

FINAL REPORT

EXECUTIVE SUMMARY

**EVALUATION OF CENTRAL SECTOR SCHEME
DURING XI PLAN**

- A. R&D, Transfer of Technology/Training/IT initiatives**
- B. Seed Organization & Human Resource Management (HRD)**
- C. Quality Certification System (QCS)**



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**CENTRAL SILK BOARD
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EVALUATION OF CENTRAL SECTOR SCHEME DURING XI PLAN

A. R&D, TRANSFER OF TECHNOLOGY/TRAINING/IT INITIATIVE

EXECUTIVE SUMMARY

1.1. Preamble

Research & Development activities of Central Silk Board (CSB) have intensified during XI Five Year Plan to improve the productivity and quality to complement the expansion programme to reach the targeted production of raw silk. The Research Institutes established under the CSB at Mysore (Karnataka), Berhampore (West Bengal) and Pampore (Jammu & Kashmir), are dealing with Mulberry sericulture. The Research Institute at Ranchi (Jharkhand) deals with Tasar, whereas the Institute at Lahdoigarh (Assam) is looking after research and development requirement of Muga and Eri sericulture. Central Silk Technological Research Institute (CSTRI), Bangalore, carries out post cocoon R&D activities. The Silkworm & Mulberry Germplasm Station, Hosur (Tamil Nadu) has the responsibility of maintaining sericulture germplasm in the country. The Seri Biotech Research Laboratory (SBRL), Bangalore, attends to R&D in frontier areas like molecular characterization of silkworm races and mulberry varieties. The Silkworm Seed Technology Laboratory (SSTL), Bangalore (Karnataka), is engaged in research on issues relating to Seed production, Seed Quality etc.

There are nine major Research & Development institutions functioning under CSB. Each of these nine R & D institutions have their own nested Regional Sericulture Research Stations (RSRSs), Regional Muga Research Stations (RMRS), Regional Eri Research stations (RERSs), Demonstration Cum Technical Service Centers (DCTSC), Silk Conditioning and Testing Houses (SCTH), Regional Silk Technologies Research Stations (RSTRS), Textile Testing Laboratories (TTL), Cocoon Testing Centers (CTC), Raw Silk Testing Centers (RSTC), and Regional Tasar Research Stations (RTRSs).

Trained human resource is one of the critical requirements for the production of quality silk at a reasonable cost. Sericulture as any other rural based cottage industry needs trained technical personnel to provide training and transfer the technology to the rural masses. CSB has been playing a pivotal role in generating the required technical manpower for the sericulture sector. It is organizing different kinds of training programmes for the benefit of various stakeholder categories of the silk industry. These programmes are tailor-made to meet the specific needs of each sector of silk industry for updating the knowledge and skills of the extension personnel.

Under the IT Initiatives, CSB concentrates on networking various cocoon and silk markets with free flow of information on the availability of raw material, market trends etc., on its website. All information required for traders, buyers and other stakeholders shall also be hosted on the website.

CSB has been implementing the Central Sector Scheme “Research & Development, Transfer of Technology, Training and IT Initiatives” during the XI Five Year Plan (2007-08 to 2011-

12) with an original outlay of Rs. 94.71 crores. However, the actual expenditure exceeded the original outlay by about 50% and the Revised outlay towards the end of XI Five year Plan stood at Rs.144.60 crores.

Present evaluation study has been undertaken by National productivity Council (NPC) as a third party independent evaluation of the Central Sector scheme namely R&D, Transfer of Technology, Training and IT initiatives implemented by CSB during the XI Five Year Plan. The evaluation has been undertaken with the following objectives, Terms of Reference and methodology.

1.1.1. Objectives of the Evaluation Study

- i. *The evaluation study of the R& D Programme of CSB is aimed at understanding the effectiveness of the scheme during XI plan period in improving the production & productivity and its impact in the field for the overall development of sericulture and silk industry in the country, results gained from the development of high yielding silkworm breeds and their food plants (Mulberry and Vanya Silk host plants), development of clonal propagation techniques, improving soil health, soil fertility and cultivation practices, water conservation techniques, development of disease management, disease forecast, forewarning system, economic farming models & practices, mechanization of sericulture farming and silkworm rearing under the pre-cocoon area etc.*
- ii. *Efforts taken in the development of improved reeling, weaving and processing devices for silk at low cost to produce quality silk.*
- iii. *To study the quantity of region specific technologies developed by CSB Research Institutes and transferred from lab to land and its success among the stakeholders.*
- iv. *To study the effectiveness of extension activities in disseminating the technologies from lab to land and creating awareness among the stakeholders through its training and other allied programmes.*
- v. *To study the development of technologies and its commercialization thereof.*

1.1.2. Terms of Reference

- i. *Relevance & usefulness of R&D projects.*
- ii. *Appropriateness of time frame of R& D projects*
- iii. *Present status of technology transfers & efficacy of the R&D project to achieve the Intended end results*
- iv. *Performance of technologies/technology packages in field and its impact in the sericulture sector*
- v. *Acceptance of technologies/technology packages by end users*
- vi. *Fulfillment of objectives to the context proposed*
- vii. *Cost effectiveness of the projects-Initial cost (beginning of the project) & final cost (at the time of completion)*
- viii. *Training programmes-its relevance & usefulness*
- ix. *Product development and Diversification*
- x. *Evaluate the status of IT initiatives*
- xi. *Evaluate the impact of IT initiatives*

1.1.3. Methodology

Evaluation study of the Central Sector Scheme – Research & Development, Transfer of Technology/Training/ IT initiatives has been undertaken in two phases. **First phase of the study** focuses on an in depth analysis of secondary sources of data and information compiled from both published and unpublished sources of each R& D institute. **Second Phase of the study** is based on personal interviews and discussions with all the major stakeholder categories such as Research and Development institutions, Training / Demonstrations Schools , institutes , IT initiatives etc., Researchers/ Project Leaders, users or beneficiaries of new technologies, implementers, training schools/staffs and trainees, IT Providers, IT Initiatives of CSB (Cocoon Bank , raw silk, market network etc.) through a sample survey across all the nine R&D institutions with structured interview schedules.

1.2. EVALUATION OF CSR&TI, MYSORE, DURING XI PLAN

1.2.1. R&D Activities

Central Sericulture Research & Training Institute (CSR&TI), Mysore, has its hinterland in all the four Southern States besides Maharashtra, Madhya Pradesh, Gujarat and Rajasthan. Nested under it are 4 Regional Sericulture Research Stations (RSRSs) at Ananthpur, Chamarajnagar, Kodathi and Salem. 18 Research and Extension Centres (RECs) at Bidaraguppe, Chitradurga, Krishnagiri, Madivala, Rayachoti, Amrawati, Baramati, Samayanallur, Vikrabad, Palakkad, Venkatagiri Kota, Udumalpet, Madakasira, Gobichettypalayam, Hosur, Agali, Nagpur and Hosangabad with 12 Sub-units at Bidar, Kinakanahalli, Shimoga, Koppal, Mugur, Eluru, Kanakapura, Maddur, Punkonda, Attappadi, Neyeli and Aurangabad and one Satellite Silkworm Breeding Station at Coonoor.

Major research areas of CSR&TI, Mysore are (a) Mulberry Crop Improvement, Production and Protection and (b) Silkworm Crop Improvement, Production and Protection. Central Sericulture Research & Training Institute (CSR&TI), Mysore, has undertaken a large number of R&D Projects during XI Five Year Plan. Many research projects are of continuous nature and the work is in progress. About 44 new technologies have been successfully transferred to the field during XI Plan.

Research projects have been undertaken in the following areas : Development of high yielding silkworm breeds and their food plant (Mulberry & Vanya silk host plants), development of clonal propagation techniques, improvement in soil health and fertility, Mulberry Cultivation / Silkworm rearing practices, water conservation techniques, development of disease management, economic farming models and practices, mechanization of sericulture farming, mechanization of silkworm rearing, product development and diversification, any other region specific technologies, improved rearing, weaving and processing devises, IT initiatives, transfer of technology, sericulture economics, Eri culture, Transfer of technology, Studies on Forecasting and Forewarning for mulberry / silkworm pests and diseases and silkworm pests., Establishment of Farmers' Field Schools and Establishment of Soil testing facility.

Funding and expenditure on various R&D projects have doubled during XI plan as it increased from Rs.1937 lakhs in 2007-08 to Rs.4109 lakhs by 2011-12.

CSR & TI, Mysore scientists have applied for 10 patents during XI Plan of which 4 patents have been awarded. 1370 research papers were published during XI plan.

1.2.2. Training & Human Resource Development

In collaboration with JICA, two International training programmes were organised for the participants from Third World countries. The participants from Kenya, Nigeria, Uganda, Ghana, Madagascar, Nepal and Kyrgystan attended the training programme. Based on the requests received from Universities, Department of Sericulture, NGOs etc., need based training programmes were also organized. In addition to this, students from various universities/colleges were supported for the M.Sc project/dissertation work.

- Persons trained under various training programmes: 4069 persons
- Enterprise promotion (MDP&TUP) : 331 persons
- Training under XI Plan of CSS including nested units: 3403 persons
- Certificate course: 45 Nos.
- Third country training programme: 28 persons
- Need based training programme : 247 persons
- Integrated Skill Development Scheme (ISDS) : 15 persons

1.2.3. Sericulture Extension, Economics and Management (SEEM)

The average cost of production of cocoon per kg estimated through sample survey was Rs.150.45, Rs.147.54 and Rs.134.58, respectively for Karnataka, Andhra Pradesh and Tamil Nadu. A total of 84,750 dfls of bivoltine hybrids were chawki reared and supplied to adopted farmers and an average cocoon yield of 68.97 kg/100 dfls was obtained. Under Cluster Development Promotion Programme (CPP), a total of 22,58,024 dfls of bivoltine hybrids were distributed in 22 clusters spread across Karnataka, Andhra Pradesh, Tamil Nadu and Maharashtra and an average cocoon yield of 67.79 kg/100 dfls was obtained. A total of 12 improved technologies are under testing/demonstration in different RSRSs, RECs and REC Sub-units. Besides, 7 demonstrations of compost making, 3 demonstrations of foliar spray with Poshan and 12 demonstrations of disinfection with Asthra were conducted by scientists of CSRTI, Mysore.

1.2.4 Extension Activities of CSR&TI, Mysore

CSR&TI, Mysore along with its RSRS and its nested units organised 847 events under 13 different programmes during XI plan period. It has been reported that a total of 21939 participants got the benefit of various training programmes.

A large number of IT initiatives have also been taken up by CSR&TI during XI plan. A number of workshops have been conducted and databases have been developed for the benefit of scientists and research students.

1.2.5 Problems faced by the Institute due to shortage of manpower, finance and Infrastructure

1.2.5.1 Manpower

- *Lack of subject expertise has failed to give a thrust in frontier areas of research including basic sciences.*
- *Due to ban on recruitment for the last two decades a vacuum has been created, no young scientists inducted into the main stream, only two new scientists recruited and appointed during XI plan for the institute of which one already resigned.*
- *No attractive incentives or career progression to attract young scientists.*

1.2.5.2 Finance

Due to restricted delegated powers vested to institute's head, most of the purchase proposals' including the external funded projects has to be routed to head quarters for financial and administrative approvals, hence the delay in implementation of programmes on time.

1.2.5.3 Infrastructure

- *Most of the labs are more than three decade old and are in a dilapidated condition, except for the JICA and NSP buildings, which were constructed after 1992.*
- *The infrastructure created during NSP and JICA period are not in operation due to lack of maintenance staff, spare parts etc.*

1.2.6 Overall acceptability of new technology among end users

- *Many of the technologies developed by the Institute are aimed at improvement in quality and quantity of cocoon.*
- *Most of the product development was towards prevention and control of silkworm diseases, which has yielded many fold benefit to the farmers' in harvesting 5-8 kg more cocoons against the non use of technology products.*
- *As on date bed disinfectants for silkworms are accepted and used in field.*
- *The concept of Commercial Chawki Rearing Centres has improved the survival rate of young age silkworms.*
- *Due to high labor cost, alternate approaches like farm mechanization, shoot rearing technology, leaf chopping machine, silkworm separator etc., has given a thrust in silkworm rearing and has reduced the labor inputs and drudgery of work.*
- *Transfer of Technology through Cluster Development Programme has brought farmers together in understanding the use of new technologies.*
- *Training cum demonstration of new technologies and trainers training programme has created awareness among the field functionaries.*
- *Production and supply of bio-control agents and development of entrepreneurs has given a role to non sericulture ones to contribute indirectly in silk production.*

1.3. EVALUATION OF CSR&TI, BERHAMPURE, DURING XI PLAN

CSR&TI, Berhampore, has been rendering outstanding research, development, technical, technological, extension and service support through its four Regional Sericultural Research Stations (RSRSs) at Kalimpong (WB), Koraput (Odisha), Ranchi (Jharkhand) and Jorhat (Assam) and 14 nested units of which 12 Research Extension Centres (RECs) at Nabagram (Murshidabad) & Mothabari (Malda), West Bengal, Rangpo (Sikkim), Deogarh (Odisha), Singhanpur (Chhattisgarh), Gumla and M.P.Raj (Jharkhand), Agartala (Tripura), Dimapur (Nagaland), Shillong (Meghalaya), Imphal (Manipur) and Aizawl (Mizoram) and two Research Extension Centres sub-units (REC-SUs) at Bhandra and Rajmahal (Jharkhand), besides, generating expertise in mulberry sericulture through its various Human Resource Development programmes. The salient highlight of research are in the areas of (a) Mulberry Crop Improvement and Production, (b) Mulberry protection, (c) Silkworm improvement, (d) Transfer of Technology and (e) Cluster promotion programmes.

1.3.1 R&D Projects and Transfer of Technology by CSR & TI Berhampore

During XI Plan CSR & TI Berhampore has undertaken 205 R&D Projects. Out of these, 55 projects have been completed and 150 projects are in progress. It may also be noted that 19 technologies developed by CSR & TI Berhampore has already been transferred to field.

1.3.2 Patents and Research papers published

It may be noted that during XI Plan five patents have been applied for whereas three patents have been awarded. The number of research papers published in national and international journals have been reported at 250 during XI Plan period.

1.3.3 Achievements in terms of R&D projects during XI five Year Plan

- i. High Yielding Mulberry Variety, C-2038 has been found to be highly suitable for the alluvial gangetic plains (under irrigated conditions) with a productivity of 54-56 mt/ha/yr, which is 27% higher than the existing ruling variety (S1635).*
- ii. For the Acidic soils of the hills and foot hills of West Bengal and similar regions, Tr-23 has been identified as a highly promising variety with a leaf yield of 14-15 mt/ha/yr over the ruling variety BC₂ 59 (9-10 mt/ha/yr), reflecting an yield gain of 50%. In the foot hills, Tr 23 is yielding 24-25 mt/ha/yr over the ruling BC₂ 59 (18-20 mt/ha/yr) (with a gain of 25%).*
- iii. A highly promising flood tolerant variety (C2028) has been developed and is under extensive popularization.*
- iv. To maintain the soil health and fertility status, a ready reckoner for Sulphur application is developed by Soil Test based targeted yield approach for a balanced use of fertilizer to optimize the quality mulberry leaf production per unit area.*
- v. Package for increasing mulberry leaf yield through Integrated Nutrient Management for the farmers of rainfed area has been developed.*

- vi. For increasing mulberry leaf yield under rainfed condition an anti-transparent KCl (1%) has been validated at farmers' level and found to be highly effective.
- vii. The season and region specific silkworm breeds/hybrids and appropriate rearing packages are being widely popularized for enhancing cocoon productivity
- viii. The Pest Management Technologies that were developed for the control of major mulberry pests are being widely popularized at farmers' fields, so as to avert pest outbreaks and huge crop losses.
- ix. The Disease Management Technologies that were developed for the control of major silkworm diseases are being widely popularized at farmers' fields, so as to avert disease outbreaks and huge crop losses.

1.3.4. Extension Communication Programme

During XI plan, Extension Communication Programmes viz., Resham Krishi Mela (RKM), Field Days, Exhibitions, Awareness Programmes (AW), Audio- Visual (AV), Farmers Field School and Trainers' Training Programme were taken up for transfer of technology and a total of 55,449 farmers were trained / sensitized.

To disseminate technologies, educate and train the farmers on different aspects of improved mulberry cultivation and silkworm rearing practices/technologies developed by the Institute, different extension programmes were taken up and more than 14694 farmers/seri-stakeholders participated in the Krishimelas, Field Days, Awareness & A-V Prog., visited exhibition and gained knowledge on different improved sericulture technologies.

1.3.5 Human Resource Development

Various HRD programmes were organised for Transfer of Technology in view of sustainable development of sericulture. Regular training was imparted to the farmers/participants on different activities of sericulture, such as, mulberry cultivation, silkworm rearing technologies, disease & pest management etc., developed by the Institute.

Under HRD programme, 1814 personnel have been trained under various structured and non-structured courses about the modern sericulture technologies developed by this institute.

1.4. EVALUATION OF CSR&TI, PAMPORE, DURING XI PLAN

CSR&TI, Pampore, Jammu & Kashmir, is a pioneering Institute in the field of temperate and sub-tropical Sericulture in North Western India. The Institute has been catering to the needs of the silk industry by consistent R&D and extension activities through its wide spread network of RSRs, RECs and CDCs located in the states of J&K, Himachal Pradesh, Punjab, Haryana, Uttarpradesh, Uttarakhand and Rajasthan. It has nested under it two Regional Sericultural Research Stations (RSRs) at Jammu (J&K) and Sahaspur (Uttarakhand), 13 Research Extension Centres (RECs) at Y.K.Pora, Gorakhpur, Chotmalpur, Gonda, Fatehnagar, Ghumarwin, Naduan, Una, Sujanpur, Udham Singh Nagar, Bageshwar, Nowshera, Barnoti with five sub units of the RECs Tikri, Bandipora, Tral, Bhadrasi, Panchakula. Further, five of the Extension centres viz., Tral (J&K), Bandipora

(J&K), Tikri (J&K), Nowshera (J&K) and Kalsi (Uttarakhand) are functioning as Cluster Development Centres (CDCs).

Major research focus areas are (a) Mulberry Improvement, (b) Mulberry production, (c) Crop protection (d) Silkworm Improvement, (e) Gene pool, (f) Seed production.

1.4.1 R&D Activities of CSR&TI Pampore

As an impact of technology on pruning and leaf harvesting, about 20% improvement in leaf yield has been recorded across all the test sites in North India during the year 2011-12.

1.4.2 Funding of R& D Projects and Expenditure during XI Plan

During the XI plan period, CSB provided a fund of Rs. 194.33lakhs for the first year 2007-08 and it increased to Rs. 443.08 lakhs by the end of XI Plan 2011-12 whereas the expenditures incurred in the respective years have been reported at Rs. 161.01 lakhs and Rs. 311.77 lakhs under R&D scheme.

1.4.3 R&D Projects undertaken during XI Five Year Plan

A total of 140 R&D projects have been undertaken during XI plan period, out of which 137 projects were completed within the time frame, only three projects got delayed. Hence, no major cost over run has been noticed with respect to the R&D projects undertaken during the plan period. Around 470 Research Papers, 17 Bulletins, 2 technical write-ups and 5 books have been published by the scientists of the institute during the plan period.

1.4.4 Training and Extension Activities

The Institute and its RSRs imparted training to 461 DOS officials of J&K, Punjab, HP, Uttarakhand and UP states on various aspects of sericulture, moriculture and extension technologies. 768 farmers were trained during 2011-12 under 7 Farmers Field Schools. 140 beneficiaries have been trained in various skills under Integrated Skill Development Scheme (ISDS) of Ministry of Textiles, in seven batches in north India. Under the women empowerment programme in North India, 693 women farmers were trained. Apart from the regular training programmes, 1143 students/farmers were trained on various aspects of sericulture. The Institute is having a network of 13 Extension Centres and 5 sub units spread over seven states and the extension services provided during XI Five Year Plan covers orientation of around 6418 farmers and rearing of 375256 DFLs etc.

During the 2011-12 , 148 Group Discussions, 32 Awareness Programmes, 54 Film Shows, 55 Farmers Field Days and 19 Vichar Goshtis were conducted. Two Krishi Melas and Two workshops were also organized during the period. Study tours were conducted for farmers to Bangalore and Tamil Nadu.

It may be noted that CSR& TI, Pampore organized 118 training programmes and a total of 4424 participants took advantage of these training programmes.

1.5 EVALUATION OF CTR&TI, RANCHI DURING XI PLAN

CTR&TI, Ranchi, is the pioneer research institution in the field of tasar culture engaged in generating useful information and technologies suited to the tropical and temperate tasar sectors, through Research & Development and their effective transfer to the field. The ultimate aim is to improve the socio-economic status of the stakeholders (Tribals) associated with tasar culture. The network of Regional Tasar Research Stations (RTRSs) – Dumka (Jharkhand), Jagdalpur (Chhattisgarh), Bangriposi (Orissa), Bhandara (Maharashtra) for tropical areas and Imphal (Manipur), Bhimtal (Uttanchal) and Batote (J&K) for temperate areas, Research Extension Centres (RECs) – Hatgalaria (Jharkhand), Katghora (Chhattisgarh), Bangriposi (Orissa), Bhadrachalam (AP), Robertsganj & Jhansi (UP), Purulia (WB), Nasik (Maharashtra) for tropical areas, two RECs for temperate areas, viz., Palampur (HP) and Gopeshwar (Uttarakhand) and three Oak Tasar Extension Centres cum BSMTCs Umrangshu, Yaikongpao and Kikrma under the control of RTRS Imphal, extend the support in transfer of technology. Three p4 stations – Chkradharpur, Jarmundi (Jharkhand) and Kargi Kota (Chhattisgarh) extend their support in the production of quality elite seeds for tropical tasar ecoraces. RTRS, Batote has started functioning as p4 station for temperate tasar silkworm.

1.5.1 Host Plant Improvement, Production and Protection

For utilization of the host plant gemplasm, 231 accessions of Terminalia sp. were characterized for 55 traits and a catalogue has been prepared. Ten superior accessions of Terminalia sp. (T. arjuna-06 and T. tomentosa-04) were isolated based upon qualitative and quantitative parameters. The same is under in-house multiplication for field transfer. Three plus trees of Terminalia sp. have been identified from different locations based upon seed and germination traits and the seedlings have been transplanted in field for leaf yield trials.

1.5.2 Silkworm Improvement, Production and Protection

The morphometric analysis was made for cocoon and moth. Gut amylase activity in Laria ecorace fed on Sal and Asan was studied and Low glycogen accumulation in fat bodies results in improper diapause leading to emergence of moths of Laria ecorace in winter season (Dec-Jan). Similarly, high tannin and phenolics content in Sal leaves cause digestive imbalance and in turn low water content in gut, which seems to be one of the reasons for low yield on Sal. Project on in situ Laria conservation being implemented in collaboration with Forest Dept. and DOS, Jharkhand at Ormanjhi was continued. Life cycle was allowed to continue in natural condition. Overlapping of generations was observed.

Studies on Reactive Oxygen Species indicated higher values in non-diapausing generations compared to diapausing ones. (Five years achievements should be given).

1.5.3 Post Cocoon Technologies

Solar operated wet reeling machine with steam line has been developed. The machine has 3 basins and 18 ends. For supply of hot water (45-50° C), a steam line is attached to it. This machine yields 600-700 g raw sill per basin per day (8 H). A solar operated vertical reeling cum spinning machine has been developed jointly with DOS, Jharkhand. The machine is

compact, handy and yields 200 g twisted silk per day. The yarn produced can be directly used both as warp or weft, without any additional twist.

1.5.4 Patents Filed

Patent applications have been filed for technologies with NRDC such as Jeevan Sudha-a botanical formulation for control of bacteriosis and virosis, Novel technique for collection of bioactive enzyme Cocoonase from *Antherea mylitta*, Development of wet reeling machine (solar operated) for tasar silk cocoons and Silk spinning and twisting machine (Samridhi).

1.5.5 Regional Tasar Research Stations

RTRS, Warangal conducted field trials of the evolved BC-IV line of Andhra Local, which yielded 35 cocoons/dfi over the parents (Andhra Local – 12 cocoons and Daba TV- 20 cocoons/dfi). RTRS, Baripada maintained the germplasm of rejuvenated Sukinda (TV) and supplied basic seeds to State department and BSMT&Cs for multiplication. A total of 4,285 dfis were supplied. The Station has preserved 3700 seed coons to maintain the elite race in the GPB of this station. The programme on conservation of local ecorace Modal has been continued. The RTRS, Jagdalpur extended technical guidance to DOS Jagdalpur for organizing Raily conservation camps in different parts of Bastar in Chhattisgarh.

Besides, RTRS, Jagdalpur extended technical guidance to DOS, Chhattisgarh under Cluster Promotion Programme (CPP). During 2011-12 a total of 14.21 lakh cocoons @ 53.8 cocoons/dfi were produced under commercial rearing. Towards introduction of daba BV rearing in the region, RTRS, Bhandara extended technical support. Out of 24,500 dfis of Daba BV 14.96 lakh cocoons (61 cocoons/dfi) were produced which indicated feasibility of Daba BV in second crop in the region.

Two productive lines of oak tasar silkworm have been developed by RTRS, Imphal with cocoon yield of 65 and 74 cocoons/dfi, as against the parents (*A. pernyi* ad *A. proylei*), which yielded 39 and 35 cocoons/dfi, respectively.

1.5.6 Human Resource Development

A total of 1626 persons have received training under different programmes (structured course 29 in two batches; Training initiatives-1012; integrated skill developmet scheme-29; Ad-hoc programmes-556; DBT project-42).

1.5.7 Extension and Transfer of Technology

The extension and transfer of technology activities undertaken by the nested units covers 29 Farmers' Meet cum Exhibition, 10 Kishan Mela, 33 Field Day, 25 Farmers' Day and 06 Vichar Gosthi etc.

1.5.8 Funding and Expenditure of the R& D Projects during XI Plan

CTR&TI, Ranchi received a total of Rs. 1267.02 lakhs during the first year 2007-08 of XI Plan and funding increased to Rs.3265.89 lakhs by the last year 2011-12, whereas the

expenditure during the respective years has been Rs.1247.28 lakhs and it increased to Rs.3256.11 lakhs. The sources of funding include CSB, DBT, New Delhi and NABARD, Ranchi.

1.5.9 Projects undertaken during XI Five Year Plan

Out of 50 projects undertaken during the XI plan period, 43 projects have been completed on time whereas 7 projects have been carried forward in XII Plan which is under progress. A total of 10 patents have been applied by CSTRI, Ranchi, during the XI Plan period. Out of which only one has been awarded.

A total of 184 research papers/articles have been published in various National and International journals. Workshops and national seminar were organized and its proceedings were published, during the XIth Plan period. Beside these, 25 Training programs were organized which covered 4666 participants.

1.5.10 Level of acceptability of new technology among the End Users

The technologies of the Institute are adopted by the tasar growing States, which has led to achieving higher level of production of tasar silk in the country. Recent socio-economic surveys conducted in Jharkhand indicated about 40% adoption of the improved technologies by the framers practicing tasar culture in natural plantations. Under such conditions the level of adoption of rearing technologies are higher than plant maintenance technologies.

1.6 EVALUATION OF CMER&TI, LAHDOIGARH, DURING XI FIVE YEAR PLAN

1.6.1 Introduction

CMER&TI, Lahdoigarh has its hinterland in the North Eastern States, West Bengal, UP and AP. There are three regional units working under CMER&TI, e.i., Regional Muga Research Station, Boko, Assam; Regional Eri Research Station, Mendipathar, Meghalaya and Regional Eri Research Station, Shadnagar, AP with three Research Extension Centres for Muga (Lakhimpur in Assam, Tura in Meghalaya, Coochbehar in West Bengal), four RECs for Eri (Diphu and Kokrajhar in Assam, Fatehpur in UP, Shadnagar in AP and one Composite REC at Mangaldoi, Assam.

1.6.2 Muga host plant improvement

Hardening of micro-propagated plantlets of muga host plants *Persea bombycina* was conducted. Culture of 168 nos. of nodal segments of S3 and S6 plants for shoot initiation have been carried out in MS and Woody Plat (Hi-media Ltd.) medium. The nodal segments were subjected to antifungal (bavistin) and antibiotic (streptomycin) treatment to reduce the microbial contamination. Sprouting of buds in few explants has been observed and aseptically transferred to shoot elongation media containing Gibberallic acid.

1.6.3 Muga Silkworm improvement

*Endocrine regulation of reproduction and enhancement of fecundity in the muga silkworm was studied. The effect of two neuro hormones (JH-III and 20-hydroxy ecdysone) on reproductive behavior and rearing performance of Muga silkworm was studied. The problem of retention of eggs by *A. assamensis* moths (which reduces the number of hatched worms) can be mitigated by application of both JH-III and 20-E. However, retention of eggs by the moths was minimum under treatment of 20-E (8 nos.). Topical application of 15µg 20-e enhanced fecundity (from normal 100-115 eggs to 150-166 eggs), survivability i.e. formation of cocoons (from normal 51-65% to around 80%), pupal and shell weight (6.10g and 0.67g, respectively). Protein content in the pupal eggs, pharate adult eggs, normal and retained eggs were significantly higher when the worms were treated with 15µg 20-E (9.66mg/ml to 13.86 mg/ml). Similar effect was observed in case of haemolymph of larvae and ovarian development.*

1.6.4 Regular Programme

*Induction of indoor rearing technique for *Antheraea assamensis* through field trails was conducted. About 200 nos. of potted plants were raised for indoor rearing of silkworms. Multi-locational trial of castor accessions was conducted. The accession Acc-003 and Acc-004 were evaluated as promising castor genotype for eri silkworm rearing. The test was conducted in 4 locations of Assam in different agro-climatic Zone and results are at par with institute's findings.*

On farm trial for development and standardization of an improved process for cooking and reeling of muga cocoons were conducted. Training and demonstration programmes are being conducted in the farmer's field in different locations and also popularized.

1.6.5 Extension and Communication Programme

The extension and Communication Programme undertaken by (CMER&TI), Lahdoigarh covers 13 Exhibitions, 03 Krishi Mela, 32 Field Day, 15 Technology Awareness programs, one workshop and seminar and 5 Advertisement campaigns etc during 2011-12.

1.6.6 R&D Projects during XI Plan

A total of 45 projects were undertaken by (CMER&TI), Lahdoigarh during XI Plan period out of which 38 has already been completed and 07 are in progress. Beside these, 36 Transfer of Technology work has also been undertaken by the institute.

1.6.7 Sources of Funding and Expenditure of R&D Projects during XI plan

(CMER&TI), Lahdoigarh received a total of Rs. 125.21 lakhs during the year 2007-08 and Rs.369.41 lakhs during the year 2011-12, whereas the expenditure during the respective years has been reported at Rs.489.73 lakhs and Rs.1272.27 lakhs. The only source of funding for the institute has been CSB.

1.6.8 Institute's achievements in terms of R&D projects taken up during XI five Year Plan

The significant achievements made by the institute during XI plan shown positive impacts delivering fruitful R&D outputs. The R&D programmes of the institute was mainly focused on important aspects of research on priority basis i.e. selection and evaluation of superior genotypes of som and castor for higher leaf yield, evaluation of wild muga silkworm for higher fecundity and survivability, preservation of muga cocoons to overcome unfavourable seasons, increase in silk recovery percent from cocoon etc.

Among the important achievements of the institute are superior plus trees of som in terms of disease resistance and better rearing performances, evaluation of superior genotypes of castor, collection and maintenance of seven accessions of muga silkworms from different pockets of Northeastern region, semi-synthetic diet for rearing of muga silkworm up to 2nd instar, muga silkworm breeds for higher productivity, juvenile hormone application to enhance the reproductive efficiency of muga silkworm, new technology for long term preservation of muga cocoons to overcome unfavourable seasons, a new bio-formulation viz. Phyto-blighton for management of leaf blight diseases etc.

The institute had applied for 5 Patents during the XI Plan period. A total of 253 research papers, 69 popular articles and 39 book chapters were published by the institute. Besides the institute organized 50 training programs which was participated by 6073 people.

1.7 EVALUATION OF SSSL, KODATHI, DURING XI PLAN

1.7.1 Introduction

Silkworm Seed Technology Laboratory (SSSL), Kodathi, Bangalore, is mandated with development of technologies for improvement of silkworm seed sector and to monitor the silkworm diseases.

1.7.2 Objective of the Institute

- Development of technologies for seed crop rearing, seed production and seed handling.
- R&D support to silkworm disease management in seed areas and multiplication levels.
- Preservation schedules for mulberry silkworm seed.
- Quarantine testing and certification for export and import of silkworm eggs
- Dissemination of technologies
- Human Resource Development

1.7.3 Long Term Preservation of Silkworm Seed

Long term preservation technique was developed for Nistari hybrids viz., crossbreed (Nistari x NB4D2 and Nistari x CSR2) and multivoltine hybrids (Nistari x M12W and M12W and M12W x Nistari) employing double step refrigeration method. The Nistari hybrids could be preserved upto 70 days for crossbreed and 50 days for multi hybrids without affecting

hatching and crop yield. The evaluation studies in silkworm seed production centres of NSSO would be initiated during Agrahyani 2012.

1.7.4 Collaborative Project with TERI, Bangalore

The solar passive rearing house built under the collaborative project with The Energy and Resources Institute (TERI) was utilized for the evaluation of CSR2 and CSR4 seed crop rearing during winter season to test verify the efficiency. The results indicated that the crop performance was on par with control and test verification would continue in summer and rainy season in 2012.

1.7.5 Developmental Biology

Incubation techniques based on the effective accumulated temperature points (EATP) for the prediction of exact day of hatching were standardised for popular bivoltine silkworm breeds and their hybrids.

Preservation schedules for two bivoltine, SK6 & SK7 and one univoltine, Barpat silkworm breeds are being evaluated under 4,6,8 and 10 months schedules, following 10, 20, 40 and 60 days aestivation.

1.7.6 Disease Monitoring Survey

Seasonal Joint Silkworm Disease Monitoring Survey involving DOS (Karnataka, Andhra Pradesh and Tamil Nadu) and NSSO was conducted for the incidence of silkworm diseases especially pebrine. A total of 1242 lots (319 Bivoltine & 923 Multivoltine) and 1294 samples (Bivoltine 393 & Multivoltine 1001) were tested in seed areas at Anekal and Kungal (Karnataka), Hosur and Denkanikottai (Tamil Nadu) and Hindupur and Meadanapalle (Andhra Pradesh).

Basic seed farms viz., P4, Hassan (CSRTI, Mysore) and P3, Mysore (NSSO, Bangalore) were also monitored for perbrine incidence and its containment in seed crop rearing and basic seed production.

1.8 EVALUATION OF CSGRC, HOSUR, DURING XI PLAN

1.8.1. Introduction

The Central Sericulture Germplasm Resources Centre (CSGRC) is the national nodal centre for conservation of Sericultural Germplasm in the country for collection, characterization, evaluation, maintenance, supply of mulberry and silkworm genetic resources for pre-breeding of elite mulberry and silkworm races in India. The activities of the centre are oriented to achieve set mandate. CSGRC has been recognized as National Active Germplasm Site for Silkworm Germplasm in the country by National Bureau of Agriculturally Important Insects (NBAII), Bangalore, similar to Mulberry Germplasm recognized by National Bureau of Plant Genetic Resources (NBPGR), New Delhi during the year 2006.

CSGRC has Mulberry Division and Silkworm Division. The supply of germplasm for utilization of crop improvement programmes is the major mandate. 331 mulberry accessions were supplied to 13 indenters in 15 spells for research and biodiversity conservation. 65 silkworm multivoltine accessions were supplied to six indenter and 48 silkworm bivoltine accessions were supplied to 7 indenters in equal number of spells for research institutes and postgraduate studies in universities.

1.8.2 Summary of R&D Projects undertaken & Financial Support Received during XI Plan

Out of 46 projects undertaken during the XI plan period, 7 have already been completed on time whereas 39 projects are in progress. (CSGRC), Hosur received a total of Rs. 239.06 lakhs during the year 2007-08, Rs. 325.30 lakhs during the year 2008-09, Rs.317.07 lakhs during the year 2009-10, Rs.365.65 lakhs during the year 2010-11, Rs.350.71 lakhs during the year 2011-02, and the entire fund was fully exhausted during the respective years. The sources of funding include CSB, Bangalore and DBT, New Delhi.

1.8.3 Institute's achievements as a result of R&D projects taken up during XI five Year Plan

Mulberry accessions 1217 (Indigenous : 885 Exotic: 332) were supplied to 56 institutions for research, fruit yielding trees and Biotechnological studies. 263 bivoltine and 340 multivoltine silkworm genetic resources were supplied to 67 Institutes for research / PG studies and breeding purposes. A total of 68 Research Articles in Journals and 27 Popular Research articles were published as well as 92 Seminars were organized by (CSGRC), Hosur, during the XI Plan period.

1.9 EVALUATION OF CSTRI, BANGALORE, DURING XI PLAN

1.9.1 Introduction

Central Silk Technological Research Institute (CSTRI) has its head quarters at Bangalore and the sub-units spread across the country. CSTRI has 11 Demonstration Cum Technical Service Centres (DCTSC) at Dharwad, Hindupur, Darmapuri, Jammu, Malda, Suri, Hagalpur, Varanasi, Dehradun, Bhandara and Cuttack, 6 Silk Conditioning and Testing Houses (SCTH) at Bagalore, Dharmavaram, Kancheepuram, Jammu, Srinagar and Malda, 4 Textile Testing Laboratories (TTL) at Bangalore, Jammu, Bhagalpur and Varanasi, 1 Zonal Office at Bilaspur, 2 Raw silk Testing Centres (RSTC) at Sidlaghatta and Kollegal, 2 Cocoon Testing Centres (CTC) at Ramnagaram and Coimbatore and 1 Regional Silk Technological Research Station (RSTRS) at Khanapara.

Ushma Shoshak unit was developed to reduce the fuel consumption for production of raw silk. The unit along with 1000 LPD insulated water tank was installed at Multi end reeling unit at Sidlaghatta. The comparative properties of fabrics woven from Indian multivoltine and bivoltine and Chinese bivoltine silk were analyzed. Fabrics made of Indian multivoltine were more lustrous than other silks and under subjective analysis; fabric made of Indian multivoltine scored the highest ranking. It has better drape which is a desirable quality for sarees and dress materials. Silver nano particles were synthesized using sericin for

imparting durable anti microbial properties to silk textiles. It was observed that the raw silk fabric does not possess antimicrobial properties while degummed silk fabric and AgNP treated fabrics showed antimicrobial properties. AgNP treated samples showed more than 90% reduction against *Klebsiella pneumoniae* (ATCC 4352) and *Staphylococcus aureus* (ATCC 6538), whereas controlled showed on bacterial reduction. Cytotoxicity test of AgNP treated samples showed is under progress.

1.9.2 Product design, development and Diversification

The new fabrics developed during the XI Plan period are Gents shawl using 2/40s peduncle yarn, Ladies shawl using 2/40s peduncle yarn, Fabrics made from eri spun yarn, Furnishing fabrics from mill spun peduncle yarn, Tasar sari produced on power-loom using wet reeled tasar yarn, Solapur chadars, Aurangabad chadars, Eri napkins, Imroo shawls and Praywe mat.

1.9.3 Training and Testing

136 candidates were trained on post cocoon activities under training programmes conducted by the main Institute. In addition, 24 candidates were trained in the Trainers' Training Programme under Integrated Skill development Scheme (ISDS). 1032 lots (cocoon, raw silk, fabric, water, etc.) were tested under physical, chemical and eco parameters have been tested at Main institute and revenue of Rs.686 lakhs was earned.

1.9.4 CDP Implementation

The main institute along with the sub-units implemented the various schemes of the post cocoon sector under the XI Plan Catalytic Development Programme (CDP). The sub units of CSTRI were involved in organizing various training programmes, conducting technology demonstrations and field interaction programmes, implementation and monitoring of various XI Plan CDP schemes. The sub-units were also involved in adoption of reeling, weaving, twisting and dyeing units for continuous monitoring for overall improvement. Testing services is the other major activity of the sub units.

1.9.5 Progress of the R&D activities and Financial support received during XI Five Year Plan

CSTRI, Bangalore received a total of Rs. 223.01 lakhs during the year 2007-08, Rs. 214.34 lakhs during the year 2008-09, Rs.211.40 lakhs during the year 2009-10, Rs.167.48 lakhs during the year 2010-11, Rs.244.44 lakhs during the year 2011-02 by CSB, However, the total expenditure incurred during the respective years has been Rs. 937.96 Lakhs, Rs. 1302.96 Lakhs, Rs. 1624.78 Lakhs, Rs. 1521.91 Lakhs, Rs. 1708.52 Lakhs by 2011-12.

1.9.6 Achievements as a result of R&D projects taken up during XI five Year Plan

The technologies developed by CSTRI, Bangalore during the XI Plan Period include Eight end multiend reeling machine for mulberry cocoons, CSTRI Sorting machine for grading tasar cocoons, Motorised cum pedal operated spinning machine, CSTRI Motorized Reeling Cum Twisting Machine (MRTM), CSTRI 2 in 1 Reeling-Cum Twisting Machine for

Production of Twisted & Untwisted Raw Silk, Low cost solar operated spinning machine, CSTR I improved handloom Model-II (Frame loom / Pit loom), Parallel beat-up mechanism for handloom (Frame loom / Pit loom), CSTR I Pneumatic Jacquard lifting mechanism (PLM) for handloom (frame loom or pit loom), Application of neem extract and lac dyes on mulberry silk etc.

1.9.7 Technologies transferred to the field during the XI Plan period

The technologies transferred to the field are Automatic Silk Reeling Machine, Automatic Dupion Reeling Machine, Silk Twisting Machine, Tub Dyeing, Arm Dyeing Machine, Fabric Dyeing Machine, Aasu Machine, Shuttleless Loom, Cluster Specific Handloom with Jacquard, Loom Upgradation (dobby, jacquards and pirn winding), Computer Aided Textile Design (CATD) System, Low Cost Electronic Jacquard for Handloom & Powerloom.

1.9.8 R&D Projects during XI Plan

A total of 27 projects were undertaken by (CSTR I), Bangalore during XIth Plan period out of which 16 has already been completed, 7 are in progress whereas 1 project is delayed. The institute had applied for 5 Patents during the last Plan period

A total number of 109 Research papers were published during XI Plan period. Also the institute organized 88 training programs which was participated by 1054 people.

1.10 R&D ACTIVITIES OF SBRL, BANGALORE, DURING XI PLAN

1.10.1 Introduction

The Seri Biotech Research Laboratory, Bangalore, is involved in research on various disciplines of Biotechnology ie., Silkworm and Host Plant Genomics, Proteomics and Molecular Pathology through CSB and DBT funded programmes. The highlights of the research activities during the period under report are discussed in the following sections.

1.10.2 Silkworm Proteomics

Quantitative expression by Real-Time PCR showed enhanced gene expression of the host-response proteins revealing activation of immune pathway, melanization events, proteolysis and Cellular apoptosis after uzifly infection. DDC showed up regulation at 48h after infection whereas down regulation at 72h. Phenol oxidase (PO) activity in integument showed a slow increase over ages with highest activity at 96h after infection indicating lower level of melanization events. Candidate gene expression studies showed activation of Toll Pathway genes such as BmToll, Spatzle, Dorsal and Relish. Real Time analysis of these genes in the integument showed early up regulation of most these genes, which showed the immunocompetence of integument of B. Mori against the parasitoid attack. Chaperone such as Hsp70 and Chaperonin showed an early up regulation after infection. RT-PCR studies from integument and haemocytes showed variability in expression of Ras1, PPO2 and PPAE between tissues and ages. Hsp70 was identified as one of the major stress protein that showed enhanced expression after the infection. To identify the interacting proteins of Hsp70 expressed during infection, interacting proteins were identified from integument and haemocytes.

1.10.3 Silkworm Genomics

The complete sets of raw and normalized data from this study have been deposited in the NCBI Gene Expression Omnibus (GEO) repository (accession number GSE35622). A total of 638 genes were up regulated and 1136 genes were down regulated at 18 hrs after oviposition, whereas, 675 genes were found to be unregulated and 595 genes down regulated at 30 hrs after oviposition. Further, 115 genes were stably unregulated, while 117 genes stably down regulated at both 18 as well as 30hrs. The genes were classified based on functions into seven groups, viz., Immune, metabolism, stress, signal transduction, cell cycle, transcription, and apoptosis. The number of genes expressed under transcription mechanism increased in diapause eggs at 30 hrs compared to 18 hrs; where as in non diapause eggs the number of genes decreased. The genes involved in metabolism in non-diapause eggs at 18 hrs was 6% while, no genes were expressed at 30 hrs. Under stress mechanism, no genes were expressed in non-diapause eggs at 18 hrs while, at 30hrs 12% of the expressed genes fall under stress mechanism. In the signal transduction category there was not much difference in the number of genes expressed in diapause eggs at 18 and 30hrs while in non-diapause eggs the number of genes expressed decreased from 24% at 18hrs to 9% at 30hrs. The overall genes expressed at 18hrs was higher than that at 30hrs under both diapause and non-diapause conditions indicating that crucial biological processes for initiation or termination of the diapause mechanism occur during 18 hr time period.

Another approach to develop NPV resistant bivoltine has been taken up by using double stranded RNA interference techniques. The four important genes of the NPV i.e. *ie1*, *leff1*, *lef3* and *P74* have been targeted. Following the technology number of transgenic lines developed at CDFD, Hyderabad. In This project three transgenic silkworm lines MEF 118B, MEF 154D and MEF 164B have been selected. The recipient lines which are regularly being used as parents for making crosses like CSR 4 CSR 27 have been selected. The transfer of the transgenes has been introgressed by back cross breeding program. Thus six combinations of the bivoltine lines have been generated. The donor parents are being selected every time by observing eye color (DS red protein gene as a marker) associated with the transgene. Now the lines are at BC4F2 generation.

1.10.4 Molecular Pathology

Five mulberry insect pests' viz., Lime butterfly (*Papilio demoleus*), Common mormon (*Papilio polytes*), Crimson Roso (*Pachliopta hector*), Common Indian crow (*Euplea core*) and plain tiger (*Danaus chrysippus*) from the mulberry fields of Kolar, Chickaballapur and Bagalore Districts have been collected. Except *Danaus chrysippus*, remaining four insect pests found to have microsporidian infection. Studies on spore morphology (phase contrast), pathogenicity, mode of transmission and cross infectivity were carried out. Cross infectivity studies revealed that, except *Euloea core* other can infect the silkworms with low virulent nature. The molecular analysis in order to know the species status of the identified microsporidian by using SSU-rRNA gene analysis has been carried out. The nucleotide sequence homology showed that these microsporidian belongs to the genus, *Nosema* Out of eighteen isolates of microsporidian species identified from the tasar silk moths from different states of Andhra Pradesh and Jharkhand, DNA was isolated form the six microsporidian species. The small subunit ribosomal RNA (SSU-rRNA) sequence gene was amplified, cloned, and sequenced from each of the 6 microsporidian isolates. These sequences were

compared with 32 othermicrosporidian SSU-rRNA sequences to develop a phylogenetic tree for the microsporidian isolated from the tasar silk moth, *Antherea mylitta*. Of the 6 microsporidian isolates, one isolate has gene sequence similar to *Vairmorpha* and others have the sequence homology with the *Nosema*.

1.10.5 R&D Projects during XI Plan

A total of 27 projects were undertaken by (SBRL), Bangalore during XI Plan period out of which 12 has already been completed, 17 are in progress. The institute had applied for only 1 Patent during XI Plan period.

A total number of 17 Research papers were published during XI Plan period. The institute organized 11 training programs which was participated by 54 people.

SBRL, Bangalore received a total of Rs. 55.39 lakhs during the year 2007-08, Rs. 91.12 lakhs during the year 2008-09, Rs.129.34 lakhs during the year 2009-10, Rs.64.45 lakhs during the year 2010-11, Rs.47.16 lakhs during the year 2011-02 by CSB and other sources.

1.10.6 Achievements of the Institute as a result of R&D Projects taken up during XI Plan

During the XI Plan a number of initiatives have been taken up with a view to utilize modern scientific knowledge to (i) evolve robust silkworm breeds (ii) techniques to diagnose silkworm disease very precisely (iii) identify association of genes with NPV tolerance, diapause mechanism, pest infestation, quality and quantity of eggs. There is fruitful attempts to find out pathogens associated disease like flacherie and pebrine so that appropriate control measures may be taken up. Simultaneously efforts were done to unravel genetic structure of *A.mylitta*, *A.assamensis* and *Samia cynthia ricni* population so that breed improvements could be implemented in non mulberry sector too.

1.11 TARGETS & ACHIEVEMENTS OF THE SCHEME DURING XI PLAN

1.11.1 Financial progress of the R&D Scheme

It may be noted that the revised outlay substantially increased from the original outlay of Rs.94.71 crores to Rs.144.60 crores in the revised outlay by the end of XI Plan. Among the 13 sub components of the scheme only 3 subcomponents exceeded the initial plan outlay in terms of actual expenditure. These sub components are R&D activities of CSB institutes. The expenditure almost doubled in this subcomponent as it increased from Rs.60.01 crores to Rs.119.72 crores in the revised outlay. Similarly, R&D support for establishment of farmer's field schools and transfer of technology marginally exceeded the initial outlay. Financial progress was very less in the case of some subcomponents such as IT Initiatives (14.5%), Product development cell (32%), training initiatives (47%), remote sensing and GIS in sericulture development (62%) etc.

1.11.2 Physical progress of R&D Scheme

R&D is the mainstay for the development of sericulture industry, which has been exclusively taken care of by Central Silk Board through a network of Research Institutes for all the

sectors. During the year 2001, the Department of Science and Technology, Government of India has declared Central Silk Board as a Science and Technology (S&T) organization as a tribute to its pioneering research in the field of sericulture. Being an S&T organization, research and development, extension and training are the major activities of the CSB, which are carried out through 9 major research institutes, 21 Regional Sericultural Research Stations and 55 Research Extension Centers, 6 Silk Conditioning and Testing Houses (SCTHs) & 9 Demonstration Cum Training Centers (DCTCS) in post Cocoon technology in Mulberry, Tasar, Muga & Eri.

The three main research institutes for mulberry sericulture are located at Mysore (Karnataka), Berhampore (West Bengal) and Pampore (J&K). One institute functioning exclusively for Tasar is located at Ranchi, Jharkhand, and for Muga and Eri, at Ladoigarh, Assam. An exclusive Research and Training Institute (CSTRI) for tackling post cocoon issues is functioning at Bangalore. In order to give focused attention to seed, a Silkworm Seed Technology Laboratory (SSTL) is functioning at Bangalore, for preserving and maintaining mulberry and silkworm genetic materials, a Central Sericultural Germplasm Resources Centre at Hosur and to exploit the bio-technological knowledge in sericulture, a Seri-Biotechnology Research Laboratory is functioning at Bangalore. Each institute along with the Regional Research Stations carry out research on a variety of fields, the output of which are transmitted to field after undertaking testing and fine tuning at Research Extension Centers. In short, the sector is loaded with a number of exclusive research institutions and supportive units to develop, fine tune and propagate findings and technologies which ultimately benefit the sericulture industry.

The R&D activities on sericulture is under the exclusive domain of CSB and over the years, these institutes have contributed significantly to the development of silk industry in terms of increasing production, improving productivity and enhancing quality norms matching with international standards. Almost all the host plants being used by sericulture farmers are developed through R&D efforts along with the new silkworm breeds, package of practices, post cocoon technologies, disease management and a number of other technologies and findings which are readily accepted by farmers over the years. The development and introduction of improved cross breed and Bivoltine hybrids for tropical Indian conditions have heralded for major improvements in sericulture industry and the country is steadily but slowly reducing the demand supply gap.

The output derived from the R&D has translated into productivity improvements in spite of drastic reduction in host plant cultivation. During the XI Five Year Plan period, raw silk production (kgs) per Hectare has grown from 86.12 to 90.55 and renditta (quantity (kgs) of cocoons required to produce 1 kg. raw silk) decreased from 8.2 to 7.95. The improvements in productivity parameters have helped the industry to attain the annual average growth rate of 4.25% during the XI Plan period.

A total of 120 new technologies have been developed by various R&D Institutes during XI Plan period. Out of which 60 Technologies have already been disseminated for the use of Sericulture farmers and processors.

1.12. Gist of the Observations of R&D Scheme implemented during XI Plan

- The new variety, “Anantha” gave about 60 MT in South India under irrigation. Another new variety, Vishala stood no.1 throughout the country and yielded 60 MT under irrigated conditions.
- 18 new hybrids (8 bivoltines, 7 multi x bivoltines and 3 multivoltines) were authorised during 2010, with high productivity.
- The deadly papaya mealy bug infestation on mulberry plant was effectively contained.
- Around 40 innovations were filed for patenting, of which 16 technologies have been commercialized.
- Integrated Nutrient Management [INM], Integrated Pest Management (IPM), Integrated Farming Systems suitable for mulberry were developed and promoted in the field.
- Developed and popularized improved sericulture equipments to the field,
- Pneumatic Lift for looms, improved Reeling cum twisting machines, motorized charkha, improved spinning wheel, improved handlooms have reduced drudgery and improved productivity and quality of silk, and
- Dupion silk reeling machine developed and is being popularized.
- A tetraploid genotype of *Terminalia arjuna* having succulent lamina and shorter internodal length was developed.
- A semi synthetic diet for tasar silkworm was developed and patented.
- Solar power source was used for spinning machines to spin upto 280 g of yarn per day. The income of spinner per day increased to Rs.175/-.
- Control of muscardine disease of muga silkworm by using newly developed anti-muscardine “Lahdoi” can save 60-70% muga cocoon crop during winter.
- Heterozygosity in muga silkworm populations both in domestic and wild was identified. This probably provides a scope for silkworm improvement programme.
- A diapause stock of muga silkworm has been isolated having a pupal diapause of 135 days pupal period during September-October season.
- A box type mountage has been designed and fabricated for cocooning of muga silkworm which require less man power (saving of 60%) and smaller space and produce superior quality cocoons.
- A new chemical formulation named, ‘Muga Silk Plus’ has been developed for cooking of muga cocoons that could improve silk recovery from the existing level of 40-45% to 50-55%.
- An improved, power operated muga reeling machine (BANI) has been developed for reeling untwisted yarn for weft. It can be operated by a single person and the productivity is 120-150 g per day against 40-60 g per day per two reelers by bhir.
- A high yielding eri silkworm breed C2 with higher fecundity and shell weight has been evolved to increase productivity.
- Developed a Platform rearing technology of eri silkworm which consisting of 3 nos. of platforms (each of 1m x 2m size made up of bamboo strips) to accommodate 25-30 dfls.
- A bamboo strip type mountage (size 1 sq. m) has been developed for cocooning 500 mature worms of eri silkworm. The device is durable (5 years), requires less space to store and ensures better cocoon recovery (>90%).
- An 8-end multiend reeling machine has been developed.

- Process norms were evolved for silk reeling units.
- Sorting machine for grading of tasar cocoons was designed.
- A special brush for brushing tasar / muga cocoons before wet reeling was designed.
- An improved version of handloom (model II) (frame loom / pit loom) was developed.
- A parallel beat-up mechanism was designed for handlooms.
- A low cost electronic jacquard was designed for handlooms.
- A twin shuttle loom was designed specially for Nagaland weaving clusters.
- Nano carbon nitride was synthesized using silk fibroin and sericin by pyrolysis method.
- Developed a process to produce anti-crease finishing in silk fabrics
- Developed a process for improving dimensional stability in eri fabrics
- Developed techniques for block printing on muga and mulberry fabrics
- Developed technique for printing of silk fabrics with coloured mud as a pigment
- Developed dye extraction technique for neem and its application on silk textiles

1.13. Major achievements during XI Plan

During XI Plan, 303 Research projects were concluded, 34 technologies were assigned, 9 technologies were patented and 10 technologies were commercialized. The salient findings and a brief highlight of Research and Development activities are as follows:

Mulberry

A newly evolved mulberry variety 'SAHANA' recommended for mixed cropping in the existing coconut plantations. RC1 and RC2 varieties recommended for input resource constraint conditions in farmers mulberry garden.

Five new genotypes evolved for moisture stress and non-stress conditions were found to be significantly superior over the existing S13 and VI varieties.

Mulberry genotype, Tr-23 was identified as suitable genotype for acidic soil of hills / foothills with an annual leaf yield of 24.5 MT.

Photosynthetically efficient mulberry genotypes T-36 and S-1572 were identified for crop improvement through conventional breeding.

Total 1136 Mulberry accessions were maintained under ex-situ conservation. Mulberry accessions were characterized for morphological, reproductive and leaf histological parameters.

Disease control package for nursery diseases, root rot and root knot has been developed. A herbal product Chetak was developed for the control of major foliar and root diseases of mulberry was developed.

Bivoltine silkworm hybrids suitable for rearing through out the year have been developed. CSR50 x CSR51 and (CSR52xCSR50) x (CSR51 x CSR53) have been selected for authorization.

A new multivoltine x bivoltine hybrid (L14 x CSR2) was developed to produce gradable silk. Some potential hybrids viz. ND7 x CSR2 (Jayalakshmi), NDV6 x CSR2 were developed.

A total of 12 bivoltine silkworm genetic resources were introduced to gene bank raising the total number of silkworm genetic resources to 441.

Long-term seed preservation technology was developed for multi x bi (PM x CSR2) eggs up to 50 days without affecting hatching, cocoon yield and cocoon traits.

Several disinfectant viz. General disinfectant Asthra, Rakshak and Decol were developed to prevent secondary contamination in Silkworm crops.

A multiplex PCR-based technique was developed to detect infections of Nosema bombycis, Nuclear polyhedrosis virus (NPV) and Densonucleus virus (DNV) in silkworm.

Suitable methods for intercropping of medicinal and aromatic plants with mulberry were evolved

Disease tolerant variety of mulberry was evolved. IPM for control of white fly has been developed.

Developed low cost package for mass production of Nesolynx thymus and Exorista phillipinensis on housefly pupae and popularized biological control .

Vanya sector

Protocol has been developed for vegetative propagation of Terminalia arjuna and T. tomentosa, with rooting of about 75%. Post transplantation survival up to 90% has also been recorded.

Disease tolerant accessions of Terminalia species against leaf spot, black nodal girdling diseases have been screened.

Vaccine against virosis has been developed. Double vaccination either in I & II, II & III or once in each instar up to III significantly reduced virosis or improved the cocoon productivity from 62.3% to 71.70%.

Jeevan Dhara a botanical powder formulation has been developed to control the viral diseases in tasar silkworm. It reduces tasar silkworm virosis by 36.54% under outdoor rearing with improvement of cocoon yield by 10-12 cocoons/df.

RAPD analysis of eleven genotypes of T. arjuna and T. tomentosa indicated genetic variation in the genotypes.

Organic farming system of muga host plant has been developed. Som (Persea bombycina Kost.) showed highest leaf yield (11.14 T/Ha) under Dhaincha + FYM (5T/Ha) + vermicompost (1T/Ha) which was at par with recommended dose.

Intercropping of Colocasia in the effective interspaces som and kesseru plantation was successful without affecting the yield of main crops ie. Som and kesseru.

Eight eco-races of A. mylitta (Daba BV, Daba TV, Sukinda, Sarihan, Modal, Modia, Raily, Laria) are maintained in the Germplasm Bank.

Indoor chawki rearing technique of Antheraea mylitta has been standardized and improved grainage, incubation and chawki rearing technologies were developed .

Conservation of eco races of Antheraea mylitta (Raily, Sukinda, Bhandara and Andhra local) in its native natural habitat was conducted.

Biodiversity among different ecoraces of Tasar silkworm was investigated using molecular markers

High yielding variety of Oak tasar silkworm Antheraea proylei have been developed.

Three species of oak fed silkworms viz., A. proylei, A. pernyi, A. frithi and ten breeds viz., PRP₂, PRP₃, PRP₅, PRP₁₂, RPP₄, Blue, C₂₇, B₆, BY₁ and Yellow were maintained in the GPB.

Towards improvement of Muga cocoon production five promising genotypes of Som were evolved in North eastern region. Micro-propagation technique for Muga host plant Persea bombycina was standardized.

Semi-synthetic diet for rearing of early stage muga silkworm larve has been developed. Feeding response to diet was recorded as 87.0% based on larval survivability in 1st instar after 48 hours of brushing.

Seven wild muga silkworm stocks viz. RMRS AS001, RMRS AS002, RMRS AS003, RMRS AS004, RMRS AS005, RMRS AS006 and RMRS AS009 collected from Assam and Meghalaya are being maintained under Ex-situ condition for characterization.

Thirty seven micro satellite loci developed from Antheraea assamensis were screened for polymorphism.

High yielding eri silkworm breeds with higher fecundity and shell weight were evolved on the basis of higher fecundity and higher shell weight.

Ten eco-races of eri silkworm were maintained. 41 genotypes of Castor germplasms, 11 varieties of Tapioca and four other secondary host plants of eri silkworms were maintained.

C. Post Cocoon Sector

Tasar silk reeling package was developed and fine-tuned for propagation at the field level. Spun silk yarn from mulberry and non-mulberry wastes for the development of fancy yarns were produced.

Reeling process parameters were developed for the cocoons produced under unfavourable season. Bivoltine hybrid cocoons and multi-bivoltine cocoons were reeled employing combination of different stifling & cooking methods.

Low cost 8 ends / basin 10 basin multiend reeling machine has been developed for mulberry silk reeling.

Solar water heating system along with mini boiler for cooking and reeling for multiend reeling unit was developed.

Eight ends multiend reeling unit suitable for tasar and muga cocoon reeling with individual break stop motion has been developed which is capable of producing superior quality yarn with higher productivity.

A low cost solar operated hand spinning machine suitable for spinning all types of non-mulberry wastes and also mulberry waste has been developed for achieving better quality of yarn and higher productivity.

A twin shuttle loom has been designed and developed specifically for the requirement of North Eastern states to weave two narrow width fabrics simultaneously,

Apart from the regular R&D programmes, during XI plan, 12 special R&D initiatives were also taken up. Some of those programmes will be continued to XII plan as the set progress could not be completed due to various reasons. These components are; establishment of a Regional Silk Technology Research Station in Assam, establishment of Regional Eri Research Station for the Non-traditional States, strengthening of CTR&TI, Ranchi, strengthening of CMER&TI, Ladoigarh, establishment of Soil Science & Agro Chemistry facility, disease Forecasting and Forewarning, Remote Sensing, Training Initiatives, Transfer of Technology, and IT Initiatives.

The progress of the training programme imparted by R&D units during the plan was quiet appreciable and achievements always outpaced the targets set for the XI Five Year Plan.

CSB has also collaborated with IGNOU for a course on certificate in sericulture under distant education mode with compulsory practical training in the Research Institutes of CSB.

The progress on IT development in CSB are; upgraded networking and server with high speed internet connectivity, started with centralized application on MIS, web based Email facility to entire CSB units & staff, developed a data centre in CSB with 24x7 operational capabilities and hosted CSB website and other applications in CSB itself, strengthened IT infrastructure by replacing old and out-dated computers across CSB, networking of research Institutes completed at Ranchi & Ladoigarh, developed information kiosk on sericulture in different regional languages and installed at different states, and IVRS installed at CSR&TI, Mysore to assist sericulture farmers for immediate information on sericulture practices.

1.14. RECOMMENDATIONS

Research and development (R&D) has potential to offer long-term solutions to the problems of sericulture sector. The concerted efforts by R&D Institutes have helped in developing a number of new technologies and provided options to derive higher benefits at lower cost per

unit of output. Advancement in post cocoon technologies facilitated reduction in losses and helped in value addition. Although the technology alone is not sufficient to provide complete solution to the ailments of the sector, it is capable of offering better solutions. Hence, the role of R&D is critical in managing and boosting the silk production. Development of technologies and increased awareness about them among farmers has resulted in adoption of improved practices and technologies. Some of the suggested recommendations for making the scheme more effective during XII Plan is listed below:

- A multi-disciplinary approach is required i.e., on the lines of ICAR's All India Coordinated Crop Improvement Programme (AICRP).
- All R&D projects need to be managed on a Project Management mode.
- All extension activities to be taken on Mission Mode Approach
- Cluster Development Approach in sericulture growing areas need to be propagated.
- Schemes having applied value and with scope for both horizontal and vertical growth need to be incorporated.
- Majority of the scientists are in the age group of 50+, therefore recruitment of young scientists needs to be taken up on priority.
- Quality and creativity comes from employee satisfaction, therefore promotional avenues and career progression need to be streamlined under HRD.
- Survey and exploration of mulberry and silkworm genetic resources should be undertaken in unexplored areas within the country.
- Mulberry and silkworm genetic resources of exotic origin should be introduced through international channels.
- Backup centers for conservation of mulberry and silkworm genetic resources may be established in different agro climatic zones.
- Long term conservation of mulberry and silkworm genetic resources may be taken up through cryopreservation technology.
- The reeling Technology needs to be improved. The presently popularized technology has been developed 15 years ago. To make this technology more acceptable to the reelers, improvements need to be undertaken.
- Reeling of silk uses a good amount of water. The efforts may be made to recycle the waters by using simple technologies
- For the reeling process, alternate sources of energy such as solar energy may be tapped to reduce the dependence on wood. Also the whole process may be made more energy efficient.
- Non mulberry silk may be reeled by using wet reeling machines. CSTR developed machine may be modified as per the requirement of reelers of Vanya silk
- New machineries need to be developed for Vanya silk / twisting and soaking. Methods need to be standardized for efficient reeling
- Objective gradation method of tasar silk is not available. This needs to be developed, which will help the reelers and wavers in sorting out price disputes and it will help in improving the quality of tasar silk.
- Tasar, Eri and Muga silk needs more attention in product development, standardization of processes etc. Focused research may be conducted in these areas.
- The chemical processing of silk yarn/ fabric needs a lot of intervention. The colour fastness of silk fabrics needs to be improved by standardizing machines, dyestuff, process parameters, chemicals, etc.

- *Dimensional stability is a major concern for any silk fabrics. Finishing processes needs to be developed to solve the instability problem.*

Based on the field survey findings, it is recommended that the “Central Sector Scheme - Research & Development, Transfer of Technology, Training and IT Initiatives,” needs to be continued during XII Five Year Plan as well. It may also be noted that since CSB - R&D institutions are the sole agencies serving the technical and transfer of technology requirement of the sericulture sector in the country, there is an urgent need to augment the manpower and strengthen the infrastructure of these R&D centres with further funding to the tune of Rs.250 crores during the XII Five Year Plan for the survival and sustenance of the sector and also to make the Indian sericulture sector internationally competitive.

B. SEED ORGANISATION & HUMAN RESOURCE DEVELOPMENT

EXECUTIVE SUMMARY

2.1 Preamble

The Central Silk Board (CSB) is a statutory body constituted under the act of Parliament. It works under the administrative control of the Ministry of Textiles, Government of India. To fulfill the mandate, the CSB had set up a National Silkworm Seed Organization for production and supply of basic and hybrid seed for promotion & development of silk industry in the country.

Central silk Board has been implementing the central sector scheme namely Seed Organization and Human Resource Development, during the XI Five Year Plan. In order to find out the effectiveness of the implementation of the Central Sector Scheme, CSB engaged National productivity Council (NPC) to undertake a third party evaluation of the scheme during XI Five Year Plan.

Since the scheme has two parts such as Seed Organization and Human Resource Development, the evaluation study has been separately conducted for these two segments of the scheme.

2.2 Seed Organization

Central Silk Board, over the Plan periods, had invested much of its material and manpower to develop well organized and systematic “Seed Organizations”, separately for Mulberry, Tasar, Muga & Eri. Each of these organizations have been provided with necessary functional freedom supported by adequate facilities to upkeep a three tier multiplication system for retaining the inherent genetical characters like, hybrid vigour and disease freeness and above all maintain and regulate high quality standards among all the stakeholders in the seed production scenario. Seed Organisations have also been entrusted with the responsibilities of implementing the recently enacted Seed Act to bring in quality standards in Seed production process in the country.

2.3 Human Resource Development (HRD)

The HRD component includes the Project monitoring activities of CSB coming under Central Sector Plan programmes carried out through 300 CSB units located at different parts of the country. These activities are coordinated at National level by CSB HQs, Bangalore. At the regional and local level CSB has Regional Offices (10 nos.), Certification Centres and Price Stabilization Programme for Vanya through the Raw Material Banks located at Chaibasa (Jharkhand) and Sibsagar (Assam).

2.4 Objectives of the Evaluation Study

A. Silkworm Seed Organization:

To study the role of Silkworm Seed Organization in the maintenance of the quality silkworm basic seeds and supply of commercial silkworm seeds, support of technical inputs to sericulturists/private entrepreneurs and its effectiveness in improving the production & productivity for quality cocoon yield.

B. Human Resource Development:

To study the effectiveness of the implementation of Human Resource Development in Central Silk Board, exposure of employees about new technologies in research field, improvement of subject knowledge etc. Effectiveness of the implementation of Human Resource Development programme for the advancement of its employees, enforcement of HRD policies for the progression of its employees issued by Govt. of India.

2.5 Terms of Reference for the Evaluation Study

A. Silkworm Seed Organization:

- i. Evaluate how farmers are benefited from Seed Support and Technical Assistance and Human Resource Development Programme covering both Mulberry & Vanya sector, viz., NSSO: BTSSO; MSSO: ESSO and zone-wise ZSSPOs: SSPCs.*
- ii. Evaluate LSPs and their grainages in providing quality seed, their difficulties, etc.*
- iii. Evaluate the responsibility of ensuring quality improvement and to keep abreast with the latest technology to provide Training to Licensed Seed Preparers (LSPs) and Chawkie Rearing Centers (CRCs) as Amended in the CSB Act & Central Silkworm Seed Regulation -2010.*

B. Human Resource Development:

- i. Study the effectiveness of the implementation of Human Resource Development in Central Silk Board.*
- ii. Exposure to employees about new technologies in research field, Accounts, General Administration,*
- iii. Improvement of subject knowledge among the employees.*
- iv. Effectiveness of the implementation of Human Resource Development programmes for the advancement of its employees.*
- v. Implementation of the Govt. of India policies.*

2.6 Methodology adopted for Evaluation Study

Separate methodologies have been adopted for the evaluation study of Seed Organization and HRD scheme.

2.6.1. Silkworm Seed Organization

The study has been undertaken broadly in two phases. In the **first phase of the study** a thorough review of the technology/methods adopted by various seed organizations for seed production, their intended objectives, their complications etc., have been analyzed and in the **Second phase of the study** field interviews have been carried out with structured questionnaires. Field survey included various seed organizations of CSB seed organizations of Department of Sericulture, Licensed Seed Producers, Graineurs, Seed cocoon farmers (who actually uses seed), Sericulture demonstration/Extension officers who provide training to Graineurs/ LSPs, staff of Chawkie Rearing Centers (owned by State Government & CSB) Field survey covered 25 NSSO/BTSSO/ESSO/MSSO seed organizations, 17 LSPs/ Private Graineurs, 9 Chawki Rearing Centres and 58 cocoon farmers or beneficiaries.

2.6.2 Human Resource Development

In the **first phase of the study** the data/information regarding the Human Resource Development programmes of CSB during the XI plan has been compiled from CSB publications and **in the second phase of the study** detailed field survey was conducted with a view to get feedback from implementers and the beneficiaries with structured questionnaires. The respondents included Human Resource Department of CSB, officials of CSB who are managing various HRD programmes in the areas of research, accounting, administration and beneficiaries

2.7. CATEGORY WISE OBSERVATIONS

CSB had invested much of its material and manpower to develop well organized and systematic “Seed Organizations”, separately for Mulberry, Tasar, Muga & Eri National Silk Worm Seed Organization (NSSO) for mulberry sector, Basic Tasar Silk Worm Seed Organisation (BTSSO) is involved in Tasar seed development and distribution, Muga Silkworm Seed Organisation (MSSO) is involved in muga seed development and distribution and Eri Silkworm Seed Organisation (ESSO) is involved in development & distribution of Eri Seed. This institutional framework has been provided with necessary functional freedom supported by adequate structural facilities to keep a three tier multiplication system for retaining the inherent genetic characteristics such as hybrid vigour, disease freeness and above all maintains and regulates high quality standards among all the stakeholders in the seed production scenario. The ultimate aim of CSB in seed sector is to assume more as a regulating and facilitating authority by limiting its role in maintaining the nucleus seed source and producing some portion of basic seed, especially bivoltine and Vanya silk sector, transform and prepare the State owned seed units as basic seed production units, and to generate the entire commercial production through private participation with necessary quality control measures.

Further the Human Resource Development scheme addresses the activities including Board’s Secretariat, Regional Offices, Raw Material Banks and Certification Centers. The Board’s Secretariat coordinates the technical activities of all its nested units in research, extension, basic seed production, publicity, price stabilization for Vanya sector, market development etc. besides maintaining the overall administrative and financial apparatus of 300 units manned by about 3900 employees.

2.7.1. Seed Organisations

Seed organizations have the mandate to implement the recently enacted Seed Act with a view to bring in quality standards in Seed production process. The Seed organizations have been playing a major role in sufficing the demand for seed at various levels. With the advent of high end technology and quality based pricing the basic support i.e. the seed supplied to the rearers need to be of very high standard. Up-gradation of infrastructure facilities at NSSO, BTSSO, MSSO and ESSO units are very much important.

2.7.1.1 National Silkworm Seed Organization (NSSO)

National Silkworm Seed Organization (NSSO) is a separate entity under Central Silk Board, established in 1975 to supplement the efforts of State Governments in supplying high quality Bivoltine and Multibivoltine silkworm seeds to the farmers. The measurable physical achievements under the category of the ongoing activities of NSSO are the DFL production

NSSO is the only organisation having the unique distinction of being ISO 9001:2008 certified. In spite of the stiff competition from other Seed producing agencies like Department of Sericulture and LSPs, considerable share of the country's seed requirement is met by the nineteen SSPCs of NSSO. During 2011-12, against a target of 315 lakh DFLs, 321.54 lakh DFLs were produced, which is a great achievement and the seed production crossed the 3.00 crore mark, after a considerable gap of 2-3 decades. A significant improvement in the quality and quantity of cocoons generated at the farms also was observed. An expenditure of Rs. 19.46 Crores was spent under the head Mulberry Seed Production for the XI Five Year Plan. The performance in terms of utilization of the funds has been found satisfactory. However, there is a requirement of strategic shift in terms of increasing the Bivoltine Seed Production instead of Crossbreed seed production for quality improvement.

2.7.1.2 Basic Tasar Silkworm Seed Organisation (BTSSO)

BTSSO undertakes the responsibility of producing the entire basic seed requirement of the Tasar sector, generated through a three tier multiplication system. The basic seed produced by the Basic Seed Multiplication Training Centre (BSMTCs) would be further multiplied by the State grainages and private grainers before reaching to the farmers.

BTSSO has been performing its seed production activities through 1 nucleus seed unit at Kargi Kota and 21 BSMTCs located in 9 tasar producing States. It is observed that State Pilot Project Centres (PPCs) and private grainers are yet to achieve the productivity norms although there are sign of sporadic improvement due to the adoption of improved methods. These experiences lead to the conclusion that the technicians associated with the seed production would have to upgrade their technical and managerial skills besides maintaining high level of hygienic atmosphere in the grainages. Hence, necessary skill up-gradation programmes are being undertaken by the BTSSO on a continuous basis. An expenditure of Rs. 15.50 Crores was spent under the head BTSSO during the XI Five Year Plan. The performance of the sector has been satisfactory and considering the gap between

demand and supply of tasar seed it is imperative to promote private entrepreneurship for commercial seed production.

2.7.1.3 Muga Silkworm Seed Organisation (MSSO)

Muga Silkworm Seed Organization (MSSO) is mandated to supply the entire basic seed (P4 & P3) required for the sector to the State farm cum grainages and private grainuers for further multiplication as commercial seed. Eight P-4/P-3 units and one SSPC under Muga sector continued with maintenance of parental stocks for basic seed production and supply in addition to commercial seed production. An expenditure of Rs. 5.66 Crores was spent under the head MSSO for the XI Five Year Plan. During 2011-12, a total of 2.130 lakh gram Muga basic seed and 0.386 lakh gram commercial seed were produced with over all achievement of 100.56 %.

2.7.1.4. Eri Silkworm Seed Organisation (ESSO)

Eri Silkworm Seed Organization (ESSO), have been established to meet the need of basic seed production and supply to Sericulture Departments of different State. Ericulture is a household activity practiced mainly for protein rich pupae, a delicacy for the tribal. Resultantly, the eri cocoons are open-mouthed and are spun. The silk is used indigenously for preparation of chaddars (wraps) for own use by these tribals. In India, this culture is practiced mainly in the north-eastern states and Assam. Later on the culture was also introduced in Andhra Pradesh due to high availability of food plants and the same has also been successful. It is also found in Bihar, West Bengal and Orissa. Under ESSO, ESSPCs against a target of 2.75 lakh dfls, a total of 3.179 lakh dfls were produced which included 0.377 lakh Eri basic and 2.801 lakh commercial seed, the over all achievement was 115.60% during 2011-12. An expenditure of Rs. 1.70 Crores was spent under the head ESSO during XI Five Year Plan. The performance in terms of utilization of the funds has been satisfactory.

Implementation of the provisions of Central Silk Board (Amendment) Act, 2006 has been an important mile stone. The various Seed Organizations existing with Central Silk Board considers that creating awareness among the seed sector entrepreneurs and seed cocoon producers about the Central Seed Act is of prime importance. In this direction, awareness programmes, booklet preparation detailed information pertaining to the Act, registration of producers and training to stakeholders are regularly undertaken by Seed Organizations.

From the field survey undertaken by the NPC study team it was revealed that in majority of Chawkie Rearing Centres (CRCs), impact of Sericulture activity on beneficiaries' family income was seen to be a positive. Most of the respondents from Licensed Seed Producers (LSPs)/Private Graineurs category also informed that they have benefitted and there in an increase in their annual family income due to sericulture activities.

Some of the grey areas that need to be addressed as reported by CRCs, LSPs and Seed Rearers that they require vehicle/ van for transportation of chawki reared worms, stability of inconsistent cocoon rates in the market, requirement of increase in financial assistance for disinfectant garden maintenance and need for more rearing equipment, Additional provision for CRC irrigation facilities, requirement of Subsidy for grainage building and sprays,

Requirement of cocoon market and cocoon bank, New technology subsidy to be provided for machine & technology, Requirement of Quality vermi- compost and Quality DFLs, more training on proper rearing and provision of more rearing appliances especially rearing nets, provision of Insurance scheme, etc.

Major Improvements as reported by the CRCs & LSPs and seed rearers in the Quality of Seed were that the increase in productivity/100 DFLs with new hybrids, increase in income, Hatching percentage increased, Disease free layings Cocoon yield/quality increased, Fecundity increased, further with better administration the Availability of DFLs was on time, Rich Laying & more than 95% Chawki & more Average yield of cocoon.

2.7.2. Human Resource Development

Human Resource Development, the process of equipping individuals with the understanding, skills and access to information, knowledge and training that enables them to perform effectively. The functional arms for undertaking the activities of this component include Board's Secretariat, Regional Offices, Raw Material Banks and Certification Centers. The Secretariat also acts as an interface between the various arms of Govt. of India, State Sericulture Departments, national and international agencies, private stakeholders starting from the poor farmers to high profile exporters and a slew of other agencies associated with sericulture and silk industry. Apart from the regular monitoring of research and technical on-going activities, the secretariat is also involved in conceiving, formulating, evaluating and monitoring various centrally sponsored schemes, such as Catalytic Development Programme (CDP), implemented through the state sericulture departments.

Besides the above, bulk of the human resource requirement of all its departments are met exclusively by the HQs, administratively headed by Member Secretary supported by Research, Technical, Establishment, vigilance, Accounts, Audit, Bills, Stores, Law, Labour, Statistics, Corporate & Entrepreneurs Development, Publicity, Rajabhasha, protocol sections. It also houses the Office of the Chairman. The Regional Offices (RO) of CSB work in various states for effective liaison of the activities of CSB in these states. The activities of all the States are also to be monitored through State Level Monitoring Committees, wherein the technical support and inputs from ROs are essential for organizing the meetings and to follow-up the decisions taken thereof.

As far as the silk industry is concerned, the two major players are the CSB and State government departments. Quality Human Resource is one of the key factors/required for the success of these organizations; therefore the internal resources should be trained and regularly updated, refined and maintained in desired manpower condition. Regular training based on containing latest techniques & methods on the sericulture sector are organized by Central Silk Board. Further, the field survey reflected that periodic audit is undertaken annually for checking whether Government of India policies have been implemented and followed strictly.

Suggestions & Improvements for betterment of the HRD scheme include organizing refresher courses/ seminars/ workshops for scientific community to discuss new innovations, technological breakthroughs, disseminating the new developments in science & other related fields to the field on a regular basis. There is a requirement of Exposure to Management,

especially with changing world trade and liberalization scenario, changing paradigms of general management thoughts & techniques, extension concepts and tools and policy changes, it is pertinent for the scientific and technical personnel to understand and comprehend these changes taking place around them and get exposed to the new developments on a continuous basis. The support service personnel require regular reinforcement and exposure to changes in rules and regulations, administrative and financial provisions and concepts and motivational interventions at desired intervals.

In order to eliminate the presence of middlemen who were exploiting the primary producers, CSB had established 3 Raw Material Banks (RMBs) for Tasar, Eri and Muga with a network of 8 sub-depots in different states.

The achievements of this sub-component are not measurable in physical terms except the progress of RMB. But this is a much-needed backward linkage to facilitate the nested units and stakeholders to achieve the mandated targets.

An expenditure of Rs. 36 Crores was spent under the head HRD-Coordination & Market Development during XI Five Year Plan.

2.7.3. Overall Observations

It has been found that the seed organization and HRD scheme has been quite successful in achieving the mandate to develop well organised and systematic “Seed Organizations separately for Mulberry, Tasar, Muga and Eri. These seed organizations played a critical role in the maintenance of the quality silkworm basic seeds and supply of commercial silkworm seeds, support of technical imports to Seri culturists/ private entrepreneurs. These seed organisations were quite successful in improving the production and productivity for quality cocoon yield during XI Five Year Plan. Considering overall health and survival of the sector for providing employment and livelihood to more than 75 lakh people mainly women and SC/ST people in the remote and tribal areas, quality seed is critical to maintain productivity hence the Govt. support through this scheme need to be continued during XII Five Year Plan as well especially in view of the recently enacted Seed Act.

HRD scheme contributed immensely to maintain and manage CSB Head Quarters and about 300 field officers spread across the breadth and length of the country. The scheme also helped in providing the necessary training to the manpower of about 3900 employees of CSB in areas of technology, management and administration. The scheme also helped in developing regional Raw material banks at (Chaibasa (Jharkhand) for Tasar and Sibsagar (Assam) for Muga cocoons).

2.8. GIST OF MAJOR OBSERVATIONS/FINDINGS

2.8.1 Seed Organizations

- *Central Silk Board, over the Plan periods, had invested much of its material and manpower to develop well organized and systematic “Seed Organizations”, separately for Mulberry, Tasar, Muga & Eri.*

- *The Seed organizations have been playing a major role in supplying quality seed to meet the demand for seed at various levels.*
- *Each of these organizations have been provided with necessary functional freedom supported by adequate facilities to upkeep a three tier multiplication system for retaining the inherent genetical characteristics like, hybrid vigour and disease freeness and above all maintain and regulate high quality standards among all the stakeholders in the seed production scenario.*
- *Seed Organisations have also been entrusted with the responsibilities of implementing the recently enacted “Seed Act” bring in quality standards in Seed production process.*
- *Major seed organizations working in the area of mulberry sector is National Silk Worm Seed Organisation. The target for NSSO during 2011-12 was set at 315 lakh DFLs whereas the actual production was 321.54 lakh DFLs.*
- *Basic Tasar Silk Worm Seed Organisation is involved in Tasar seed development and distribution with a target of 32.59 lakh DFLs during 2011-12 and the achievement was 34.76 lakh DFLs.*
- *Muga Silkworm Seed Organisation is involved in Muga seed development and distribution and the achievement was 2.52 lakh DFLs during 2011-12.*
- *Eri Silkworm Seed Organisation is involved in development and distribution and the achievement was 3.17 lakh DFLs during 2011-12.*
- *With the advent of high end technology and quality based pricing the basic support i.e. the seed supplied to the rearers need to be of very high quality with appropriate hatching, egg recovery, disease control, vigour.*
- *Quality and cost of production are the key factors for sustaining in the Post liberalization and free trade regime. Technology is critical, therefore modernization of the Seed organizations and up gradation of technology is imperative.*
- *During the field survey by NPC, it was observed that in some cases commercial cocoon was fetching better prices than the Seed cocoon*
- *Most of the seed organizations were of the view that the equipments and technologies available were not upgraded over the years.*
- *An effective recording of the seed based operations of all the seed organizations shall require the linking of all the units with the Information Technology network and data base of the stake holders,`*
- *Adoption of strict pruning schedule & application of inputs for some plants, field sanitation, cellular rearing following P-4 level production norms coupled with adherence to effective microscopic examination of silkworm larvae, pupae & moth*

following Fujiwara technique has immensely reduced the disease incidence besides improving quality and productivity in the unit.

- *Officers and staff dealing with the seed production at the state level were relatively less aware of advanced techniques, usage of the computer/internet for regular feedback and online support mechanism.*
- *During the discussions with DOS official of Karnataka it was found that during the last few years the firmly established Licensed Seed Producers network in Karnataka is showing signs of weakness.*
- *Seed Zone receive lesser cooperation from DOS and the zones are considered to be the responsibility of CSB for improvement in the productivity and quality of Silkworm seed.*
- *The Assistance given for the construction of Rearing house and raising the plantation was not sufficient as discussed with most of the seed cocoon farmers. The adopted seed rears (ASRS) are given rearing bays & training under the ASR component.*
- *Provision of suitable transport facilities to seed organisations for the extension of field related sericulture activities of seed organizations at grass root level for various sericulture a activities need to be ensured.*
- *Other than producing nucleus and basic seeds at the CSB level, support may be extended to the states to strengthen seed production units and encourage private participation through different programmes. Seed is the vital link for the success of the sericulture industry.*
- *The cold storage facilities with CSB are very crucial for the storage of seed and the same require to be upgraded/operationalized with immediate effect for preventing wasteful utilization of Resources and immediate steps need to be undertaken in this regard.*
- *There was deficit of proper infrastructure for Grainage and pre cocoon operations in Non mulberry sector.*
- *Visits of Seed Officers and Seed Analysts to the field especially in the Non mulberry sector need to be ensured.*
- *Establishment of proper connectivity, basic amenities and infrastructure for the functionaries at the field level need to be provided for both Mulberry and Vanya Sectors.*
- *Eri seed production by the private Graineurs was not being undertaken in an organized manner.*

- *Private seed producers were of the opinion that better technical support, testing facilities and marketing of Mulberry, Tasar, Eri and Muga seed would be helpful in improving the quality of the seed produced.*
- *The rearers and the field level officers were of the opinion that demonstration training could improve the acceptability of new technologies and best rearing practices.*
- *Lesser availability and fixed head wise allocation of fund for training was also a major hinderance in organizing training programmes.*
- *Supply of disinfectants was a major boon to the Adopted Seed Rearers and it had reduced the disease incidence. Further, Adopted Seed Rearers also advocated the provision of Input support for standardised seed production.*
- *CRCs were of the view that incubation chambers could ensure uniform hatching and greater crop success.*
- *In North and East zones, due to lesser demand, seed cocoon aren't procured from all farmers times the seed cocoon producers are forced the seed cocoon in the open market for reeling purpose.*
- *During XII Plan, under the purview of seed act there was a requirement of establishment of suitable quarantines units setup for silkworm seed export/ import.*
- *During the field visit of NPC Study Team, it was observed many seed cocoon producers were not covered under insurance scheme that was offered under CDP.*
- *Chawkie reared worms and Seed cocoons had to be transported for seed production and multiplication, for the purpose there is a requirement of a vehicle (four wheeler).*
- *It was seen in the field the number of seed producers was going down drastically. It may be due to better avenues for the stakeholders in other areas.*
- *ISO certification of silkworm seed produced by LSPs and P1 grainages through ISO 9001:2008 shall ensure better, quality, monitoring and organized production.*
- *Multivoltine seed cocoon growers need to be supported through infrastructure, equipment and inputs to sustain and improve the cross breed seed production and cocoon productivity.*
- *There is a requirement of scientists / staff given the work load in view of ageing / retirements for the maintenance of units and their sustenance.*

2.8.2. HRD Scheme

- *The HRD component of the scheme includes project monitoring activities coming under Central Sector Schemes through 300 CSB units controlled by the Head office at Bangalore.*
- *The CDP Implementation and Monitoring Mechanism in the new format with Zonal Cells need induction of additional skilled manpower for effective functioning and operation. There are many important technical activities in CSB HQs and Regional Offices like Bivoltine development, Cluster development programmes, Ser-business enterprises development, Seed Act Implementation, Post Cocoon Affairs, Corporate and Entrepreneur Development, Product Design Development and Diversification, Vanya Silk Market Promotion, Parliament Affairs, Research Coordination, Capacity Building, price support system, Development of Community Based Organizations, Insurance support, Foreign Affairs, Women and Tribal affairs, Credit facilitation, etc., which needed focused attention and required to be manned by middle level Officers.*
- *These Middle Level Officers must have profound knowledge in sericulture besides expertise on project preparation, monitoring and reviewing, managerial concept on sericulture, sensitized on socio-economic aspects, good proficiency in language and computer literacy.*
- *At present, adequate Officer level staffs are not readily available to undertake these activities in a focused manner.*
- *Entry level of the Board Secretariat Technical Cadre need to be augmented on account of the vacancies arises as above and also due to increased work load in the Plan activities of CSB.*
- *The analysis of organizational need necessitates organizing refresher courses/seminars/ workshops for scientific community to discuss innovations, technological breakthroughs, disseminating the new developments in science & other related fields to the field on a regular basis.*
- *There is a varied range of pricing prevalent in Vanya seed sector.*
- *During the field visit, it was revealed that Muga graineur & are not given exposure mulberry rearing and graineunins outside NE states since they are involved in Muga culture. Further most of muga rearing and muga grainage trainings was not considered much useful by the beneficiaries.*
- *Franchise Chawkie Rearing Centre and disinfection were considered as the boon to the sericulture farmers and were found to be of high utility and importance.*
- *Most of the stakeholder was not aware with the various aspects of Silkworm Seed Act and its implementation.*

- *Regular fund allocation for maintenance functions of SSPCs, BSMTCs & SSUs is essential for the continuous technological & infrastructure up gradation.*
- *During the field survey, it was observed that demonstration training programme practically were helpful in better acceptance of technology and good sericulture practise. Further, Trainings in local languages ensured better acceptability and understanding. Further, the periodicity of trainings ensured better follow-up and scheduling of activities.*

2.9. RECOMMENDATIONS

2.9.1. Seed Organization Scheme

- *The Seed organizations have been playing a major role in supplying quality seed to meet the demand for seed at various levels.*
- *With the advent of high end technology and quality based pricing, the basic support i.e. the seed supplied to the rearers need to be of very high quality with appropriate hatching, egg recovery, disease control, vigour. The various units with CSB presently involved with seed production and multiplication have been performing to the best of their capabilities, but given the uphill task of increasing productivity, the continuous up-gradation of infrastructure facilities in NSSO, BTSSO, MSSO and ESSO units is most essential and desired.*
- *Quality and cost of production are the two key factors that determine the sustenance of any sector during sustenance of any sector during Post liberalization and free trade regime. Technology is critical, therefore modernization of the Seed organizations and up gradation of technology is imperative. Both advanced as well as indigenous technology needs to be developed and integrated in the system.*
- *The price rise seen in case of the commercial cocoon needs to be closely monitored and the price support at par for Mulberry silkworm seed crop rearers (Adopted Seed Rearers) for quality silkworm seed cocoon generation need to be ensured and followed by all the agencies involved and to be revised yearly.*
- *Establishment of isolated testing facility at Central Seed Testing Laboratory and establishment of International Laboratory Accreditation Cooperation certified laboratories with Central Seed Testing Laboratory for effective disease monitoring.*
- *An effective recording of the seed based operations of all the seed organizations shall require the linking of all the units with the Information Technology network and data base of the stake holders.*
- *Adoption of strict pruning schedule & application of inputs for mulberry, field sanitation, cellular rearing following P-4 level production norms coupled with adherence to effective microscopic examination of silkworm larvae, pupae & moth*

following Fujiwara technique has immensely reduced the disease incidence besides improving quality and productivity in the unit.

- *Officers and staff dealing with the seed production at the state level need to be trained in advanced techniques. Refresher courses and advanced programmes/usage of the computer/internet for regular feedback and online support mechanism are essential.*
- *During the discussions with DOS official of Karnataka, it was found that during the last few years the firmly established Licensed Seed Producers network in Karnataka is showing signs of weakness. It is critically important to put into optimum use of the facilities already created.*
- *Seed zone should be declared by DOS & Central Silk Board in close coordination for improvement in the productivity and quality of Silkworm seed. Entrepreneurship Development aspects may be included in training curriculum (Seed Act).*
- *The Assistance given for the construction of Rearing house and raising the plantation should be revised upwardly as the same has become insufficient due to the high inflationary trend over the last five years.*
- *Provision of suitable transport facilities for the movement of field related sericulture activities of seed organizations at grass root level for mobile disinfection work, chawki rearing, procurement of seed cocoon and seed extension work need to be ensured and given priority.*
- *Other than producing nucleus and basic seeds at the CSB level, support may be extended to the states to strengthen seed production units and encourage private participation through different programmes. Seed is the vital link for the success of the silk industry.*
- *The cold storage facilities with CSB are very crucial for the storage of seed and the same require to be upgraded/operationalized with immediate effect for preventing wasteful utilization of resources and immediate steps need to be undertaken in this regard.*
- *There is requirement of proper infrastructure for Grainage and cocooning operations in Non-mulberry sector.*
- *Visits of Seed Officers and Seed Analysts to the field especially in the Non-mulberry sector need to be ensured.*
- *Establishment of proper connectivity, basic amenities and infrastructure for the functionaries at the field level need to be provided for both Mulberry and Vanya Sectors.*

- *Organizing small scale Eri seed producers to form Private seed producers' in PPP mode in NE states need to be visualized and operationalised during XII Plan.*
- *There is a requirement of Assisting Private seed producers in tool support, testing facilities and marketing of Mulberry, Tasar, Eri and Muga seed.*
- *Initiating flexible but effective periodic testing and certification mechanism for private seed production units and adherence to the quality standards is an immediate requirement.*
- *Technology improvement is most essential to ensure Integrated Disease Identification and Management for the seed sector. The need based enhancement of knowledge of scientists in terms of new developments in their area of work both in terms of technology and experiential learning needs to be given top priority.*
- *More emphasis should be given on hands-on-training & exposure/field visits in order to provide a better understanding to the stakeholders. Model Farms may also be developed and Successful farmers incentivized through better coordination and monitoring.*
- *Unit cost of training may be increased by maintaining flexibility for utilization of fund under different heads within the unit cost by the implementing officer for better management of training programme.*
- *In light of seed act, provisions may be made to improve / strengthen seed area and seed rearers in non-traditional states.*
- *Rearing house subsidy and plantation subsidy should be raised in case of Adopted Seed Rearers for ensuring dedicated supply of seed.*
- *Free supply of disinfectants to be continued as it was felt essential by Adopted Seed Rearers (ASR)*
- *Motivational incentives to the seed production units on annual basis based on the performance.*
- *Input support to the Adopted Seed Rearers may be provided for sustenance of quality seed production.*
- *CRCs may be provided with incubation facilities in mulberry sector for uniform hatching and assured crop success.*
- *Establishment of Seed Cocoon Procurement Centres in North and East zones is required.*

- *Streamlining of quarantine procedure for export / import of silkworm seeds during XII Plan is required.*
- *Health insurance cover for workers and staff of silkworm seed production units should be considered.*
- *Vehicular (2-wheeler) support to the staff working in extension units is required for effective implementation.*
- *Vehicle facility (4-wheeler) for transportation of seed cocoons for SCPCs / SSPCs is essential as the existing vehicles are very old and need to be replaced.*
- *It was seen in the field the number of seed producers was going down drastically. It may be due to better avenues for the stakeholders in other areas. However, to ensure Retention / attraction for young generation for sericulture activity from rural areas, incentives and socio economic benefits need to be integrated in the scheme for Seed Rearers and Seed Producers.*
- *ISO certification of silkworm seed produced by DOS and LSPs through ISO 9001:2008 need to be taken up.*
- *ISO certification for P1 grainages*
- *Multivoltine seed cocoon growers need to be supported through infrastructure, equipment and inputs to sustain and improve the cross breed seed production and cocoon productivity.*
- *Improvement and popularization of new cross breed varieties in the field are required.*
- *Immediate / adequate recruitment / position of scientists / staff on par with the work load in view of ageing / retirements for the maintenance of units and their sustenance.*
- *Performance linked new marketing strategies maybe worked out by introducing monetary benefits based on the sale of commercial dfls to improve the efficiency in seed production units of CSB.*

Based on the findings of the evaluation study, it is recommended that there is an utmost need for increasing the level of financial support to the seed sector of Sericulture to the tune of Rs.90 crores as seed is the basic and primary requirement for the growth and development of Sericulture. Considering the fact that the Seed Sector in Agriculture, Horticulture and Other Allied Sectors are being supported by huge subsidies by the Government of India, Sericulture sector is also comparable under the given parameters of performance and it provides livelihood options to large segments of relatively poor and landless stakeholders based at rural and tribal areas dominated by women workforce.

2.9.2. HRD Scheme

- *The HRD component of the scheme includes project monitoring activities coming under Central Sector Schemes through 300 CSB units controlled by the Head office at Bangalore.*
- *The CDP Implementation and Monitoring Mechanism in the new format with Zonal Cells need induction of additional skilled manpower for effective functioning and operation. There are many important technical activities in CSB HQs and Regional Offices like Bivoltine development, Cluster development programmes, Ser-business enterprises development, Seed Act Implementation, Post Cocoon Affairs, Corporate and Entrepreneur Development, Product Design Development and Diversification, Vanya Silk Market Promotion, Parliament Affairs, Research Coordination, Capacity Building, price support system, Development of Community Based Organizations, Insurance support, Foreign Affairs, Women and Tribal affairs, Credit facilitation, etc., which needed focused attention and required to be manned by middle level Officers.*
- *These Middle Level Officers must have profound knowledge in sericulture besides expertise on project preparation, monitoring and reviewing, managerial concept on sericulture, sensitized on socio-economic aspects, good proficiency in language and computer literacy.*
- *At present, adequate Officer level staffs are not available to undertake these activities in a focused manner.*
- *Entry level of the Board Secretariat Technical Cadre need to be augmented on account of the vacancies arises as above and also due to increased work load in the Plan activities of CSB. For this purpose, few Technical Assistants with Degree qualifications and working in the field level technical cadre can be inducted into Board Secretariat Cadre at the entry level, without involving any creation or up-gradation of posts. These personnel can be inducted through a selection process conducted departmentally*
- *It is strongly recommended to strengthen the Project Management Division in CSB HQs and Regional Offices by instituting middle level Officers and bringing in qualified field level technical personnel to CSB HQs and Regional Offices to augment project monitoring mechanism of Central Sector and Centrally Sponsored schemes of CSB.*
- *The analysis of organizational need necessitates organizing refresher courses/seminars/ workshops for scientific community to discuss innovations, technological breakthroughs, disseminating the new developments in science & other related fields to the field on a regular basis.*
- *Requirement of Price support system to protect the primary producers from exploitation by middlemen through Raw Material Banks in Vanya seed sector.*

- *Muga graineur & rearers should be provided field visit to mulberry rearing and grainage outside NE states*
- *Training of Franchise Chawkie Rearing Centre management and disinfection to use mobile disinfection units as envisaged under the Seed Act may be implemented at a larger level and in intensified manner.*
- *Practical muga rearing and muga grainage trainings should be given to the farmers regularly to ensure higher level of adoption and understanding*
- *An intensive training and exposure programme for CSB Scientists, Seed Officers and Seed Analysts is a must along with Regular Orientation and Refresher Trainings for CSB Scientists, Silkworm Seed Producers and Chawki Rearers with due consideration to the aspect of Silkworm Seed Act*
- *Regular fund allocation for maintenance functions of SSPCs, BSMTCs & SSUs is essential for the ground level development of the seed sector.*
- *The training programme should be arranged on all the sericultural/moricultural aspects for different cadres separately. The course material should be supplied in soft language. All trainings should be given practically and demonstrated properly to avoid confusions. Trainings should also be arranged for farmers/women workers at all levels in particular local languages and the course material/ possible literature should made available in local languages. The Field Days / Vichar Goshtis should be arranged at proper intervals to take feedback at farmers' level.*
- *Training of scientific/technical personnel involved in seed quarantine and monitoring programmes.*

Various activities implemented under the HRD scheme involving coordination, market development and Infrastructure development/Management may be continued as a separate scheme delinked from Seed Organisations scheme during XII Five Year Plan with seperate financial allocation of Rs.60 crores.

C. QUALITY CERTIFICATION SYSTEM

EXECUTIVE SUMMARY

3.1. Background

Quality Certification System (QCS) scheme has been implemented as a Central Sector Scheme to ensure quality maintenance at different levels of production process (silkworm seed, cocoon and raw silk production) for production of quality silk of international standard to compete in Global Markets as well as for the generic promotion of silk at large. Quality assessment during the process of production is carried out by ‘Raw silk testing centre’s as well as ‘Cocoon testing centres’ whereas quality of finished silk goods among the national and international consumers is being assured through “Silk Mark”. The QCS scheme was launched by Central Silk Board (CSB) and it aims at instituting quality pricing system for cocoons and raw silk in the country, by establishing Cocoon Testing Units, Raw Silk Testing Centres and promoting “Silk Mark”. Silk Mark is being promoted by Silk Mark Organization of India (SMOI) under Central Silk Board as a part of Quality Certification System.

To assess the impact of Quality Certification System (QCS) scheme during the XI plan period and obtain suggestions for modifications, if any, for better implementation of the Scheme in future, Central Silk Board (CSB), Bangalore has entrusted the task of evaluation of QCS scheme to National Productivity Council. The present report is an outcome of the study undertaken by National Productivity Council based on the data/information gathered from SMOI chapters, Raw Silk Testing Centres, Cocoon Testing Centres, Authorized Users and retailers of Silk Mark as well as consumers of silk products.

3.1.1. Objectives of the Evaluation Study

To study whether the Quality Certification System (QCS) Scheme has really created awareness among the public about the purity of silk and its usefulness as well as to ascertain the effectiveness of the scheme in modifying the purchase behavior of consumers.

3.1.2. Terms of Reference

- i. Relevance of the Quality Certification System Scheme*
- ii. To find out, whether the Silk Mark Organization of India (SMOI) is protecting the interests of the silk consumers.*
- iii. Effectiveness of the Cocoon testing & Silk Testing units established*
- iv. Usefulness of Silk Mark Label and its effectiveness among the users and stakeholders in domestic & international markets.*
- v. Evaluation based on visits to quality certification system established.*
- vi. Sample survey of silk traders in all the SMOI centres viz., Bangalore, Mumbai, Chennai, Varanasi, Hyderabad, New Delhi, Guwahati, Srinagar, Kolkata, Lucknow, Coimbatore, Palakkad and Panchkula.*

3.1.3. Sample Frame

A total of 13 SMOI chapters, 68 Authorized users, 102 consumers/retailers and 8 testing centres have been visited by NPC study team to undertaken evaluation of QCS Scheme.

3.2. BROAD OBSERVATIONS AND FINDINGS

An outlay of Rs. 13.66 Crores was planned for Quality Certification System for the XI plan period which was revised to Rs. 14.75 Crores. The Progress of SMOIs and Cocoon testing centers under QCS scheme has shown incremental growth over the years during the XI Five Year Plan period. The Thirteen SMOI chapters have organized a total of sixty Silk Mark expos from the year 2008 to 2012 which attracted around 7.05 Lakh visitors. The total business transaction during these expos has been around Rs. 131.94 Crores. Besides these expos, 1410 Authorized Users have been registered, 4512 sales persons have been trained, 116 Lakhs Silk Mark labels have been sold, 1745 promotional programmes/Events have been organized by these SMOIs during the XI plan period. During the period, a total of Rs. 24 lakhs have been released for the establishment of 24 cocoon testing centres (CTC). Out of these 24 CTCs, 17 have already been established and funds have already been released for the establishment of rest 7 CTCs. Since, the component of Raw Silk Testing Centre was discontinued during the XI plan period; hence, not much growth has been registered in connection with raw silk testing centres.

Promotional activities undertaken by the Silk Mark Organization of India (SMOI) has enhanced the visibility of the pure silk product as well as awareness level regarding Silk Mark and purity of silk among the traders as well as consumers. However, Strong measures need to be adopted to ensure the awareness about the Silk Mark among one and all. An aggressive campaign through print and e-media may be initiated to publicize the scheme among one and all.

The performance of the thirteen SMOI have been found to be satisfactory during the XI Five Year Plan, however, it may be noted that it has not been uniform for all the chapters. Almost 34% of the Authorized Users are associated with the two South Indian States i.e. Tamil Nadu and Karnataka. Also, SMOI, Tamil Nadu has organized maximum number of awareness/promotional programmes followed by Bangalore Chapter.

Besides the promotional activities taken to establish Silk Mark, SMOIs are also involved in various export utility services such as pre-shipment inspection of silk goods for various types of certifications such as Hand woven certificates to EEC countries, Handicraft product certificates to EEC countries, Handicraft certificate to Australia, Swiss Tariff Certificate, Certificate of Origin, Special certificate of origin to U.A.E., Sri Lanka and Yugoslavia Silk Mark certificate etc. SMOI chapters have 10 certification centers across India.

3.2.1. Manpower Strength of various SMOI Chapters

Major activity associated with Silk Mark Scheme is to build awareness about the Silk Mark. To achieve the targeted awareness level during the next plan period, vigorous extension work is needed. However, as per NPC field survey, almost 82% of SMOI Chapters report

that they face shortage of manpower to carry out promotional and extension activities. At some of the SMOI chapters, no separate staff strength has been dedicated for the SMOI work and CSB officials put up for other CSB activities are taking care of the SMOI work also. Considering the volume of promotional and extension activities to be managed by these SMOIs, the work force at these chapters need to be rationalized.

3.2.2. Infrastructure and testing facilities available with SMOIs

There is general satisfaction regarding the quality parameters being followed and tests undertaken by these SMOIs, however, more than 50% SMOI chapters need testing equipments of latest technologies to enhance their efficacy. Shortage of man power was also unanimously reported by around 82% of SMOI chapters.

3.2.3. Cocoon Testing & Raw Silk Testing Centres

The Cocoon testing centres (CTCs) and Raw Silk Testing Centres (RSTCs) have also expressed shortage of testing infrastructure, equipments as well as man power. The Raw Silk testing centres and Textile Testing Laboratory are facing infrastructural constraints with regard to bigger space and latest machineries requirements.

3.2.4. Authorized Users, Retailers and Consumers

In order to evaluate the success of Silk Mark and its demand among the AUs, Retailers as well as Consumers, feedback was collected from them through personal interview along with structured questionnaire covering aspects like retaining customer's confidence, identifying and positioning high quality genuine silk seller, gaining more customers, more sales, more profits, more prestige etc.

A total of 94 Authorized Users were personally contacted in 13 major cities and silk clusters in selected sample states and almost 65 percent of Authorised Users were affirmative that demand for their products had increased after getting Silk Mark Certification. All most 80 percent of users were of the opinion that Silk Mark improved the quality of their products, however, very few expressed any impact with respect to increase in export. During the field survey, a substantial number of users have opined that there is an increase in domestic sales and turnover.

Some of the suggestions provided by Users for promoting Silk Mark in India are increasing awareness through various print and e-media, Silk Expo's at hotels and malls, increase in the duration of Silk Mark expo, regular inspection and quality check by SMOI, promotion of the names of users/members in print and electronic media, penalties for not adhering to quality standards and more awareness campaigns etc.

3.2.5. Silk Product Consumers

NPC Field Survey findings reveal that consumers are generally not aware of availability of type of Silk Mark products. As many as 70 percent of the consumers have opined that the prices of Silk Mark products are higher by around 10% as compared to similar silk products without Silk Mark. Only 10 percent of the consumers have expressed price difference of

more than 30%. The price difference observed by the consumers may be attributed to the fact that they are not able to distinguish between pure Silk Mark products with the impure silk products.

3.2.6. Areas of Improvement for certification process during XII Five Year Plan and promoting Silk Mark in India

Some of the major steps suggested by consumers for promoting Silk Mark in India during XII Five Year Plan are increasing awareness about Silk Mark through banners, advertisement in electronic and print media at state and national level, road shows and display at expo, exhibition etc, regular inspection of authorized users of Silk Mark regarding authenticity of Silk Mark product and improvising the attractiveness of Silk mark labeling etc.

3.3. GIST OF FINDINGS & RECOMMENDATIONS

The opinions and suggestions received have also been utilized along with the data collected from the field in drawing the inferences. Major findings and recommendations have been summarized below:

3.3.1 FINDINGS OF THE EVALUATION STUDY

- Promotional activities undertaken by the Silk Mark Organization of India (SMOI) has enhanced the visibility of the pure silk product as well as awareness level and has resulted in the enrollment of a large number of Authorized Users (AUs) over the years.
- Authorized Users of “Silk Mark” label have got an edge over their competitors in marketing silk products.
- Around 60 exhibitions have been organized since the year 2008 by SMOI chapters in association with Authorized Users and these exhibitions have created awareness of Silk Mark products across the country.
- 24 Cocoon testing centres established during the XI Five Year Plan ensured good prices to Cocoon farmers on the basis of quality grading.
- Transparency in price fixing has improved the credibility of cocoon markets where CTCs have been established.
- Price fixing mechanism has ensured right prices for the reelers and twistors wherever raw silk testing centres are functioning.
- Financial support may be provided to Authorized Users to participate in international textile exhibitions.
- Present manpower deployment across SMOI chapters need to be rationalized based on the promotional work targets and achievements.
- Though the awareness regarding Silk Mark is increasing, still a lot of efforts are needed to promote the brand among the retailers and consumers.
- Silk Mark as a symbol of quality is yet to establish its presence in the field. Due to the fact that consumers rely mostly on their personal relation with the retailer for quality of the silk material they are buying and not on the Silk Mark certification.

- *Consumer demand for pure silk has declined to some extent owing to the price rise in the recent years.*
- *There is no regular surveillance from the SMOIs*
- *Silk Mark only certifies that the product is pure silk; it does not guarantee the percentage composition of the silk. This is being misused by some people as some of the retailers mix Tasar with Muga and sell the product by saying it is pure Muga.*
- *Efforts to increase the visibility of Silk Mark on international platform are required.*

3.3.2 RECOMMENDATIONS

- *Strong measures need to be adopted to ensure the awareness about the Silk Mark. An aggressive campaign through print and e-media may be initiated to publicize the scheme among one and all.*
- *Rather than forcing Silk Mark from the sellers end, efforts should be made to create the demand from consumers end. The awareness campaign should also be planned in the sub-urban as well as in rural areas so that the coverage could be broadened.*
- *Promotional activities at international platform should be taken up so that the Silk Mark could achieve international recognition. Funds should be allocated to advertise Silk Mark in international exhibitions.*
- *Suitable policy measures should be adopted to make the prices of pure silk products comparable to its competing products so that the domestic demand for pure silk could be sustained.*
- *Regular surveillance of the premises of authorized users is required to minimize any kind of possible misuse of Silk Mark.*
- *Muga being a costly material and high in demand in Assam, a “MUGAMARK” would be most beneficial which would certify the product of having pure Muga and not blended with any other silk yarn.*
- *Present manpower deployment across SMOI chapters need to be rationalized based on the promotional work requirement as per the targets.*
- *Establishment of Raw silk testing centres has guaranteed quality yarn for the weavers. The component was dropped during XI Five Year Plan. There is a need to include the component during XII Five Year Plan.*

It has been found that the QCS scheme immensely contributed towards the dissemination of quality consciousness among the producers, authorized users, retailers and consumers across India. The scheme was also successful in spreading the much needed awareness about the purity of silk. The spread of “Silk Mark” helped to provide the much needed fillip to brand India in the international arena. Therefore, it is recommended that the QCS scheme may be continued with additional financial support of Rs.50 crores during the XII Five Year Plan.

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