhat. The procedure suggested by Karthikeyan (1994) for calculation of adoption quotient was utilized to measure the general adoption level of the respondents. Accordingly, the following formula was used to calculate the overall adoption level.

$$\text{Adoption index} = \frac{\text{Respondent's total score}}{\text{Total possible score}} \times 100$$

The score was assigned for the adoption of each of the practices in the following way:

Adoption Pattern	Score
Non-adoption	0
Partial adoption	1
Complete adoption	2

Thus, the maximum score that one could get was 12 and the minimum score was 1. Depending upon the total score(s) obtained by each respondent, they were grouped into three categories as full, partial and non adopters with mean and standard deviation as a measure of check.

3.6 : Measurement of independent variables

1 Age	Schedule developed
2 Education	Schedule developed
3 Family size	Schedule developed
4 Operational land holding	Schedule developed
5 Sericulture income	Schedule developed
6 Experience in muga culture	Schedule developed
7 Extension participation	Schedule developed
8 Mass media participation	Schedule developed

3.6.1 Age: Based on age, the respondents were categorized into young, middle and old and it was done for the purpose of analyzing their socio-economic characters. Categorization of age was done as follows

Category	Scores
Young	<36
Middle	36-56
Old	>56

The results were expressed in frequency and percentage.

3.6.2 Education: Based on the formal educational level, the respondents were categorized in to four categories as illiterate, primary, secondary and graduate and above. The results were expressed in frequency and percentage.

3.6.3 Family size: Family size of the respondents was determined based on the total number of members residing in the family of the respondent. The size of the family was categorized as below.

Category	No. of members
Small	1-3 members
Medium	4-5 members
Large	>5 members

The results were expressed in frequency and percentage.

3.6.4 Operational land holding: It refers to the area of land possessed in muga food plant cultivation by the respondents. Based on the responses of the respondents, they were grouped into three categories as less than 1.0 acre, 1.0 acre and above 1.0 acre. The results were expressed in frequency and percentage

3.6.5 Sericulture income: Sericulture income is defined here as the income from sericulture particularly in muga culture. The income per annum of the respondent was arrived by adding the income generated from different crops reared in a year. Based on the average income per annum, post classification was taken into three categories as low medium and high.

Category	Income (In Rs).
Low	30000- 40000
Medium	40000 - 60000
High	>60000

The results were expressed in frequency and percentage.

3.6.6 Experience in muga culture: Experience in muga culture refers to number of years a farmer has been in the profession of muga culture. Based on the answer elucidated the respondents were categorized in to three category as below.

1. Less than 10 years
2. Between 10 to 20 years
3. Above 20 years

The results were expressed in frequency and percentage

3.6.7 Extension participation : It refers to the extent of participation of the respondent in different extension programme viz. Technology awareness, Field days, Technology demonstrations, Training, Exhibition, Exposure visit, Group discussion, Reshom Krishimela, etc. The extension activities were listed and respondents were asked to indicate their extent of participation in each one of them. Based on the participation of extension programme, the respondents were categorized as regular, occasional and never. The results were expressed in frequency and percentage.

3.6.8 Mass media participation: It is referred to the exposure of the respondents to different mass communication media and participation in the related activities such as listening to radio, viewing television and reading news paper, sericultural journals, etc. Further, the respondents were asked to indicate their frequency of participation in different programmes of television and radio. The responses were expressed in frequency and percentage. Based on the participation of extension programme, the respondents were categorized as regular, occasional and never. The results were expressed in frequency and percentage

3.7 Instruments used for data collection: A structured schedule was prepared with the help of experts in the field of sericulture extension, which included subject matter content of both improved and traditional practices of muga culture and all the items under each of the variables selected for the study. To determine the constraints of the respondents for non adoption of improved technologies, the respondents were provided with structured questions to mention the degree of seriousness of the constraints as very serious, serious, not very serious and not a constraints with scores 3, 2, 1 and 0 respectively. Based on the weighted mean score (WMS), the constraints were categorized. Data collection was done by personal interview method with the help of the interview schedule (**Appendix-I**). Further, field observation and joint interpretations was done to arrive at conclusions of documented traditional practices.

3.8 Assessment of muga silkworm crop performances

In order to assess the crop performances under both traditional practices as well as improved technologies, two years crop performance data of the farmers were observed in the study area separately for seed and commercial crops. Crop performance data were collected using the format specially structured for the purpose (**Appendix-II**). To evaluate the crop performance under traditional practice, data were collected from two groups of farmers having with one acre of land area under cultivation of muga host plants. One group of farmers were identified as seed crops rearers and another group of farmers were identified as commercial crops rearer. Both the groups were comprised with 30 farmers equally. To compare the crop performance under improved technologies with the performance of traditional practices, data were collected from 30 adopted farmers of CMER&TI, Lahdoigarh each for seed and commercial crops in the study area. The adopted farmers were provided all the assistance for adopting the technologies effectively under constant monitoring of the institute.

In order to compute the economics of cocoon yield, the annual cost of cocoon production in both traditional and improved practices were calculated based on the actual expenditures and prevailing market rate of different items.

The data collection was done during 2014 and 2015.

3.9 Statistical methods used for data analysis : The statistical tools and tests such as frequency, percentage, mean, correlation coefficient, multiple regressions, chi-square, t-test for equality of means were used wherever found appropriate and the data was analyzed systematically to draw valid inferences.

Frequency: A simple frequency distribution was also used to identify the number of growers distributed on different groups. .

Percentage: Percentage was used to make the simple comparison of different groups.

Mean and Standard Deviation: Mean and Standard Deviation were computed to classify the respondents into different categories.

Correlation test: Simple correlation test was used to find out the nature of relationship between independent variables and dependent variables.

Multiple Linear Regression Co-efficient: The test was carried out to determine the combined contribution of the all independent variables on dependent variables by subjecting the variables into multiple regression analysis. Further, R^2 was used to assess the level of contribution between the variables under study.

Chi-square test: The chi-square test was used to test whether the set of observed frequency in the distribution had arisen from a normal distribution population or otherwise. The Chi-square test was conducted as recommended by Ferguson (1966).

t -Test: The t-Test was used to test any difference between the observed data in two different groups.