STUDIES ON HIGH BUSH AND TREE TYPE MULBERRY PLANTATION UNDER RAINFED CONDITION OF ODISHA

Project Proposal Submitted to
The Director,
C.S.R&T.I., Central Silk Board,
Ministry of Textiles (Government of India),
Berhampore (W.B.)

By

RUSHI SAHU, Scientist-C
(Project Investigator)

Regional Sericultural Research Station
Central Silk Board
Ministry of Textiles, Govt. of India
Koraput-764020, Odisha

PROFORMA – I (To be filled by applicant)

PART I: GENERAL INFORMATION

1.	Name of the Institute / University / Organization submitting the Project Proposal	:	**Central Sericultural Research & Training Institute,** Central Silk Board, Ministry of Textiles: Govt. of India, Berhampore - 742 101, West Bengal, India
2.	Status of the Institute(s)	:	[Only for non-CSB institutions]
3.	Name(s) and designation of the Executive Authority of the Institute / University forwarding the application	:	DR. B.B. Bindroo, Director
4.	Project Title	:	**Studies on High Bush and Tree type mulberry plantation under rainfed condition of Odisha**
5.	Category of the Project	:	Applied
6.	Specific Area	:	P – **P**lant
7.	Duration	:	05 (Five) years i.e. from November 2012 to October 2017
8.	Total cost:	:	Rs. 0.75 Lakh
9.	Is the Project: single institutional or multi-institutional?	:	Single institutional
10.	If the Project is multi-institutional, please furnish the following: Name, Designation and Address of the Project Co-ordinator	:	[The Project Coordinator shall be one of the Principal Investigators who takes the overall responsibility of conducting the project as a whole.] NA
11.	Project Summary	:	To develop a package of practice for High Bush and Tree type mulberry plantation under rainfed condition

Prelude: Mulberry sericulture is facing tough competition with many other cash / traditional crops presently. Still, there is better demand for mulberry cultivation due to its specificities like topography, congenial climatic conditions, soil characteristics, diversified human resources etc. The low bush mulberry cultivation is facing tough challenge due to cattle menace, lack of suitable land areas in hills, acceptable package of mulberry cultivation for this region. Since, high bush mulberry cultivation with optimum planting geometry is not only suitable for Odisha; but, equally acceptable model even in sloppy/undulated terrains also, with a view for an increased income per unit area, which is the importance of the proposed project under context of the current status.

Aims / Objectives: Odisha is a non traditional state on mulberry cultivation; the practice is mainly confined to the tribal populace. Cattles set free for grazing after the harvest of traditional crops and conversely the mulberry plantation gets amenable to them, which finally results low productivity of this food crop for the silk worm as its aftermath consequence. Therefore, there is a need to develop an intense package

concerning plantation of tall bush and tree mulberry varieties for achieving higher target of survivability; diversifying and direct the road of sericulture up to the vicinity of rural population.

Work to be carried out: Finding out a suitable planting geometry of high bush mulberry plantation for long term and large scale cultivation of mulberry to ensure better quality, sustained leaf production and to facilitate better mechanization. Two mulberry varieties viz; **S1635** & **C1730** selected basing on their leaf yield data from AICEM conducted at this research station.

- DETAILS OF METHODOLOGY :
  Technology   : Recommended rain fed package of practices
  Variety (two)   : S1635 & C1730
  Height   : 5 ft
  No. of treatments (spacing): 3 (10ft×10ft; 8ft×8ft; 6 ft×6ft)

  (a) Plot with 10'×10' spacing, experimental plant =24, Border plant=24, Total No. of plants=48; Area required = 80ft×60ft.
      (Lay out enclosed separately)

  (b) Plot with 8 ×8' spacing, experimental plant =24, Border plant =26, Total No. of plants=50; Area required =80ft×40ft
      (Lay out enclosed separately)

  (c) Plot with 6'×6' spacing, experimental plant =33, Border plant =32, Total No. of plants =65; Area required =78ft×30ft
      (Lay out enclosed separately)

  (d) Total Experimental Area   = 341 ft × 290 ft

  (e) No. of Replications   = 6

  (f) Spacing between blocks   = 7ft

  (g) No. of crops   = 2

  (h) Pruning / Training schedule   = 2   (Bottom at Crown : June-July
                                             & Middle   : Mid Dec)
  (i) Harvesting schedule   = 2   (Aug-Sept & Feb-Mar)

Treatment	Spacing	Height	Experimental Plant	Border plant	Total no. of plants
T1	6' x 6'	5 ft	33	32	65
T2	8' x 8'	5 ft	24	26	50
T3	10' x 10'	5 ft	24	24	48

A total number of 5 experiments each have to be taken which are as under:

E01: Study on growth and yield parameters of the mulberry varieties:
    Parameters to be studied
    Leaf yield (kg/plant), length of longest shoot, total shoots length (cm),
    Wt of 100 leaves with moisture content (%) and moisture retention capacity (%)

E02: Study on disease incidence of the mulberry varieties:
    Parameters to be studied

The percentage Disease Index (PDI) of the major diseases viz., Bacterial Leaf Spot, Myrothecium Leaf Spot, Pseudocercospora Leaf Spot and powdery mildew

E03: Study on pest incidence of the mulberry varieties:
Parameters to be studied
Population of Thrips, Population of white fly, Tukra and Bihar Hairy Caterpillar.

E04: Study of Biochemical parameters of the mulberry varieties:
Parameters to be studied
Chlorophyll-a, chlorophyll-b, total chlorophyll, total soluble sugar and total soluble protein

E05: Bioassay study:
Parameters to be studied
Larval duration, ERR% by No. and Wt., Yield /100 dfls, Single cocoon wt, Single shell wt, Silk ratio

Expected outcome of the Project:

1. To obtain optimum leaf yield,
2. Check cattle menace and
3. Curtail maintenance expenditure.

PART II: PARTICULARS OF INVESTIGATORS

12.	Name: Date of birth Sex Project Designation Designation & Department Institute / University: Address	:	RUSHI SAHU 03.03.1955 Male Principal Investigator Scientist-C, RSRS, Central Silk Board, Koraput – 764020, Odisha
	Name: Date of birth Sex Project Designation Designation & Department Institute / University: Address	:	SUNIL KUMAR MISRO 23.07.1965 Male Co-Investigator Scientist-C, RSRS, Central Silk Board, Koraput – 764020, Odisha
	Name: Date of birth Sex Project Designation Designation & Department Institute / University: Address	:	Dr. N. R. RAO 15.05.1956 Male Co-Investigator Scientist-C, RSRS, Central Silk Board, Koraput – 764020, Odisha
13.	No. of Projects being handled by each investigator at present: 1. Rushi Sahu 2. Sunil Ku Misro 3. Dr. N. R. Rao	:	**As PI** **As CI** Nil 02 01 02 Nil 02
14.	Proposed Research fellows [Detailed justification with work sharing is must]	:	Nil, NA

PART III: TECHNICAL DETAILS OF PROJECT

15.	Introduction	[The introduction shall include origin of the proposal; rationale behind the study supported by cited literature, hypothesis and key questions; the relevance and expected outcome of the proposed study; and the preliminary work done so far, if any.]
15.1	Definition of the Problem	Should be supported by cited literature, hypothecation, key questions, etc.

Mulberry (*Morus* sp.), the food plant of the silkworm (*Bombyx mori* L.) believed to have originated in the lower slopes of the Himalayas, is the native of China and India. Even today, there exists some thousands-year old, very big mulberry trees in the nature, which were discovered by the Chinese scientists in Xizang (Tibet) in the province of China. It grows well in many parts of the world as a fast growing deciduous tree. At present, mulberry trees are widely spread in Asia, Europe, Latin America and Africa and cultivated in more than 30 countries. The distribution of mulberry trees in different regions reflects particularly their adaptability to wide range of environmental conditions. The systematic position of mulberry in the plant kingdom is:

Phylum: Spermatophyta

Sub-Phylum: Angiospermae

Class: Dicotyledonae

Sub-Class: Archichlamydeae

Order: Urticales

Family: Moraceae

Genus: *Morus*

Species: *Morus alba*

The package of practices on high bush and tree type mulberry plantation has not been developed for the state of Odisha. As per the demand of the state, a study needed to be designed for the sustainable development of the mulberry sericulture activities in the region.

At Regional Sericultural Research Station Miransahib, Jammu Dr B.B. Bindroo *et al* studied on the mulberry tree production technology on different mulberry varieties, agronomical practices in the strategies implied for management of pests and diseases. During 1987, A.K.Tiku *et al* studied on the effect of training on the yield of mulberry and observed that there was no significant difference among the tall, semi- dwarf and dwarf plant varieties. However, the yields were significantly (1% level) higher than the Bush trained plants. During 2007, R. K. Fotedar *et al* studied on the effect of years, Plant density and Pruning on the leaf yield of mulberry under high cut type of plantation. The leaf yield with spacing 8' X 9' was found to be significantly superior to 8' x 12' and 12' x 12'. During 2007, R. K. Fotedar *et al* studied on the package of practices for mulberry cultivation under sub-tropical conditions and recommended exclusive package of practices for free growing trees.

Fotedar *et al* (1995) suggested 90 x 90 cm for bush, 180 x 180 cm for high bush and 270 x 270 cm for tree type plantation, which need to be tested in the north eastern region due to wide variation of soil characteristics, cultivation pattern, topography and agro-climatic conditions.

Mulberry being a deciduous tree it is suitable for tree / high bush plantation for fast growing multipurpose use, cropping characteristics and crown form at a convenient height to harvest and avoid grazing by animals (Rajanna and Dandin, 1997). Keeping this

in view, the good tree forming characters like fast growth, better stand structure, high branching, good crowned canopy coverage and medium to high yield varieties like S1301, S36, S523, Tr4, C776, S41, S30, Tr8, S799 etc, were recommended for tree type plantation.

Quality of tree or high bush mulberry is superior to that of low bush plantation; because, it develops the root system deep into soil and once established, the tree plantation can sustain during the prolonged dry period with out much effect on yield quantitatively and qualitatively too. Vinod Kumar & Benchamin (1989); Fotedar *et al* (1993-1995) have shown higher cocoon yield in high bush plantation than low (bottom) bush mulberry plantation. Sudradjat (1989), reported that although pruning at different height (20, 70, 120 cm) did not influence the quantity of leaves, pruning height of 70 and 120cm produced leaves containing more protein, calcium and phosphorous compared to those pruned at 20 cm above ground level.

15.2	**Origin of the proposal cum rationale of the study:** [This should clearly indicate what prompted to propose this project; and, how the investigators propose to reach their goals. This should be logical and supported by the connected work, relevant hypothesis, key questions, etc.]

The state of Odisha comprises vast area and unique topography on biodiversity. The technologies pertaining to mulberry varieties perfected at CSR & TI Berhampore (WB) might be slightly different for Odisha and stressed to develop technologies which are suitable for this region. As per the need of the sericulture farmers of the state of Odisha RSRS, Koraput has initiated this Project in its own farm to develop a package of practice as cattle menace is the main problem for maintenance of mulberry garden at farmers' level.

Therefore, an attempt has been taken to develop a package of practices on High Bush and Tree type mulberry plantation under rainfed condition of Odisha followed by studies on growth and yield parameters of the mulberry varieties.

15.3	Relevance to the current issues and expected outcome	[This should clearly indicate as to why this study is needed and what could be the outcome in terms of economic and qualitative output or contribution to the society?]

Mulberry is one of the most important components of sericulture industry and has a significant role in overall cocoon production. Odisha is a non traditional area on mulberry cultivation practiced mainly by the tribal populace. The cattle are released free to out side after harvest of their traditional crops which exposes the Mulberry plantation to cattle grazing; thus leading to lower productivity. Therefore, there is a need to develop a package of practices for high bush and tree Mulberry plantation for achieving higher survivality to make sericulture to find in roads in to the rural population

In view of the current status, undertaking of this project seems to be essential. This package of practices may prove a handy, low-cost technology than any other physiological, chemical or agronomical method/s, if any, developed to combat this problem.

15.4	Objectives	[The objectives must be in bullet form and unambiguous. This should be followed by a short paragraph indicating the methods to be followed for achieving each of the objectives and verifiable indicators of progress.]

► **To develop a package of practice for High Bush and Tree type mulberry plantation for sustainability of sericulture Industries.**

Mulberry sericulture is facing tough competition with many other traditional crops due to cattle menace, lack of suitable land in hills, acceptable package of mulberry cultivation in this region. High bush mulberry cultivation with optimum planting geometry will be an acceptable model for more income generation per unit area.

16.	REVIEW OF STATUS OF RESEARCH AND DEVELEMENT ON THE SUBJECT	[The review should restrict to relevant information which gives an insight into the current issue / problem or cues for solving the problem. Any relevant work on other organisms that can provide cues for solving the present problem should also be included.]
16.1	INTERNATIONAL STATUS	

16.2	NATIONAL STATUS	

AT THE INSTITUTE:

The package of practices on high bush and tree type mulberry plantation has not been developed   for the state of Odisha. As per the demand of the state a study needed to be designed for the sustainable development of the mulberry Sericulture activities in the region.

Krishnaswamy *et al* (1970); Dasgupta (1961); Bhuyan (1981) reported that the quality of mulberry leaf differ due to different cultivation practices. Tree mulberry leaves are richer in crude fiber and proper moisture content in comparison to the leaves of bush plantation (*Anonymous*, 1975). Choudhury *et al* (1991) reported that higher leaf yield and significant increase in soluble sugar and protein contents in leaves with increased crown height up to 40 cm above the ground height. Doss *et al* (2000) evaluated leaf yield quality and rearing performance of five mulberry varieties viz, C1726, C1730, C1729, S1708 and S1635 at the spacing of 45 x 45cm, 60 x 60 cm, 150 x 150 cm are improvement in leaf yield from closer spacing (60 x 60cm) than wider spacing. Bioassay results proved that wider spacing (150 x 150 cm) exhibits significantly better than closed spacing for larval weight and single cocoon weight. Low bush mulberry 10-15cm height plantation with different spacing *viz*, 15 x 45cm, (30 + 60cm) x 15 cm and (15 +75 cm) x 15 cm spacing are practiced in different locations to get quality leaf yield (Ghosh *et al* 1985-86; Kabir and Rao 1990; Roy *et al* 1996-97 and Rahman *et al* 1999).

The above results indicate a definite improvement in leaf yield at wider spacing which is reflected in better rearing performance of the silkworms. The project will generate information about appropriate planting geometry for better acceptability by the farmers on the basis of yield stability and improvement in mulberry leaf quality. Moreover, wider spacing will allow use tilling machines such as power tillers, country plough etc, so as to reduce the cost on manual laborers' and increase the profitability at farmers' level. The Technology thus developed will ensure good quality leaf production at reduced cost.

16.3	IMPORTANCE OF THE PROPOSED PROJECT IN THE CONTEXT OF CURRENT STATUS	Lack of suitable land in hills, limited sources of irrigation, cattle menace are three crucial factors, can be taken care for good yield through this project.

16.4	ANTICIPATED PRODUCTS, PROCESSES/TECHNOLOGY PACKAGES, INFORMATION OR OTHER OUTCOME FROM THE PROJECT AND THEIR EXPECTED UTILITY	This shall indicate the utilizable output and how it can utilize and its advantages there to.

- Finding out a suitable planting geometry of high bush mulberry plantation for long term large scale cultivation of mulberry to ensure better quality, sustained leaf production and to facilitate better mechanization.
- Tree type mulberry plantation maintained by the farmer through conventional methods in Odisha will be improved through scientific techniques for commercial exploitation.
- An appropriate planting geometry for dwarf mulberry farming has advantage of sustained good quality high leaf yield over the years and reducing maintenance cost and increasing quality leaf yield and cocoon production.

16.5	EXPERTISE AVAILABLE WITH PROPOSED INVESTIGATION GROUP / INSTITUTION ON THE SUBJECT OF THE PROJEECT	This should briefly indicate the capabilities of each of the associated investigators required in carrying out various activities of the proposed project.

This project includes the following work components and expertise available with the investigation group is given below:

a) Review of literature   - Rushi Sahu, S. K. Misro
b) Project preparation   - R. Sahu, S. K. Misro
c) Studies on growth and yield parameters - R. Sahu, S. K.Misro
d) Recording of disease incidence   - S. K. Misro
e) Pest incidence   - N.R. Rao
f) Physiological and biochemical studies - R. Sahu, S. K. Misro
g) Bioassay studies   - R. Sahu, N. R. Rao & S. K. Misro
h) Statistical analysis and designing   - R. Sahu, N. R. Rao & S. K. Misro
    Supporting help would also be available from Statistics section of the Institute

16.6   LIST OF FIVE EXPERTS IN INDIA IN THE PROPOSED SUBJECT AREA

Sl.No.	Name	Designation	Address
1	Dr. Santosh Ku Dash santoshdash64@yahoo.com (09439961487-Mob)	Professor Biosciences (Retd.)	Brajanagar 3rd line Extn., Berhampur- 760001, Dist: Ganjam, Odisha
2	Dr. Malaya Ku Misra malayakmisra@rediffmail.com (09861268613-Mob)	Professor Botany (Retd.)	Berhampur University, Bhanja Vihar, Dist:Ganjam, Odisha
3	Dr. T. Ch. Kara dr_tckara@rediffmail.com (09437656305-Mob)	Professor cum Principal,	F.M. Autonomous College, Balasore, Odisha
4	Dr. Bibhuti Bhushan Dash bibhuti_dash2001@yahoo.co.uk (09337125382-Mob)	Professor Soil Chemistry	Dept. of Soil Science & Agri. Chemistry, Collage of Agriculture OUAT, Bhubaneswar, Odisha
5	Dr M. Madhu madhupmd@gmail.com (08895036750-Mob)	Head of Centre	Central Soil & Water Conservation Research Institute (ICAR), Sunabeda, Odisha

17.	**WORK PLAN**		
17.1	Methodology		This should clearly indicate in detail the procedures to be followed in taking up the proposed study/work including the experimental design, analysis to be carried out, etc.

Selection of mulberry varieties S1635 & C1730 have been made basing on the leaf yield performance data obtained from AICEM Phase I & II and few multi-location trials conducted at this station. The project work is having five experiments. The plantation will be made with three different spacing *i.e.* 6'x6', 8'x8' & 10'x10'. The HYV saplings of 8–10 months old will be made available with 6 ft height x 5 cm girth for transplantation.

A total experimental area of 2.27 acre (290ft x 341ft) will be developed for raising tree plantation. A plot with plant spacing 10'x10' requires 48 no of plants (24 plants for experimental and 24 plants for boarder)
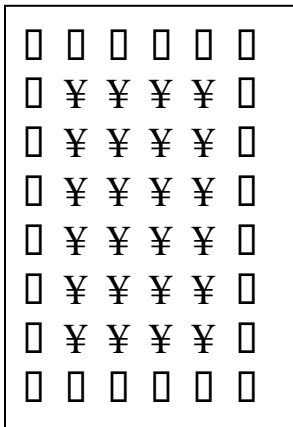
A plot with plant spacing 10'x10'. Experimental plants 24, Boarder plants 24, Total 48

A plot with plant spacing 8'x8' requires 50 no of plants (24 plants for experimental and 26 plants for boarder)

A plot with plant spacing 6'x6' plants for experimental and 32

A plot with plant spacing 8'x8'. Experimental plants 24, Boarder plant 26,

Total 50

A plot with plant spacing 6'x6'. Experimental plants 33, Boarder plant 32, Total 65

requires 65 no of plants (33 plants for boarder)

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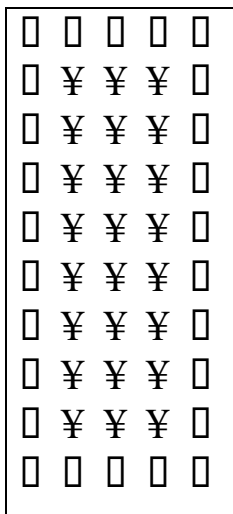
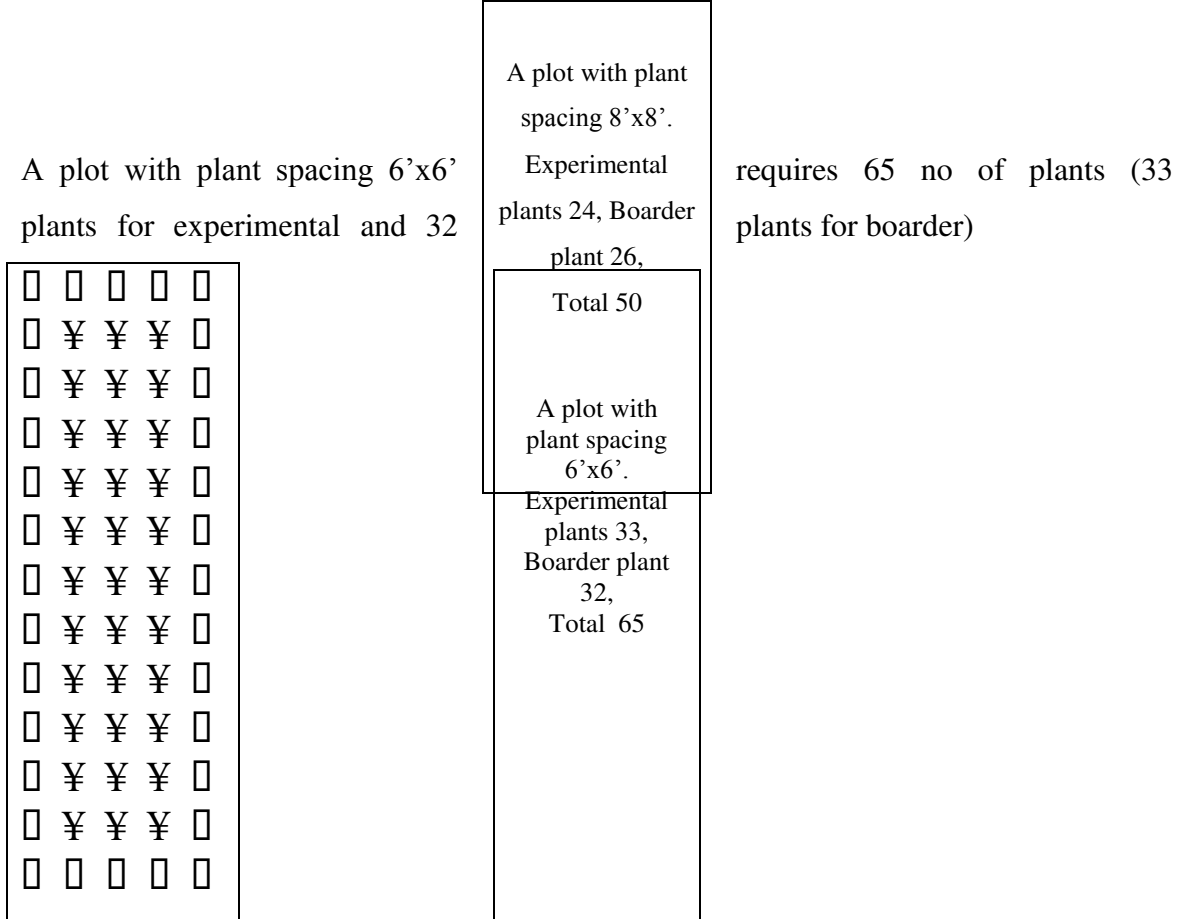During May-June, 2013 land preparation for experimental plots and design of the layout; Pit preparation of size 2'x2'; Application of FYM @ 10 mt /ha/yr in equal two split dose *i.e.* July & December (5 kg/ plant); Transplantation of mulberry sapling in experimental plots during onset of monsoon *i.e.* July2013; Application of chemical fertilizer NPK @ 75:50:50 kg/ha during August 2013 and 2nd dose Nitrogen 75 kg/ ha during February followed by pot watering be undertaken. The plantation will be left for establishment for two years with recommended package of practices. In 3rd year the plants will be trimmed at a crown height of five feet during onset of the monsoon *i.e.* July 2015. A total five experiments will be under taken *viz*; Growth and yield parameters of the mulberry varieties; Disease & pest incidence of mulberry varieties including bio-chemical parameters of mulberry varieties and bio-assay study in the 5th year as per details in the project work plan.

Project work:

E01: Study on growth and yield parameters of the mulberry varieties

Parameters to be studied

Leaf yield (kg/plant), length of longest shoot, total shoots length (cm), wt. of 100 leaves (moisture content (%), moisture retention capacity (%)

Length of longest shoot: It is the measurement (in cm) of length of longest shoot from point of origin to the shoot tip. This shall not include the crown left over after pruning. The data collection should be from 5 randomly selected plants from each replication on the 70th day after pruning.

Total shoot length: It is the measurement of length of all the branches including primary and secondary from point of origin to the shoot tip. This shall not include the crown left over after pruning. The data collection should be from 5 randomly selected plants from each replication on the 70th day after pruning. The unit of the length is in centimeter (cm).

Leaf moisture (%) & Moisture retention capacity (%):

Harvest the leaves below the largest glossy leaf from one healthy primary shoot excluding the deformed and damaged leaves if any on a day subsequent to irrigation or rain fall. Record the fresh weight 100 leaves immediately in the filed. Preserve the leaves kept loosely in the cloth bundles duly numbered in a leaf preserved chamber. Record the weight after 6 hours after plucking the leaf. Dry the leaves in hot air oven at 80 ^{O}C for 48 hours with the air vents open. Take the final weight and calculate the moisture percentage as at the time of plucking and after 6 hours. Moisture (%) = [(Initial weight of the leaf - dry weight) / initial weight of the leaf] X 100.

Moisture retention capacity (%):=

[(Initial weight of the leaf - dry weight) / dry weight] X 100.

Leaf yield: Strip the entire leaves from the harvested shoots and weight (in kg/plant) in 2 harvest *i.e*. Aug-Sept & Feb-March.

E02: Study on disease incidence of the mulberry varieties:

Parameters involved are the Percentage Disease Index (PDI) of the major diseases viz., Bacterial Leaf Spot; Myrothecium Leaf Spot; Pseudocercospora Leaf Spot and powdery mildew. Data to be collected from five randomly selected plants from each variety in every replication/ block. Counting of the number of leaf spots per leaf from the longest shoots of each plant and to calculate the average number of spots per shoot from which finally the graded estimation of the diseases are to be made as follows:

Leaf spot Disease	Leaf Rust Disease	Mildew Disease

Avg. No. of Spots / leaf	Grade	Intensity
< 4	1	Resistance
5 - 9	2	Resistance
14 – 19	3	Moderate
20 – 26	4	Susceptible
>27	5	Susceptible

Avg. No. of Spots / leaf	Grade	Intensity
< 10	1	Resistance
11 - 20	2	Resistance
21 – 30	3	Moderate
31 – 40	4	Susceptible
>41	5	Susceptible

The PDI to be calculated as follows:

$$\text{* PDI (i. e. Percentage Disease Index)} = \frac{\text{Sum of numeric Grades X 100}}{\text{Total number of plants x Maximum Grade}}$$

E03: Study on pest incidence of the mulberry varieties

Parameters to be studied: Population of Thrips, Population of white fly, Tukra and Bihar hairy caterpillar.

1. **Incidence of Thrips:** The population of thrips [*Pseudodendrothrips mori* Niwa] is to be recorded from 10 randomly selected plants/ replications / varieties. Selected the severely infested branch from each plant and count the number of thrips present on 4th to 6th leaves. Take the average of the four leaves and that shall be the mean thrips population per leaf. The economic Threshold Level of thrips population is 20/leaf.

2. **Incidence of Mealy Bug/Tukra:** The mealy bug [*Maconellicoccus hirsutus* Green] causes the disease called Tukra. To record the tukra infestation, 10 plants shall be selected randomly from each replication. Total number of primary shoots? Plant with the shoot tip affected by tukra is to be counted to estimate the

percentage of infestation (PI) as (Number of shoots infected in the plant / Total number of shoots in the plant) x 100. Grading may be made as follows:

Average number of shoots / plant (average of 10 plants)	Percent shoots tips infected	Grade
	20 or less	1
	30	2
	40	3
	50	4
	60 & above	5

Calculating PDI using the formula given below:

$$* \text{PDI (Percentage Damage Index)} = \frac{\text{Sum of numeric Grades } \times \ 100}{\text{Total numbers of plants } \times \text{ Maximum Grade}}$$

3. Incidence of Whitefly: The white fly [*Dialeuropora decempuncte* Quittances & Baker] causes serious crop loss in Odisha and north eastern parts of India. A few other species were also reported. White fly population per plant shall be assessed by recording the populations of adult fly, early and late nymphs. These three stages will give total populations, which can be estimated from top, middle and bottom leaves of each shoot. Counting the number of flies/nymphs present in top two leaves each at the top, middle and bottom positions of the shoot, the total populations per shoot can be counted from 5 plants from each replication. The percentage infestation (PI) shall be assessed by counting the number of leaves infested in 10 randomly selected plants from each replication and following the formula, (Total number of number of leaves infested in each shoot / Total number of leaves in the shoots) X 100. Grading and PDI can be calculated as in the case of Tukra infestation given above.

4. Incidence of Bihar Hairy Caterpillar:

E04: Study of Biochemical parameters of the mulberry varieties

Parameters to be studied

Chlorophyll-a, chlorophyll-b, total chlorophyll, total soluble sugar and total soluble protein

E05: Bioassay study

Parameters to be studied: Larval duration, ERR% by Number and Weight, Yield /100 dfls., Single cocoon wt, single shell wt, Silk ratio

CSR2 x CSR4 shall be used for conducting bioassay to assess the leaf quality. Rearing shall be carried out in Spring & Autumn during the final year of the evaluation Programme. There shall be 4 replications in each treatment and two dfls shall be brushed in each replication and 500 larvae shall be retained after third moult. And reared following standard practices. The following data items shall be recorded.

a. **Larval duration:** In days and hours
b. **No of cocoon harvested (Out of 500 larvae retained)**
c. **Weight of cocoon harvested in kilogram (Out of 500 larvae retained)**
d. **Single cocoon Weight in grams:** Average of 20 randomly picked cocoons individually (10 male & 10 female)

e. **Single Shell weight in grams:** Average of 20 randomly picked cocoons individually (10 male & 10 female)
f. **Silk ratio:** The ratio of silk is calculated [Single cocoon weight/Single Shell weight X 100]
g. **Yield / 100 dfls:**
h. **ERR% by No. and Wt.:**

Statistical Analysis – Data will be statistically analyzed as per design of the experiment (**S**imple **L**attice **D**esign).

| 17.2 | ORGANISATION OF WORK ELEMENTS | [This shall contain only the organizational aspect such as the work distribution among the scientists/institutions, out sourcing if any, etc. |

Sl. No.	NAME	DESIGNA-TION	TIME TO BE SPENT [%]	WORK TO BE DONE
1.	Rushi Sahu, Principal Investigator	Scientist- C	60	E01: Study on growth and yield parameters of the mulberry varieties
2.	S. K. Misro, Co-Investigator	Scientist- C	30	E02: Study on disease incidence of the mulberry varieties E04: Study of Biochemical parameters of the mulberry varieties
3.	Dr. N. R. Rao, Co-Investigator	Scientist- C	10	E03: Study on pest incidence of the mulberry varieties E05: Bioassay study

| 17.3 | PROPRIETARY / PATENTED ITEMS, IF ANY, EXPECTED TO BE USED FOR THIS PROJECT | No |

| 17.4 | SUGGESTED PLAN OF ACTION FOR UTILIZATION OF THE EXPECTED OUTCOME FROM THE PROJECT | [Give a brief plan of action to utilize the out come assuming that the project is successful] |

Immediately after completion of this project, the package of practices on high bush tree type plantation *viz;* spacing & variety suitable to the agro climatic condition of Odisha for sustainable development of sericulture to meet the demand of the state will be recommended for dissemination from research station to the farmers' field.

17.5: TIME SCHEDULE OF ACTIVITIES GIVING MILESTONES

Expt. Code	Milestone	Expected Date of		Expected out come / visible / measurable indicators
		Starting	Closing	
	Sapling raising	Nov.' 2012	June 2013	Establishment of Tree plantation
	Transplantation of saplings	June 2013	July 2013	

	Establishment of Tree plantation	July 2013	June 2015	
E01	**Study on growth and yield parameters of the mulberry varieties** Leaf yield (kg/plant), length of longest shoot, total shoots length (cm), wt. of 100 leaves (moisture content (%), moisture retention capacity (%)	June 2015	April 2017	Suitable mulberry variety and spacing with good growth rate and leaf yield will be identified.
EO2	**Study on disease incidence of the mulberry varieties** The percentage Disease Index (PDI) of the major diseases viz., Bacterial Leaf Spot, Myrothecium Leaf Spot, Pseudocercospora Leaf Spot and powdery mildew	June 2015	June 2017	Minimize the disease incidence and getting optimum leaf yield
EO3	**Study on pest incidence of the mulberry varieties** Population of thrips, Population of white fly, tukra and Bihar hairy caterpillar.	June 2015	June 2017	Minimize the pest incidence and getting optimum leaf yield
EO4	**Study of Biochemical parameters of the mulberry varieties** Chlorophyll-a, chlorophyll-b, total chlorophyll, total soluble sugar and total soluble protein	Aug 2016	July 2017	Physio-biochemical Status of the tree mulberry will be worked out.
E05:	**Bioassay study** Larval duration, ERR% by No. and Wt., Yield /100 dfls., Single cocoon wt, single shell wt, Silk ratio	July 2016	April 2017	Suitability of the Mulberry tree viz; variety & spacing for silkworm rearing will be tested
	Compilation & Final Report preparation	April 2017	May 2017	To find out the suitable type of tree plantation

17.6. Project Implementing Agency / Agencies

Name of the Agency	Address of the Agency	Proposed Research Aspects	Proposed Amount	Cost Sharing %
Central Silk Board	Central Silk Board Ministry of Textiles (Government of India) BTM Layout, Madivala Bangalore – 560 068	Develop a suitable package of practices for tree plantation	Rs. 0.75 lakh	NA
Total:			Rs. 0.75 lakh	

PART IV: BUDGET PARTICULARS

18. **BUDGET (in Rupees):** Rs.0.75 lakh

[In case of multi-institutional projects, the budget details should be provided separately for each of the institute]

A. Non-Recurring (e.g. equipments, accessories, etc.) [Rupees in Lakh]:

Sl.No.	Item	1st Yr	2nd Yr	3rd Yr	4th Yr	5th Yr	Total
1	Electrical conductivity meter	--		-			--
2	Spectrophotometer	--		-			--
	Sub-total A:	**--**					**--**

B. Recurring:
B1. Manpower: -

Sl. No.	Position	Nos.	Consolidated Emoluments	1st Yr	2nd Yr	3rd Yr	4th Yr	5th Yr	Total
	JRF/SRF/RA	Nil	NA	-	-	-		-	-
	HRA	NA	NA	-	-	-		-	-
	CCA	NA	NA	-	-	-		-	-
	Sub-total B1:	-	-	-	-	-		-	-

B2. Consumables:

Sl. No.	Item	1st Yr	2nd Yr	3rd Yr	4th Yr	5th Yr	Total
1.	Stationeries / Office Contingencies.	0.01	0.01	0.01	0.01	0.01	0.05
2.	Research Operations [Chemicals, Glass Wares Apparatus, Livestock Etc.	0.10	0.10	0.10	0.10	0.10	0.50
3.							
	Sub-total B2:	**0.11**	**0.11**	**0.11**	**0.11**	**0.11**	**0.55**

Other Items:

Sl.No.	Item	1st Yr	2nd Yr	3rd Yr	4th Yr	5th Yr	Total
B3	Travel	-	-	-	--	--	--
B4	Contingency	-	-	-	0.10	0.10	0.20
B5	Overhead charges						
	Sub-total (B1+B2+B3+B4+B5):						**0.75**

PART V: EXISTING FACILITIES

19. AVAILABLE EQUIPMENT AND ACCESSORIES TO BE UTILIZED FOR THE PROJECT:

[Should be provided separately for each of the Institution]

Sl.No.	Name of the Equipment / Accessory	Required or not	Make	Model	Funding Agency	Year of Procurement
1.	WORKSHOP FACILITIES	-				
2.	WATER & ELECTRICITY	✓				
3.	STAND-BY POWER SUPPLY	✓				
4.	LABORATORY SPACE & FURNITURE	✓				
5.	AIR CONDITION ROOM FOR EQUIP	-				
6.	TELECOMMUNICATION	-				
7.	TRANSPORTATION	-				
8.	ADMIN. & SECRETARIAL SUPPORT	✓				
9.	LIBRARY FACILITIES	✓				
10.	COMPUTATIONAL FACILITIES	✓				
11.	REARING / GLASS HOUSE	✓				
12.	MULBERRY GARDEN	✓				
13.	REARING EQUIPMENT	✓				
14.	LAND	✓				
15.	LABOUR	✓				
16	SPECTROPHOTOMETER	✓				
	HOT AIR OVEN	✓				
16.	ANY OTHER					

PART VII: BIODATA OF PROJECT COORDINATOR / PRINCIPAL INVESTIGATOR / CO-INVESTIGATOR (S)

PRINCIPAL INVESTIGATOR

1. Full Name (in Block letters) : **RUSHI SAHU**
2. Designation : Scientist- C
3. Department/Institute/University : Moriculture section
4. Address for Communication : Regional Sericultural Research Station,
   Central silk Board, P.B.No:9, Koraput – 764020
   Odisha
   E mail: rushisahu6@gmail.com
   Mobil no: 09438543887
5. Date of birth : 03.03.1955
6. Sex : Male
7. Education (Post Graduation onwards & Professional Career):

Name of the university	Degree passed	Year of Passing	Subjects taken with specialization	Class / Division
Berhampur University	M.Sc.,	1983	BOTANY Plant Physiology & Bio-Chemistry	1st Division

8. Awards: [Not required for in-house personnel]

Year	Award	Agency	Purpose	Nature

9. Positions Held / Research Experience in various institutions:
   [Not required for in-house personnel]

Employer	Designation of the post held	Date of Joining	Date of leaving

10. Members / Fellowships:
    [Not required for in-house personnel]
11. Patents:
    [Not required for in-house personnel]
12. Publications (Numbers only):
    Books : nil
    Research Papers, Reports : 06
    General articles : 04
13. Project(s) submitted/being pursued/ carried out by Investigator:

Sl.No.	Title of the Project	Funding Agency	Duration From	To	No. of Scientists/ Associates working under the project	Total approved cost of the project

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1	PPS-3435: Studies on micro nutrients for sustained high productivity of quality mulberry in Eastern and |North eastern India	CSB	Jan 2010	Mar 2013	01	
2	AICEM-phase III	CSB	April 2011	Mar 2015	01	

Highlights of outcome / progress of the project(s) handled during the past 10 years their outcome and utilization (in 200 words) - N.A

PART VII: BIODATA OF PROJECT COORDINATOR / PRINCIPAL INVESTIGATOR / CO-INVESTIGATOR (S)
CO-INVESTIGATOR
1. Full Name (in Block letters)   :SUNIL KUMAR MISRO
2. Designation   Scientist- C
3. Department/Institute/University   Moriculture section
4. Address for Communication   Regional Sericultural Research Station,
                                        Central silk Board, P.B.No:9, Koraput – 764020
                                        Odisha
                                        Email:misro23@gmail.com
                                        Mobile: 09437204142
5. Date of birth   23.07.1965
6. Sex   Male
7. Education (Post Graduation onwards & Professional Career):

Name of the university	Degree passed	Year of Passing	Subjects taken with specialization	Class / Division
Andhra university Vishakhapatnam	M. Sc	1987	Zoology (Spl – Animal Physiology & Biochemistry)	1st Division

8.Awards: [Not required for in-house personnel]

Year	Award	Agency	Purpose	Nature

9. Positions Held / Research Experience in various institutions:
   [Not required for in-house personnel]

Employer	Designation of the post held	Date of Joining	Date of leaving

10. Members / Fellowships: [Not required for in-house personnel]

11. Patents: [Not required for in-house personnel]

12. Publications (Numbers only):
       Books   :   nil
       Research Papers, Reports   :   05
       General articles   :   nil

13. Project(s) submitted/being pursued/ carried out by Investigator:

Sl.No.	Title of the Project	Funding Agency	Duration From	To	No. of Scientists/ Associates working under the project	Total approved cost of the project
1	CSS -2107: Development of forecasting and forewarning system of Mulberry	CSB	Oct 2009 –	Mar 2012 Cont..	01	
2	B-KPT(P)-17:Assessment of fertility status of mulberry growing soils in selected Seri - Villages of Koraput for appropriate fertilizer management	CSB	Jan 2012	Dec 2013	01	0.053 Lak

Highlights of outcome / progress of the project(s) handled during the past 10 years their outcome and utilization (in 200 words) - N.A

PART VII: BIODATA OF PROJECT COORDINATOR / PRINCIPAL INVESTIGATOR / CO-INVESTIGATOR (S)

CO-INVESTIGATOR

1. Full Name (in Block letters) : Dr. N. Rajeswar Rao
2. Designation : Scientist- C
3. Department/Institute/University : Sericulture section
4. Address for Communication : Regional Sericultural Research Station, Central silk Board, P.B.No:9, Koraput – 764020 Odisha
   Email: drnrrao1956@gmail.com
   Mobil: 0939240452
5. Date of birth : 15.05.1956
6. Sex : Male
7. Education (Post Graduation onwards & Professional Career):

Name of the university	Degree passed	Year of Passing	Subjects taken with specialization	Class / Division
Andhra university Vishakhapatnam	M.Sc	1984	Zoology (Spl – Endocrinology	1st Division
Andhra university Vishakhapatnam	Ph.D	1993	Studies on Molluscs with special reference to Wedge clam *Donax cuneatas* L.	

8.Awards: [Not required for in-house personnel]

Year	Award	Agency	Purpose	Nature

9. Positions Held / Research Experience in various institutions:
   [Not required for in-house personnel]

Employer	Designation of the post held	Date of Joining	Date of leaving

10. Members / Fellowships: [Not required for in-house personnel]
11. Patents: [Not required for in-house personnel]
12. Publications (Numbers only):
   Books : nil
   Research Papers, Reports : 06
   General articles : 02
13. Project(s) submitted/being pursued/ carried out by Investigator:

Sl.	Title of the Project	Funding	Duration	No. of Scientists/	Total

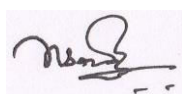| No.		Agency	From	To	Associates working under the project	approved cost of the project
1	PRE - 3345: Development of weather based forecasting models for major pests of mulberry in Koraput, Odisha.	CSB	Apr 2009	Dec 2015	01	
2	BMO(P)-003- Institute village linkage programme (IVLP)	CSB	2010	2013	01	

Highlights of outcome / progress of the project(s) handled during the past 10 years their outcome and utilization (in 200 words) - N.A
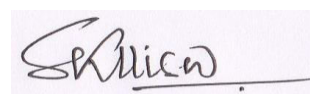
PART VIII: DECLARATION / CERTIFICATION

It is certified that

a. The research work proposed in the project does not in any way duplicate the work already done or being carried out elsewhere on the subject

b. The same project has not been submitted to any other agencies for financial support

c. The emoluments for the manpower proposed are those admissible to persons of corresponding status employed in the Institute/ University or as per the Ministry of Science & Technology guidelines (Annexure-III).

d. Necessary provision for the project will be made in the Institute in anticipation of the sanction of the scheme.

e. If the project involves the utilization of genetically engineered organism, it is agreed that we will ensure that an application will be submitted through our institutional bio-safety committee and we will declare that while conducting experiments, the bio-safety guidelines of the Department of Biotechnology would be followed *in toto*.

f. If the project involves field trials / experiments / exchange of specimens etc. we will ensure that ethical clearances would be taken from the concerned ethical committees / competent authorities and the same would be conveyed to the Department of Biotechnology before implementing the project.

g. It is agreed by us that any research outcome or intellectual property right(s) on the invention(s) arising out of the Project shall be taken in accordance with the instructions issued with the approval of the Ministry of Finance, Department of Expenditure, as contained in annexure-V.

h. We agree to accept the terms and conditions as enclosed in Annexure-IV. The same is signed and enclosed.

i. The institute agrees that the equipment, the basic facilities and such other administrative facilities as per terms and conditions of the grant will be extended to investigators through out the duration of the project.

j. The institute assumes to undertake the financial and other management responsibilities of the project.
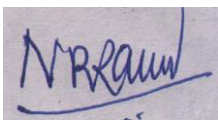
1. Signature of Project Coordinator
   [Applicable for Inter-institutional Projects   only]
Date:

2. Signature of Executive Authority of Institute with Seal
Date:

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3. Signature of Principal Investigator
Date: 29.05.2013

4. Signature of Co-Investigator
Date: 29.05.2013

6. Signature of Co-Investigator
Date:

5. Signature of Co-Investigator
Date: 29.05.2013

Reference:

Choudhary, P.C., Shukla, P., Ghosh, A., Malikarjuna, B. and Sengupta, K. 1991. Effect of spacing, crown height and method of pruning on mulberry leaf yield, quality and cocoon yield India. J.Seric.,30(1): 46-53.

Dahiphale, V.V., Sondge, V.D. and Raikhelkar, S.V. 1992. Foliage yield plant density relations and resource use in mulberry, J. Maharashtra Agric. Univ.,17(3): 364-367.

Fotedar, R.K., Dhar, S. and Mukherjee, P.1995. Effect of different pruning heights on the mulberry yield and silkworm rearing. India J. Seric., 24(2):105-109.

Fotedar, R.K., Dhar, A. Bindroo, B.B. 1995. Package of practices for mulberry cultivation under subtropical conditions of Jammu. Indian Silk, 34(3): 21-24.

Ghosh,A., Ambika, P.K. and Mishra, R.K. 1997.Effect of varieties, spacing and fertilizer doses on growth, yield and quality of mulberry. Indian J.Seric.,36(2): 105-109.

Kasiviswanathan, K., Krishnaswami, S.and Choudhary, P.C.,1979. Long term studies on variety, spacing and nitrogen fertilization for the improvement of yield potential for mulberry. Indian J.Seric., 8(2): 23-29.

Khajuria, H.N. and Sharma, R. 1998. Effect of spacing and pruning height on growth and yield of mulberry. Indian J.Seric. 6(1 &2): 11-15.

Tikader, A., Raychoudhury, S., Mishra, A.K. and Das, B.C. 1993. Foliage yield of different varieties of mulberry (Morus sp.) grown at two spacings in hills of West Bengal. Indian J.Agric.Sci., 63(1): 36-37.

Tiku, A.K., Bindroo, B.B., Pandit, R.K. and Trag, A.R. 1987. Feasibility of adopting bush cultivation of mulberry in Kashmir. Indian Silk, 26(1): 17-18.

Tiku, A.K., Bindroo, B.B. and Pandit, R.K. 1989. Effect of training on the yield of mulberry Indian J. Seric., 28(2): 191-193.

Studies on high bush and tree type mulberry plantation under rainfed condition of Odisha - the field layout (Page 1/2)

Block-I

S1635 10'x10'	S1635 8'x8'	C1730 6'x6'	C1730 8'x8'	C1730 10'x10'	S1635 6'x6'
60'	40'	30'	40'	60'	30'

80' / 7'

Block-II

S1635 8'x8'	S1635 6'x6'	C1730 8'x8'	C1730 10'x10'	C1730 6'x6'	S1635 10'x10'
40'	30'	40'	60'	30'	60'

80' / 7'

Block-III

C1730 6'x6'	C1730 8'x8'	C1730 10'x10'	S1635 6'x6'	S1635 10'x10'	S1635 8'x8'
30'	40'	60'	30'	60'	40'

80' / 7'

Block-IV

C1730 10'x10'	C1730 6'x6'	S1635 8'x8'	S1635 10'x10'	S1635 6'x6'	C1730 8'x8'
60'	6' 30' 6'	40' 6'	60' 6'	30' 6'	40'

80'

341'

290'

A plot with plant spacing 10'x10'. Experimental plant 24, Border plant 24, total 48

80' / 60'

A plot with plant spacing 8'x8'. Experimental plant 24, Border plant 26, total 50

80' / 40'

A plot with plant spacing 6'x6'. Experimental plant 33, Border plant 32, total 65

78' / 30'

1

Block-I · **Block-II** · **Block-III** · **Block-IV**

80' · 7' · 80' · 7' · 80' · 7' · 80'

341'

290'

A plot with plant spacing 10'x10'. Experimental plant 24, Border plant 24, total 48 — 60' × 80'

A plot with plant spacing 8'x8'. Experimental plant 24, Border plant 26, total 50 — 40' × 80'

A plot with plant spacing 6'x6'. Experimental plant 33, Border plant 32, total 65 — 30' × 78'

Prepared by
Nirvan Das

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