Technology Descriptors in Muga and Eri culture

Central Muga Eri Research & Training Institute

(An ISO 9001: 2015 Certified Institute)

Central Silk Board, Ministry of Textiles

Govt. of India, Lahdoigarh-785700, Assam, India

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Foreword

North Eastern Region (Longitude 77 to 90^0 E and Latitude 22 to 28.50^0 N) of India comprising Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura occupies an important position for its distinctive contribution to the countries faunal and floral wealth. The sericulture fauna of the region along with their host plants, forms a separate habitat called **"Seri-biodiversity"**. India's wild silkmoth biodiversity consists of 47 number of species described under fifteen genera and two subfamilies of the family Saturniidae, of which, 19 species are reported to be available in North East India alone. The region with tropical to temperate climate holds indomitable positions in the global sericultural map since all the four commercially exploited silkworms are available here. Though all the four varieties of silk viz., Mulberry, Oak Tasar, Eri and Muga are produced in North East region, the strength of the region lies mainly with muga and eri sericulture. The region shares above 99% eri and 99.8% muga raw silk production of the country. As a matter of fact, sericulture and silk weaving remained, since time immemorial, an inseparable part of the socio-economic activities of the rural folk of North East. It provides gainful occupation to more then three lakh families at present, where involvement of women folk is above 65% and involvement of weaker section of the society is 52.4% (ST- 40.90% and SC- 11.50%).

Keeping above in view, in order to provide R&D support in muga and eri silk industry in NE India, **Central Silk Board (CSB), Ministry of Textiles, Govt. of India** established **Central Muga Eri Research Station** at Titabar, Assam in 1972, which was later bifurcated into Regional Sericultural Research Station, Titabar for mulberry research and Regional Muga Research Station (shifted to Boko) during 1982 for exclusive research on muga. Again during 1987, CSB established a full fledged Research and Training Institute for muga and eri and christened as **Central Muga Research & Training Institute** at Lahdoigarh, Jorhat. It came into being as a full-fledged Research & Training Institute in 1999 and during the same year, it was re-

named as **Central Muga Eri Research & Training Institute** with a mandate to serve as the apex R&D institute for both muga and eri. At present, CMER&TI is functioning with three Regional Stations one in muga and two eri, namely, **Regional Muga Research Station, Boko (Assam)**, Regional **Eri Research Station, Mendipathar (Meghalya) and Regional Eri Research Station, Shadnagar (Andhra Pradesh).**

Over the last decades CMER&TI has developed numbers of technologies in pre and post cocoon sectors of muga and eri culture. These technologies were percolated to the field through various extension activities of both Central Silk Board and State Sericulture Department. Proper percolation to the field of all the technologies still has to get momentum. Different socio- economic factors play an important role for dissemination of technologies. Lack of a proper documentation of technologies is one of the factors hindering in dissemination to the filed. With an aim for proper dissemination and adoption of proven technologies among muga and eri farmers the present technology descriptor has been compiled. This will also help to develop more technologies in R&D sector for future researchers.

(Dr. B.K. Singh)
Director

Introduction

Muga culture is an important cottage industry of the Brahmaputra valley engaging families, which can earn their livelihood from it either directly or indirectly. The story of the origin and the growth of muga culture in the Assam valley are lost in the antiquity. About hundred years ago a European writer mentioned that "silk cultivation in Assam is capable of in definitive development provided that capital and enterprise were enlisted in the speculation; there is every hope of the trade being worked up in great perfection. Muga culture is considered to be endemic to North-East. The muga silkworm *Antheraea assamensis* (Helfer) still exists in the wild state. The silkworm is holometabolous i.e. it passes through complete metamorphosis from egg to adult. Rearing is conducted outdoor and the silkworms are exposed to fluctuating environmental conditions with profound impact on production and productivity during different seasons.

Eri silk is highest producing popular Vanya silk of India. The Brahmaputra valley of Assam and its adjoining foot hills is believed to be the original home of eri silkworm i.e. *Samia ricini* (Donovan). Eri silk has certain excellent textile properties and unique in many respects such as insulin properties in intake temperature, fineness, density, cross sectional shape, surface properties etc., which play important role for determining the end use of a fibre. It is mainly practiced in few districts of the neighbouring states mainly Arunachal Pradesh, Manipur, Meghalaya, Mizoram,Nagaland and Sikkim. Due to its immense scope in product diversification, byproduct management, adaptability, hardiness made eri culture a popular cottage based industry in India and spreading in different non-traditional states like Andhra Pradesh, Gujarat, Madhya Pradesh, Chhattisgarh, Tamil Nadu, Karnataka, Maharashtra, Uttaranchal, Uttar Pradesh, Jharkhand, Bihar, West Bengal and Orissa. Of late different diversified products have given a new dimension in eri culture. By-product management can generate additional income from eri culture. Besides, it will ensure considerable value addition to the product and additional employment generation. Both on-farm and off-farm sectors of the culture have potential to convert their wastes into useful by-products of commercial value.

R&D Support and Technologies Developed:

Since muga and eri silk production is primarily restricted to North-Eastern region mostly for domestic consumption, its uniqueness and potential are not well known outside the region. Both the culture has been surviving through ages based on traditional system. A few technological advancement made through research are gradually being absorbed. Stronger extension supports are required for full absorption of available technologies. However, many major and important areas of research could not be intensified primarily due to the lack of infrastructural facilities including expertise. Though some of the research projects have been conducted / concluded in institutes other than Central Silk Board, the outcomes are yet to reach the grass root level or remained as basic research.

Being agro-based, the muga and eri cottage industry was till recently remained in an unorganized form. The Central Silk Board played a pivotal role in shaping different sectors of the industry from a scattered, unorganized condition in to an integrated export oriented rural industry through R&D support. The technologies developed in the fields of pre and post cocoon sector covering host plant cultivation and maintenance, silkworm rearing, seed technology, pest and disease management and post cocoon technology have been compiled with a view to cater to the needs of the industry and also the users at the grass root level.

Muga culture

Sl.No.	Particulars	Description
1	**Name of the technology**	**Improved S3 & S6 morphotype of som, (*Persea bombycina*).**
2	Origin & background	Identified during 1994 at RMRS, Boko.
3	Details of the technology (with Advantage/ Disadvantage,Special precautions/care to be taken for adoption, Cost benefit ratio)	▸ S3 & S6 are most promising morphotypes of Som. ▸ Leaf shape: Lanceolate in S3 and Narrow Ovate in S6. ▸ Leaf size: Average length 7.8 x 1.0 cm in S3 and 6.4 x 1.8 in S6. ▸ Leaf yield: 18-20 MT per ha. ▸ Least susceptible to foliar dis eases. ▸ Highly palatable to muga silkworm.
4	Adoption level (Full/Partial/ Non)	Partial
5	Recommended areas/ location	All muga growing areas of NE India.
6	Scope for improvement	Mass multiplication through vegeta-tive propagation & micropropagation.

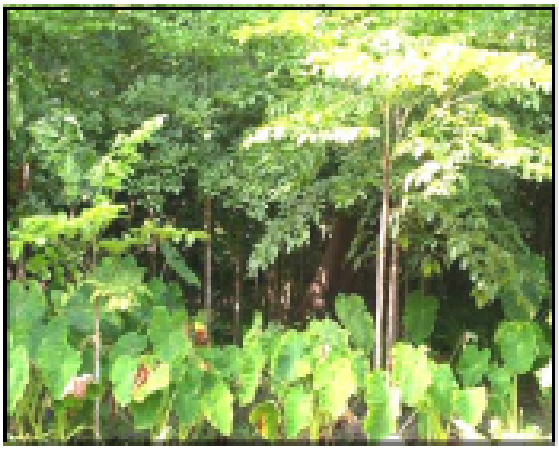
Leaf of S3 morphotype of Som

Leaf of S6 morphotype of Som

Improved plantation

Sl.No.	Particulars	Description
1	Name of the technology	**Intercropping in Som and Kesseru plantation**
2	Origin & background	Conducted a research project PPF 5840 Development of Muga and eri based intercropping system during 2005-09. During OFT, the result showed conformity with the institute findings.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	For enhancing the farm income, intercropping of Ginger, Turmeric and Colocasia as well as Chilli has been introduced in Som and Kesseru plantation. The intercrops grow well without affecting usual growth and leaf yield of host plant. An additional net income can be generated from intercropping.
4	Adoption level (Full/Partial/Non)	Partial
5	Recommended areas/ location	All muga and eri growing areas of India.
6	Scope for improvement	More intercrops may be added to this system for enhancement of income generation.

Intercropping of Ginger with Som



Intercropping of Colocasia with Kesseru

Sl.No.	Particulars	Description
1	**Name of the technology**	**Vegetative propagation technique of som**
2	Origin & background	Conducted a research project PIT 5842 Development of clonal propagation technique of production of quality planting stock of som, *Persea bombycina* (king Ex. Hoo F.) Cost On farm trial of single leaf and bud cuttings was done and technique is utilized for multiplication of desired varieties of Som.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	Different techniques like single leaf and bud cuttings, chip budding, veneer and cleft grafting etc. were tried for clonal propagation of Som plants and single leaf and bud cuttings technique was found best with 80% rooting and 62-83% survival. OFT of the technology was done and same is utilized for multiplication of plus tree.
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All muga and eri growing areas of India.
6	Scope for improvement	Technique may be further fine tuned to get more rooting and survival.

Single leaf and bud cuttings

Sl.No.	Particulars	Description
1	**Name of the technology**	**Organic manure based farming system for Muga silkworm food plant, Som (*Persea bombycina*, Kost).**
2	Origin & background	Conducted a research project PIB 5813 Development of organic farming system of muga host plant Som (*Persea bombycina* Kost) during 2002-2008 and on farm trial was conducted during 2008.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	In this technique incorporation of a popular organic manuring plant Dhaincha (*Sesbania rostrata*) with 5 MT FYM and 1 MT Vermicompost has been utilized for manuring of 1 hectare Som plantation. Adoption of this system registered leaf yield (16.83 MT/ha) of Som which is at par with recommended doses of inorganic fertilizer (N: P: K 150:50:50 kg/ha) without affecting quality of leaves. Growth of plant is slower in organic farming system but quality of soil and leaf biomass improved. This is also a cost effective technology with a cost benefit ratio of 1: 1.63.
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All muga growing areas of NE India.
	Scope for improvement	To incorporate other organic farming components.

Organic farming

Application of Vermicompost

Sl.No.	Particulars	Description
1	**Name of the technology**	**Ready reckoner for NPK fertilizer application in Som plantation.**
2	Origin & background	Conducted a research project PPS 5839: Characterization of soils in different Muga rowing areas of N.E. region in relation to productivity during 2005-10. Multilocational trial has been conducted showing conformity of the result.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	Developed a model for fertilizer recommendation for Muga host plant Som cultivation based on soil test value. Instead of blanket application of NPK it can be applied based of soil test value to get potential leaf yield.
4	Adoption level (Full/Partial/ Non)	Partial
5	Recommended areas/ location	All muga growing areas of NE India.
6	Scope for improvement	The reckoner may be developed for eri food plant also.

Nitrogenous fertilizer recommendation chart for Som

Soil test value N (kg/ha)	Targeted yield (MT/ha/yr)				
	16 (75)	17 (80)	18 (85)	19 (90)	20 (95)
	Fertilizer N (kg/ha/yr) required				
100	181	217	263	329	436
150	162	197	243	309	417
200	142	178	224	406	398
250	123	158	204	270	378
300	103	138	185	250	359
350	83	119	165	231	339
400	64	99			

Phosphatic fertilizer recommendation chart for Som

Soil test value P_2O_5 (kg/ha)	Targeted yield (MT/ha/yr)				
	15 (75)	16 (80)	17.5 (85)	18.5 (90)	19.5 (95)
	Fertilizer P_2O_5 (kg/ha/yr) required				
25.0	99	125	159	207	288
45.0	67	94	128	175	256
65.0	36	62	96	143	224
85.0	04	30	64	111	193
105.0	-	-	32	80	161
125.0	-	-	-	16	97

Nitrogenous fertilizer recommendation chart for Som

Soil test value K_2O (kg/ha)	Targeted yield (MT/ha/yr)				
	15 (75)	16 (80)	17.5 (85)	18.5 (90)	19.5 (95)
	Fertilizer K_2O (kg/ha/yr) required				
50	93	116	146	189	262
75	66	90	120	162	236
100	40	63	93	136	209
125	13	37	67	110	183
150	-	11	41	83	156
200	-	-	-	30	104

Values in the parenthesis indicate leaf yield in percentage of theoretical maximum

Sl.No.	Particulars	Description
1	**Name of the technology**	**Control of stem borer of som.**
2	Origin & background	Conducted a research project PRP 5831: Studies and control of Stem borer, *Zeuzera indica*, a pest of muga food plants, Som and Soalu during 2004-07.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	Stem borer (*Zeuzera indica*) causes 60 % damage in Som plants during Sept.–Oct. season. It can be controlled by mechanical means (mud plastering of the openings and wrapping with polythene sheet) up to 68%, biological (*Trichoderma species*) and plant extract spray (Neem, Dhatura, Titabahak and Castor) up to 80% and chemical method (Plugging of borer holes with cotton swab soaked in 1.5% Nuvan) up to 95%. The BCR is 1: 1. 46.6.
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All muga growing areas of India.
6	Scope for improvement	The technique may be percolated to field.

Stem borer infestation of Som

Stem borer (Zeuzera *indica*)

Sl.No.	Particulars	Description
1	**Name of the technology**	**Control of leaf blight disease of Soalu.**
2	Origin & background	Conducted a research project PRP 5841: Studies on leaf blight disease of muga food plant, *Litsea monopetela* (Roxb.) Pers. (Soalu) during 2005-08.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	Causal organism of leaf blight has been identified as *Coletrotricum gloeosporioides*. Occurrence of disease was maximum during July to December Plant extract of *Bougainvillea spectabilis results* 86.3% reduction in disease severity. Cost benefit ratio was 1: 3.48 in B. *spectabilis* against 1:2.77 in control. The product is named as Phytoblighton and applied for patent.
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All soalu growing areas of NE India utilized for muga silkworm rearing.
6	Scope for improvement	The technique may be percolated to field.

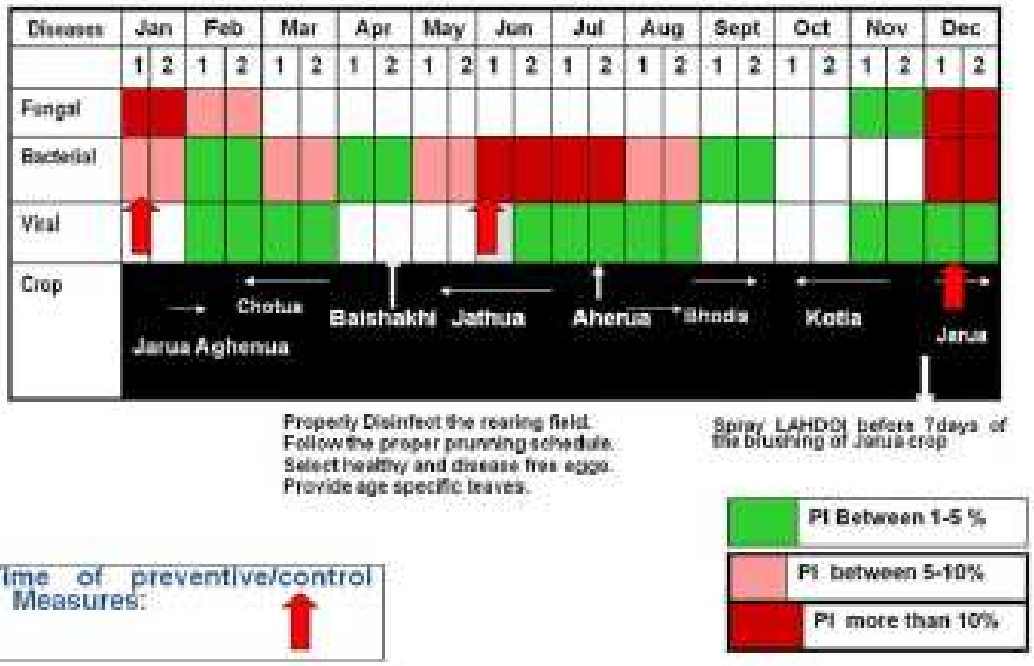
Blight Infected twig

Phytoblighton

Sl.No.	Particulars	Description
1	**Name of the technology**	**Forecasting and Forewarning of Pest & Diseases of Muga Host Plants and Silkworms.**
2	Origin & background	Conducted a research project PRE 5852: Forecasting and Forewarning of Pest & Diseases of Muga Host Plants and Silkworm during 2011-14. Survey was done in Jorhat, Sivasagar, Dibrugarh and Golaghat districts covering 20 villages and 200 muga gardens for collection of data on pest and disease incidence of som & soalu.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	Survey revealed that occurrence of foliar diseases of Som like leaf spot was the highest during August (5-8 PDI), red rust during May (>5 PDI), Anthracnose during August (8.8 PDI) and grey blight during July (9.2 PDI). In Soalu, brown blight was the highest during October (10.8 PDI) and grey blight during May (8.2PDI). Pest infestation in som like stem borer (11.2 %), leaf gall (8.0%), sucking pest (6.6 %) was maximum during August. In soalu, stem borer (17 %) , leaf minor (8 %) and leaf gall (6.5%) was max. during August. In Muga silkworm, Flacherie and Pebrine occurred through out the year and were max. (34-70% & 11-19 % respectively) during August. Muscardine disease was found in December- January season (18-30 %). Farmers are regularly informed about precautions to be taken for possible occurrence of disease and pests by regular SMS sending twice during month.

4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All soalu growing areas of NE India utilized for muga silkworm rearing.
6	Scope for improvement	Awareness programme to be organized time to time in disease and pests prone zones.

Forewarning calendar for disease of silkworm



Sl.No.	Particulars	Description
1	**Name of the technology**	**Biological control of uzifly pest of muga silkworm.**
2	Origin & background	Conducted a research project ARP-5830: Integrated management of uzi fly, a pest of muga silkworm during 2004-07. Biological control of uzi fly has been developed.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	Integrated management of uzi fly infestation has been proved to be very effective in muga culture. Biological control through the hyper-parasitoids of uzi fly, viz. E. *phillipinensis* and *Nesolynx thymus*, which have been recommended for controlling uzi fly which is a serious pest of muga silkworm. Though the technique minimize uzi population the continuous release of hyper-parasitoids in muga field is a cumbersome job. Further rearing inside net control the uzifly infestation.
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All muga growing areas of NE India.
6	Scope for improvement	The technique may be percolated to field.

Uzi infected larvae

Release of N.thymus in farmers field

Rearing inside nylon net cover

Sl.No.	Particulars	Description
1	**Name of the technology**	**Control of muscardine disease of muga silkworm.**
2	Origin & background	Conducted a research work for formulation of an anti-muscardine to control muscardine disease during 2007-08. A chemical formulation named "*Lahdoi*" was found effective against muscardine disease of muga silk worm. The formulation was applied for patenting vide No. IPR/4. 18. 12/ 070128/2008. BCR is calculated as 1: 1.6.9.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	Muscardine causes heavy loss (93-100%) of Jarua (December – January) muga seed crop. Pre and during rearing application of Lahdoi can prevent effectively occurrence of muscardine disease of muga silkworm.
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All muga growing areas of NE India.
6	Scope for improvement	The technique may be percolated to field.

Infected larvae

Lahdoi

Sl.No.	Particulars	Description
1	**Name of the technology**	**Long term preservation of Muga seed cocoons.**
2	Origin & background	Conducted a research project APS 5849 Studies on improvement of seed production of muga silkworm, *Antheraea assamensis* Helfer during 2009-12.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	Effect of long term preservation of Muga seed cocoons by double step preservation method on fecundity and hatching was studied and found that seed cocoons can be preserved up to 62 days in BOD incubator during winter and 42 days during summer without much affect on fecundity (162 against 190 in control during winter and 169 at 7.5 0C and 172 at 10 0C against 178 in control during summer) and hatching (65 % against 75 % during winter and 72% at 7.5 0C and 70 % at 10^0C against 82% in control during summer).
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All muga growing areas of NE India.
6	Scope for improvement	Available cold storages may be utilized for large scale preservation.

Sl.No.	Particulars	Description
1	Name of the technology	**Methoprene- a juvenile hormone analogue for enhancement of fecundity in muga silkworm.**
2	Origin & background	Conducted a research project SR/SO/AS-55/2007 Endocrine regulation of reproduction and enhancement of fecundity in the muga silkworm, *Antheraea assamensis* Helfer (DBT sponsored project collaborative with NEIST, Jorhat and NEHU, Shillong during 2009-11.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	Dissolve 100 mg methoprene in small quantity (1-2 ml) acetone in a screw cap tube and make up the volume to 10 ml. This may be taken as stock solution and keep in refrigerator till use.When the muga silkworms are just entering 5th instar, 0.1 ppm Methoprene is sprayed on the silkworm. For this, take 1 ml from the stock solution and added to 10 litres of clean water. Spray the solution on the muga silkworms with the help of a hand sprayer or knapsack sprayer. The muga silkworms should be drenched properly. 100 to 120 muga silkworms may be treated per litre of Methoprene solution. Advantages: 25-27 % enhancement of fecundity of treated mother moths over control.The effect is noticeable during Aherua and Bhadia crops of muga silkworm.Less emergence of crippled moths in treated samples compared to control, which is otherwise a very common problem during Aherua crop grainage.75-90 % hatching of eggs in treated ones compared to very low (below 45 %) to medium (50 %) hatching in the non treated eggs during summer crops.

4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All muga growing areas of NE India.
6	Scope for improvement	To identify more cost effective analogue to minimize the cost.

Methoprene and its application

Sl.No.	Particulars	Description
1	**Name of the technology**	**Box type mountage for muga silkworm**
2	Origin & background	A research work done at RMRS, Boko and a box type mountage was developed for spinning of muga worms. Further, same was developed bamboo box type mountage at CMER&TI, Lahdoigarh during 2002-2003.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	A box type mountage has been fabricated for cocooning of muga silkworm which require less man power (save 60% labour) and space (reduce 90% space) and produce superior quality cocoons. The BCR is calculated as 1: 1.50.
4	Adoption level (Full/Partial/ None)	Partial
5	Recommended areas/ location	All muga growing areas of NE India. The technology package may be transferred to the field for dissemination of improved rearing technique of muga silkworm under various development scheme like CDP, CPP etc.
6	Scope for improvement	Along with wooden structure plastic fabrication is being attempted for large scale production.

Bamboo box type mountage

Eri culture

Sl.No.	Particulars	Description
1	**Name of the technology**	**High yielding varieties of Castor.**
2	Origin & background	Conducted a research project PIP 001 Evaluation of suitable variety of castor during 1997-2000 and evaluated a variety NBR-1 out of 42 accessions of GPB with 12MT leaf yield per hectare. Further, conducted one more research project PIB 5848: Evaluation of superior genotype (s) of Castor *(R. communis* L) for eri silkworm rearing during 2008-10. Evaluated 2 (two) more productive castor genotype from 7 accessions of castor. These accessions were isolated from 72 castor accessions collected under NATP.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	The first evaluated variety of castor, NBR-1 showed 12 MT leaf yield per hectare. Latter on the high yielding castor, Acc-003 (named as NBR-2) showed 13.79 MT leaf yield per hectare, which is 37.90 % above benchmark i.e., 10 MT/ha/year and 14.92% than earlier record (12MT/ha/year) and Acc-004 (named as NBR-3) showed 13.38 MT leaf yield per hectare, which is 33.80 % above benchmark and 11.50% than earlier record. Multilocational trial conducted in for locations showed conformity with institute's result.
4	Adoption level (Full/Partial/None)	Full in potential eri growing areas.
5	Recommended areas/ location	All eri growing areas of India. .
6	Scope for improvement	To take action for more percolation to field.

NBR-1

NBR-2

NBR-3

Sl.No.	Particulars	Description
1	**Name of the technology**	**High yielding varieties of Kesseru.**
2	Origin & background	Conducted a research project PIE 5853 Collection, characterization, evaluation and conservation of perennial host plants for eri silkworm rearing during 2011-14. Identified 10 accessions of kesseru viz., HF 001, HF 002, HF 001, HF 003, HF 004, HF 005, HF 006, HF 007, HF 008, HF 009 and HF 010 and maintained in the germplasm bank along with *Ailanthus grandis* and *A. excelsa* GPB.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	Highest leaf biomass recorded in HF 008 showing potentiality of 27.57 MT leaf yield/ha/year followed by HF 005 showing potentiality of 26.72 MT leaf yield/ha/year. Thus, HF 008 showed 10.28% higher leaf yield than benchmark with improved package and 37.85% than benchmark of traditional practice. Similarly, HF 005 showed 6.68% higher leaf yield than benchmark with improved package and 33.60% than benchmark of traditional practice. Moreover, for the first time a leaf roller, Pyralid Lepidopteran pest has been recorded infesting kesseru (HF 002) with 100 % loss of foliage. A new pest of Brown Bug, Agonoscellis nubila Fab. (Hemiptera: Pentatomidae) on kesseru recorded during summer.

4	Adoption level (Full/Partial/ None)	The HF 008 and HF 005 are on popularization.
5	Recommended areas/ location	All eri growing areas of NE India.
6	Scope for improvement	Technique may be further fine tuned to get more rooting and survival.

HF 008

HF 005

Sl.No.	Particulars	Description
1	**Name of the technology**	**Cultivation technique of perennial castor.**
2	Origin & background	Conducted a research project PIB 6003 (A) Improvement of productivity of eri host plant during 2002-05 and PIB 6003 (B) Improvement of Castor in leaf yield & quality during 2000-05. Out of two projects application of NPK dose, spacing, pruning height and pruning season developed.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	For perennial castor cultivation application of NPK @ 120:40: 40 kg/ha along with 10 MT FYM/ha/year was recommended with a BCR of 1:1.22 (with labour cost) and 1.4.44 (excluding labour cost). Developed agronomical practices viz., spacing (1 x 1.5 m), and pruning technology (1 m height during March) for (perennial) biennial castor plantation. MLT on the findings showed conformity with research findings.
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All muga growing areas of NE India.
6	Scope for improvement	Attempt to be taken for more percolation of technology to field.

Perennial castor

Sl.No.	Particulars	Description
1	**Name of the technology**	**High yielding eri silkworm breed C2.**
2	Origin & background	Conducted a research project AIB 5847 Development of Eri silkworm Samia ricini (Donovan) breeds with higher fecundity and shell weight during 2006-10. Two breed C1 and C2 with higher shell weight were developed by hybridization between two potential parents Genung (SRI-018) X Borduar (SRI-001), C2 breed showing shell weight 0.47 + 0.05 g and fecundity 390.29 + 58.39. Extensive trial was conducted under hybrid authorization programme at DOS, CSB farm and farmers field during 2011-14.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	The C2 breed showed above 350 fecundity and shell weight above 0.50 g. However the breed susceptible to flacherie disease during summer season at high temperature (> 35oC) and high humidity (> 90 %).
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All muga growing areas of NE India.
6	Scope for improvement	Attempt to be taken for more percolation of C2 variety to field.

Egg laying moth

C2 Breed cocoon

Local race Cocoon

Sl.No.	Particulars	Description
1	**Name of the technology**	**Platform rearing technique of eri silkworm.**
2	Origin & background	A research project APS 6001 Improvement of eri silkworm crop production was conducted during 2000-2003. A new rearing device for eri silkworm rearing has been developed. This was further fine tuned in later part.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	The platform rearing device for Eri silkworm rearing is consists of 3 nos. platforms each of 1.0 m x 2.0 m size and made up of bamboo strips with sieve size 1sqcm. Platforms are placed in 3 tier in bamboo rack of size L 2.2 m x B 0.75 m x H 1.60 m. Two nos. of such racks can be placed in a room floor area 5.4 sq m. (1.2m x 4.5m). Maximum of 1200 eri silkworms at 5th instar can be reared in each platform to accommodate total 7200 silkworms by brushing 25- 30 dlfs of eri. The technology is found to be advantageous to accommodate almost double quantity of silkworms per unit against the traditional round bamboo try (1m dia. with capacity of 300 nos. 5th instar worms) rearing system. The technology included in technology demonstration as well as in scheme like CDP, SMV etc.
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All muga growing areas of NE India.
6	Scope for improvement	More percolation at farmer's field may be tried

Rearing on platform

Platform rearing device

Sl.No.	Particulars	Description
1	**Name of the technology**	**Improved wooden collapsible split type mountage**
2	Origin & background	A research project APS 6001 Improvement of eri silkworm crop production was conducted during 2000-2003. A bamboo split type mountage has been developed. This was further innovated to wooden collapsible split type mountage during 2014.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	To accommodate 400 worms the size of the mountage is to maintain 90 cm X 60 cm (length X breadth). Size of wooden bar to make the mountage is to maintain 3.5 x 3.5 cm. Size of wooden strip is to be maintained 1 cm thickness and 3.5 cm breadth, fitted in grooves of side bar and which can be easily pulled out for cocoon harvesting. Gap between two strips is to be maintained 3.5 cm. Backside of mountage is to be covered with netlon net. After placing the matured larva in the gaps the mountage has to cover with a paper. By pulling out the strips the cocoons can be harvested easily. From this mountage, 99.75% good cocoon can be harvested. Space requirement is negligible in comparison to traditional jail. Due to collapsible in nature harvesting takes very less time i.e., 3-4 minutes required to harvest 400 cocoons against 30-35 minutes of traditional jail. The bamboo strip type mountage can be utilized for brushing tray by removing the strips. In a 90 X 60 cm size montage 25 dfls of eri silkworm can be brushed and can be reared up to 2nd instar. Fur-

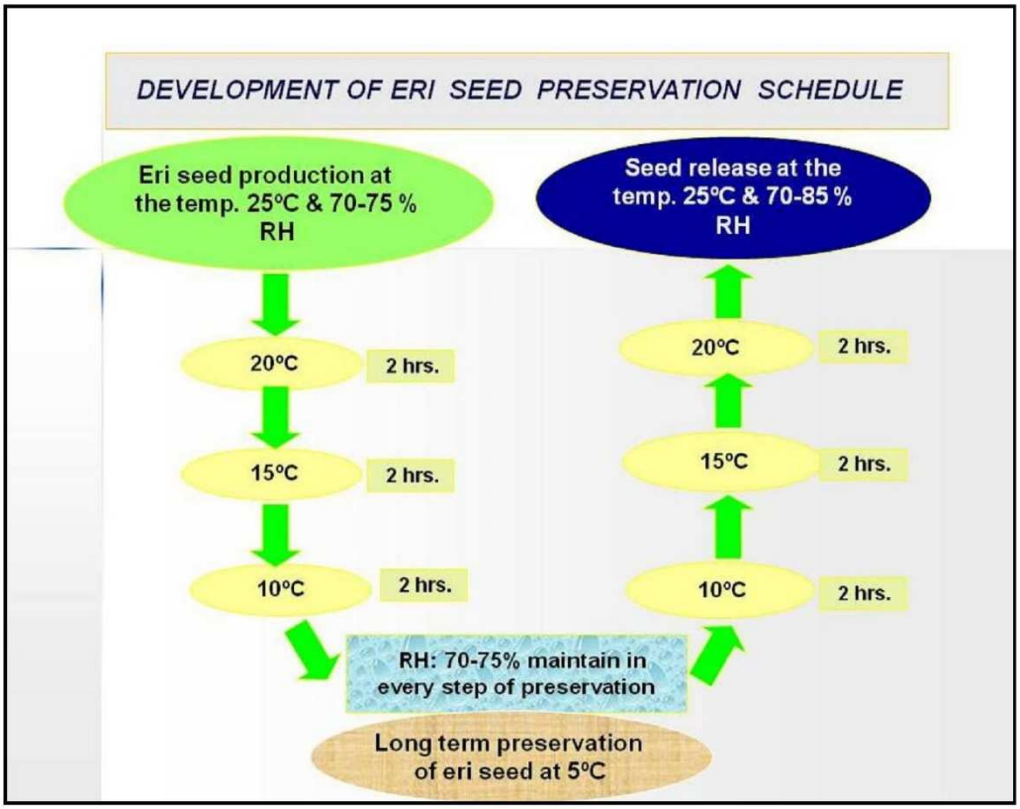
		ther, cocoons harvested from this mountage are more suitable for utilizing as seed cocoons as cocoons are formed in one layer getting sufficient aeration.
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All muga growing areas of NE India.
6	Scope for improvement	Instead of wooden strips treated bamboo mountage can be made strips may be attempt.

Improved mountage

Cocooning in improved mountage

Sl.No.	Particulars	Description
1	**Name of the technology**	**Long term preservation of eri egg.**
2	Origin & background	Conducted a research project APS 5859: Development of egg preservation technique of eri silkworm *Samia ricini* (Donovan).
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	For the experiment of eri seed preservation, different stages of eri silkworm embryo viz., 15, 17, 21, 22, 23, 24, 25, 27, 28 & 29 were isolated successfully and embryonic charts prepared. Eri embryonic stages: 15, was identified as longest stage and suitable for long term preservation. For eri seed preservation, five different age groups and stages viz. 12 hrs, 24 hrs, 36 hrs, 48 hrs, and 60 hrs old eggs were preserved in BOD in the temperature of 5 °C and 75 - 80 % relative humidity as per recommended methods to find out suitable age. The study revealed that the 36 - 42 hrs. old age group at embryonic stages - 15 showed maximum 30 days of preservation without affecting the normal hatching and rearing performance. However, rearing of 21 days preserved lot of eri eggs were conducted successfully, where all the economic characters i.e. cocoon weight, shell weight and ERR % were also found at par with control.

4	Adoption level (Full/Partial/None)	Technology is under trial.
5	Recommended areas/ location	Eri seed production centre like ESSPC and State seed grainages.
6	Scope for improvement	Egg preservation technology manual may be published for easy adoption and available cold storages may be utilized for large scale preservation..



Post cocoon

Sl.No.	Particulars	Description
1	**Name of the technology**	**Muga Silkplus, an improved formulation for cooking and reeling of Muga cocoons.**
2	Origin & background	Conducted a research project Development and standardization of an improved process of cooking and reeling of Muga cocoons (NEC funded collaborative with IIT, Delhi) during 2004-05. Silk recovery achieved is 5% (approx) higher than traditional cooking as field trial has been conducted with the new formulation in different areas to 205 Muga reelers / beneficiaries. This new cooking formulation has been applied for patenting through NRDC.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	A new chemical formulation, "Muga Silk plus" has been developed for cooking (softening) of muga cocoons which increases raw silk recovery from the present level of 40-45% to 50-55%. Conversion of raw silk as less quantity of cocoons is required to produce same quantity of raw silk with significant improvement in tensile property (tenacity) of thus reeled silk.
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/location	All eri growing areas of India
6	Scope for improvement	More percolation to field may be attempted.

Silk plus

Cocoon cooking

Muga Yarn

Sl.No.	Particulars	Description
1	**Name of the technology**	**Muga reeling machine "*Bani*".**
2	Origin & background	Conducted a research work during 2004-05 for fabrication of muga reeling machine and a Bani yarn (weft yarn) reeling machine developed. The "*Bani*" reeling machine has been developed keeping in view that weft yarn has a share of about 60 percent of total reeled yarn consumed in muga weaving industry.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	A muga weft yarn reeling machine "*BANI*" has been developed by CMER&TI, Lahdoigarh. The frame of the machine is made of steel. The reeling speed of this machine is 64 m (meters) per minute with a production of 120 gms (35/40 Denier) and 200 gms (50/55 Denier) per 8 hours of working. The reelability achieved is 70% which is 10% higher (approx.) than traditional "Bhir" reeling. Silk recovery achieved is 45-50 percent, which is 4% (approx.) higher as compared to "Bhir". The reeling efficiency achieved is 71 percent, which is 10% increase over conventional reeling. The cost benefit ratio in "Bani" is higher (1:1.3) over "Bhir" (1:1.1).
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/location	All eri growing areas of India
6	Scope for improvement	More percolation to field may be attempted.

Bani machine

Muga yarn

Sl.No.	Particulars	Description
1	**Name of the technology**	**Muga cocoon drying machine.**
2	Origin & background	Conducted a research work for ddevelopment of a low cost Muga cocoon drying chamber during 2004-05.
3	Details of the technology (with Advantage/Disadvantage, Special precautions/ care to be taken for adoption, Cost benefit ratio)	A Muga cocoon drying chamber has been fabricated for stifling and drying of Muga cocoons using locally available fuels. Its capacity is 8000 number of Muga cocoons at a time and approx. 40,000 numbers of cocoons can be stifled and dried uniformly in 8-9 hours. Instead of power locally available fire wood may be utilized for heating.
4	Adoption level (Full/Partial/None)	Partial
5	Recommended areas/ location	All Muga growing areas of India
6	Scope for improvement	More percolation to field may be attempted.

Stifling of muga cocoon at drying chamber

For more details please contact

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