

for the export oriented qualified silk cloth in order to earn the foreign exchange, the promotion of bivoltine sericulture is indispensable for the improvement of quality of the Indian silk and the productivity.

However, though the Government of India had been trying to promote the bivoltine sericulture in NSP, the developed bivoltine sericulture technologies were not suited for the Indian tropical climate and the conditions of the farmers, and its efforts to introduce the bivoltine sericulture to the people concerned were not so successful. The development of technologies in the fields of mulberry cultivation, silkworm breeding, silkworm seed production, silkworm rearing, silkworm disease control, reeling and spinning are indispensable for the increase of bivoltine silk, and development of technologies by research and experiment in these fields are extremely important.

In this sense, the Indian expectation of the Bivoltine Sericulture Technology Development in India is extremely high, and the importance of this Project in CSB is also high.

### 3-2 Achievement of the Project Purpose

The objective of the Project is to develop the practical technologies of silkworm breeding, silkworm disease control, silkworm rearing, mulberry breeding and cultivation, silkworm seed production and reeling, required to improve quality and yield of the bivoltine silk in the Indian environment, thereby contributing to promotion of the sericulture industry which plays an important role in the national economy and rural development of India.

Between India and Japan, when compared with each other, there are differences about weather conditions, rearing environment, kinds of diseases and their measures, varieties of mulberry, reeling technologies and machinery, institutions etc. For this reason, it is necessary first of all to survey and evaluate in detail various actual conditions regarding the sericulture practiced by the Indian farmers in the Indian environment in order to develop the practical technologies which the Indian farmers can utilize, and after that to develop the technologies suitable to India without simply transferring the Japanese technologies as they are to India.

From the stand point of view, when the results of the Project activities are scrutinized, as the results of the Project activities, the actual conditions of the Indian environment and sericulture technologies are being studied and grasped, the technologies are being developed based on the activities, the results are summed up in the manual and it is said that the notable results are being attained. However, these results are basically laboratory level results, and it is difficult to say that they are the practical technologies which are suitable to the Indian environment, and which can be usable to the Indian farmers.

In this fiscal year, the enlightenment and popularization activities are being implemented for the purpose of verifying the technologies in the field and modifying them to the practical technologies, based on the extracted questions. As the result of this activity, the useful information including

the State Government's extension policy of the bivoltine sericulture, the technological conditions required for the Indian farmers, farmers' opinion, all of which are contributing to the discussions about the development and extension of the practical technologies required for bivoltine sericulture is being gathered.

In short, in order to contribute to the pending targets of promotion of the Indian sericulture, it is necessary to verify the results which are gradually being achieved now and to modify them to the practical technologies which are usable to the farmers, as the technologies which are now being developed are still at the unsatisfactory, incomplete and unfinished stage. In order to achieve the project targets, it is necessary to firstly attain the output targets, which is being accomplished, and secondly to verify them in the field and to modify them to the technologies which can be practically usable at the farmers' level.

### 3-3 Achievement of the Outputs

Achievement situation of output targets is listed below :

#### 1) Development of Silkworm Breeding Technology

As the actual conditions of the Indian environment and sericulture are grasped, and at the same time, breeding technologies suitable to India have been developed, bivoltine hybrid races which are superior in respect of both pupation and shell rate have been selected.

The counterparts have acquired these breeding technologies and have learned to conduct the survey and research themselves.

However, regarding the silkworm races developed in this Project, and those races which have the possibility of being developed in future, the tasks remain unsolved as to consideration of heat tolerance, development of maintenance method of superior character and adaptability to different places and seasons.

#### 2) Development of Silkworm Disease Control Technology

The diagnosis of virus and pebrine diseases have been developed, and their control method has been also developed. The counterparts have acquired the technologies about them, and have learned to make the survey and research themselves.

The subject on decision of disinfection method of rearing bed has remained unfinished, but it will be more effective, it is considered, to study this subject in practical use test in silkworm rearing field. Therefore, it is judged that all the targets of subjects in this field have been accomplished.

#### 3) Development of Silkworm Rearing Technology

The actual conditions of silkworm rearing in the field have been grasped and young age as well as old age silkworm rearing methods have been standardized. And the mountages and mounting method fitted for the Indian conditions have been decided, and the suitable cocoon collection method have

been developed. However, the developed rearing technologies system will first have to be verified at various sericultural areas in many districts, using the newly developed bivoltine hybrids, and thereafter it will have to be improved or modified. And regarding the mounting method, taking into account the Indian weather condition and rearing facilities, there still remain the necessity for considering the measure to improve the quality of cocoon fiber by improving the mounting environment.

#### 4) Development of Mulberry Breeding and Cultivation

The survey was conducted on the actual condition of mulberry for the young age as well as old age silkworm, and the technologies for breeding, cultivation, harvesting, transport etc. have been developed. A cultivation package - Indo-Japanese system of cultivation- developed under the Project using S36 variety (evolved earlier by CSR&TI, Mysore), has proved promising to increase mulberry leaf yield and quality. However, there still remains the necessity for conducting the area adaptability test for its practical use.

It also remains to be tested the potential of VI a new mulberry variety evolved by CSR&TI, Mysore to know the potential of leaf yield and quality under the Indo-Japanese system of cultivation.

#### 5) Development of Silkworm Seed Production

Technologies for basic preservation of silkworm seed, rearing of basic silkworm, control of pebrine disease in silkworm seed production centre and mass production of silkworm seed have been developed.

However, while regarding the hibernation egg preservation technology, the task of research on race characteristics remain, and regarding the formulation of management process of silkworm egg preservation, the task of formulation of preservation schedule which enables the intentional yearly hatching and distribution remain.

#### 6) Development of Reeling Technology

The survey on the actual condition of the Indian reeling technology was conducted, the actual condition was grasped. And based on the results, the technologies for cocoon quality evaluation, dried cocoon and its storage method, reeling, raw silk testing, all of which technologies are suited to India, have been developed, and the introduction of these technologies to the field was made. The counterparts have acquired these technologies.

However, regarding the cocoon quality evaluation method and silk reeling technology, there still remains the necessity for modifying them to those fitted to the Indian environment.

As was seen in the above, at the end of the Project, many results are expected to come up, but there will remain some subjects, of which original targets will not have been achieved.

Further, it is considered appropriate to extend the ongoing Project after sorting out the cooperation fields because it is necessary to discuss area adaptability and practicality of the results developed so far and further to modify them in order to achieve the project target which will contribute to the promotion of sericulture at the next step of the ongoing Project.

### 3-4 Implementation of the Inputs

#### (1) Japanese Inputs

##### 1) Dispatch of Japanese Experts

According to R/D, the Japanese side is to dispatch the following long term experts in addition to the Team Leader and Coordinator:

- a) Silkworm Breeding
- b) Silkworm Disease Control
- c) Silkworm Rearing
- d) Mulberry Breeding and Cultivation
- e) Silkworm Seed Production

Short term experts are to be dispatched, as the necessity arises.

The Japanese side has so far dispatched 12 long term experts, 21 short term experts. These experts not only imparted the technical guidances to the counterparts, but also propelled the Project activities.

##### 2) Acceptance of Counterparts

So far 25 Indian counterparts have been accepted, and the knowledge and techniques which are helpful for the development of bivoltine sericulture technologies in India have been acquired by them. The 'rooting rate' to the Project by the Indian counterparts is extremely good.

##### 3) Provision of Equipment

The Japanese side has provided to the Project the equipment and machinery equivalent to Y 321 million, which includes machinery and equipment received in 1995.

The kinds of equipment and machinery and their utilization situation etc. are shown in the ANNEX 5. Most of equipment are managed under the responsibility of the Indian side and are kept in the good condition.

##### 4) Local Cost Affairs

In 1995/1996 the enlightenment and popularization programme on the bivoltine sericulture has been implemented in 4 States of Karnataka, Kerala, Andhra Pradesh and Tamil Nadu with the budget of Y 2.9 million, conducting the survey on the actual condition of the sericulture farmers, distributing the pamphlets on the results of the Project activities, and having interaction meetings with the farmers and reelers. As the results, the actual conditions of sericulture farmers and social, economic, and institutional problems are being grasped, and the useful information that will contribute to the discussions about the direction of technology

development and extension method on bivoltine sericulture in future is being accumulated.

Further, in December in 1995, with the approximate budget of Y 3 million, the technology exchange programme with Thai National Sericulture Research and Training Centre is scheduled to be implemented. As the results, the actual conditions of the Thai sericulture are expected to be grasped, some points in the Indian sericulture that will have to be improved are expected to be clarified, and the useful suggestions on the technical guidance as well as the extension of bivoltine sericulture in India in future is expected to be obtained.

The total amount of Y 44 million including the amount set aside for 1995/1996 has been spent for the local expenses necessary for the activities of experts.

(2) Indian inputs

1) inputs Results by Field

a) Silkworm Breeding

Number of Staff: 39

About Rs. 15 million spent, 1992 to 1994

Major Equipment: Mountage, Automatic Reeling Machine, Small Car, Boiler

b) Silkworm Disease Control

Number of Staff: 24

About Rs. 9.2 million spent, 1992 to 1994

Major Equipment: Clean Bench, Microscope, Big Refrigerator, Phase Contrast Microscope

c) Silkworm Rearing

Number of Staff: 10

About Rs. 2.7 million spent, 1992 to 1994

Major Equipment: Mountage, Shelf for Shoot Rearing

d) Mulberry Breeding and Cultivation

Number of Staff: 38

About Rs. 10.8 million spent, 1992 to 1994

Major Equipment: Tractor, Microscope, Balance

e) Silkworm Seed Production

Number of Staff: 52

About Rs. 12.7 million spent, 1992 to 1994

Major Equipment: Tractor, Microscope, Big Refrigerator, Mountage, Incubator

f) Reeling

Number of Staff: 15

About Rs.6.4 million spent, 1992 to 1994  
Major Equipment :Cocoon Boiler, Balance, Reeling Machine,  
Multiend Reeling Machine

#### 2)Land, Building and Facilities

The land, building and facilities necessary for the implementation of the Project have been provided, and the base for the Project activities has been assured. Especially, the construction of SSTL, Silkworm Seed Production Centre of NSSP as sub site were delayed, but completed. And they contributed to the smooth activities of the Project. During the period from 1991 to 1994 the approximate total amount of US\$ 3 million was spent for the equipment of infrastructure, construction of laboratory buildings, purchase of equipment and furniture etc.

#### 4. Impact and outstanding matters

(1)The results obtained by each cooperation field have been summed up. The contents of these manuals will be further improved, based on new results available in future, and preparation of another improved manuals is scheduled to be made. These manuals including the technologies developed by the Project are not only used by counterparts, but also distributed to the sericultural organizations concerned and are being used by them as the results of the Project activities.

a)Silkworm Breeding Field

- ⊙ Guidelines on Multiplication of Bivoltine Basic Seed and Handling of the Seed
- ⊙ Manual on Rearing and Maintenance of Characters of Bivoltine Silkworm
- ⊙ Characteristics of New Hybrid (No.1:CSR2 x CSR4)
- ⊙ Characteristics of New Bivoltine Hybrid (No.2:CSR2 x CSR5)
- ⊙ Characteristics of New Bivoltine Basic Seed of Chinese Race (No. 1:CSR2)
- ⊙ Characteristics of New Bivoltine Basic Seed of Japanese Race (No. 2:CSR4)
- ⊙ Characteristics of New Bivoltine Basic Seed of Japanese Race (No. 3:CSR5)

b)Silkworm Disease Control Field

- ⊙ Moth Examination Method

c)Silkworm Rearing Field

- ⊙ Manual on Young Age Silkworm Rearing

d)Mulberry Breeding and Cultivation Field

- ⊙ Manual on Mulberry Cultivation

e)Silkworm Seed Production Field

- ⊙ Loose Egg Production Method

f)Reeling Field

- ⊙ Cocoon Testing and Reeling Technology

(2)Presentation of Thesis

The Results of the Project were also made public in the form of the following thesises:

a)Silkworm Breeding Field

- ⊙ Method on Selection of Superior Silkworm Races(Y. Mano and others)
- ⊙ High Yielding Bivoltine Hybrid Developed in India (H. K. Basavaraja and others)

b)Silkworm Disease Control Field

- ⊙ Control Programme on Outbreak of Silkworm Disease in India(S. Utumi)

c)Mulberry Breeding and Cultivation Field

- ⊙ Method on Effective Evaluation of Feed Value of Mulberry Leaves (H. Fujita and A. Sarkar )

(3)Presentation of Report

The following reports were presented to the international conference on sericulture, which contributed to the introduction of the Project :

- ⊙ Strategy of Development on Cocoon Production(Y. Otuki)
- ⊙ JICA and Indian Sericulture(J. Obitu)

(4)Development of Devices

As the result of the Project activities the following devices were developed. They are used not only at the Project sites but also at

other related organizations.

a)Silkworm Rearing Field

- ⊙ The cocoon collector for rotary moutage was developed and it made it possible to perform the works in 40 to 60 % of the manual labour time.

b)Silkworm Seed Production Field

- ⊙ Stand for washing off silkworm, which is required for loose egg production, Device for drying silkworm seed, Device for sorting out silkworm seed etc., were manufactured.
- ⊙ Container for Loose Egg and Incubation Cover have been developed.
- ⊙ Box for transporting silkworm egg, which has various functions was manufactured.

c)Reeling Field

- ⊙ Indian made Multiend Reeling Machine has been improved. It is normally working at the site.
- ⊙ The Denier Indicator was developed with the Japanese one as the model.  
This has won popularity at the site, and the production plan on the commercial basis is progressing.
- ⊙ Small Permeation Chamber (with the vacuum device operated by motor) has been developed.

(5)Others

- ⊙ Draft Regulation on Import of Silkworm (with reference to Pebrine examination), (T. Fujiwara and SSTL)
- ⊙ Authorization System of Silkworm Races, Developed in India (Y. Otuki, Y. Mano, S. Rao, CSB)
- ⊙ Japan-India Collection of Sericultural Terminology (K. Kitaura, Y. Otuki, Ramakant)

The above materials have been prepared in joint cooperation between Japan and India.

5. Organization for the project implementation

(1)Organization for Implementation

In the Indian implementation organization for the Project, the Ministry of Textiles is positioned as the responsible organization and CSB which is the subordinate organization of the above Ministry, as the implementation organization. This Project is run at the following 4 subordinate organizations of CSB:

- 1)CSR&TI Mysore (Main site; Silkworm Breeding, Silkworm Rearing, Silkworm Disease Control, and Mulberry Breeding and Cultivation)
- 2)SSTL, Bangalore (sub site; Silkworm Seed Production)
- 3)NSSP, Bangalore Grainage (sub site; Silkworm Seed Production)
- 4)CSTRI, Bangalore (sub site; Reeling)

The Joint Secretary (Jute and Silk), Ministry of Textiles is the



paramount person responsible for this Project.

The Member Secretary of CSB bears full responsibility for the management of the Project as a project manager. The Joint Director of CSB assists the Member Secretary as a chief coordinator responsible for coordination at all the sites.

The Director of each site is responsible for the implementation of the plan of works allotted to the site as well as the coordination as a coordinator.

As mentioned above, the responsibility of the Indian implementation organization is clarified, which contributes to the smooth management of the Project.

The organization chart for the Project implementation is as shown in the attached ANNEX 13.

## (2) Counterparts

The Project manager as counterpart for the Japanese Team Leader, and the chief coordinator as counterpart for the Japanese coordinator, are positioned. As the Indian counterparts for the Japanese experts, the Director at each site as well as the corresponding Indian experts are manned.

Since as Indian counterpart, those researchers at CSB research institutes, who hold Dr's degrees are manned, the Project activities including technical transfer and technology development are smoothly implemented.

## (3) Management of the Project

Management of the Project is smoothly implemented through the following three meetings:

### 1) Monthly Meeting

It is held at two places every month, or at CSR&TI Mysore and SSTL Bangalore. The participants in the meeting at CSR&TI Mysore are from the Japanese side, Team leader, Coordinator, and long term experts and from the Indian side, Director, counterparts, and the participants in the meeting at SSTL Bangalore are from the Japanese side, Team Leader, Coordinator, a long term expert and from the Indian side, Director, the related counterparts and one counterpart from the Silkworm Seed Production Centre, Bangalore, attached to NSSP.

The agenda includes progress of annual work plan, problems arising out of the Project activities etc. The chairman is the Director of each Institute.

### 2) Quarterly Meeting

It is held once in each quarter of the year at CSR&TI Mysore. The participants are from the Japanese side, all the experts including

the Team Leader, and from the Indian side, the Member Secretary as chairman, Chief Project Coordinator, Directors of each institute, main counterparts including those from sub sites. The agenda are progress report on activities in each field, problems faced by both sides in the course of implementing technical cooperation activities etc.

### 3) Joint committee Meeting

It is held in New Delhi once at the end of the fiscal year. The participants are from the Japanese side, Team Leader and Coordinator and from the Indian side, Joint Secretary (Jute& silk), Ministry of Textiles, Member Secretary, CSB, 4 Directors of Institutes concerned, and Project coordinator, CSB. JICA Office and Embassy of Japan in New Delhi are invited to attend the Meeting. The agenda includes the report on the works implemented and work plan in the following year, discussions about problems regarding the technical cooperation etc. The chairman is Joint Secretary.

## 6. Sustainability of the Project

### 6-1 Organizational sustainability

As mentioned in 5. Organization for Project Implementation, organization for management of the Project has already been established, and it can be said that the sustainability for the management of the Project has been achieved.

### 6-2 Financial sustainability

The Indian side, as mentioned in 3-4 Implementation of the Inputs (2) Indian inputs, not only has paid the management expenses without any hindrance throughout the Project period, but also purchased the equipment itself, and has not had any financial problems. And that can be highly appreciated. It is hoped that the Indian efforts would be continued in future too.

### 6-3 Technical sustainability

As the Indian counterparts, those researchers at the CSB research institutes who hold the Dr's degrees are manned. As the counterparts are equipped with the talent to be able to utilize the technical guidance by the Japanese experts and the results of training in Japan, the target of each subject is being steadily achieved.

Judging from the above circumstances, it can be said that each cooperation subject is about to reach the stage where the technical independence will be possible.

The present manning of counterparts to each field is as listed below :

- 8 to Silkworm Breeding,
- 7 to Silkworm Disease Control,

- 6 to Silkworm Rearing,
- 6 to Mulberry Breeding and Cultivation,
- 9 to Silkworm Seed Production,
- 5 to Reeling.

As shown in the above, as the plural number of counterparts are manned to each field, it is possible to maintain the technical level as the organization.

However, although the activities under the present Project are focused on the development of technologies on the laboratory level, in future it will be important to develop the practical technologies, based on the ones already developed under the Project, which can be usable to the farmers. While it is important to give technical advices to the counterparts, so that they could develop the practical technologies which the farmers can utilise, it is far more important for the counterparts to understand well the importance of developing the practical technologies.

## 7. Necessity of extension of the cooperation period

### 7-1 Necessary of extension of cooperation period

As said above, if the projects achievements judged in a composite way, the present project has progressed to a great extent in smoothness. In case of each field may remarkable results have been elevated. However, a part of the objectives estimated in the beginning has yet to be completed, and in order to achieve the proposed objectives, which is said to be playing an important role in promotion of the sericulture industry and which is a next step in this project, it is necessary to continue and extend the cooperation period after rearranging the each field of study.

### 7-2 Extension period and activities

The necessity of extension in each field of study, anticipated results and study period based on the extension and corresponding plans are as follows:

#### 1. Development of Silkworm Breeding Technology

##### (3)-a) Breeding for robustness

###### (Necessity of extension)

For the hybrid combination from the new races evolved with excellent raw silk quality and high silk content and for high temperature tolerance in these races will be studied and then it is important to select hybrid combination having robustness.

Again, it is also necessary to investigate and improved the investigation method for high temperature tolerance. In order to do such studies/investigations guidance is necessary.

###### (Anticipated results based on extension)

Silkworm races will be selected which could be reared in rearing season or sericultural areas, where the high temperature is a cause for bad crop failure.

###### (Objectives)

Expert will give guidance in silkworm breeding.

###### (Required period of extension)

Ten months.

##### (3)-d) Development of silkworm breed maintenance method

###### (Necessity of extension)

In order to maintain the excellent characteristics of the evolved races properly, as it is necessary to have good experience and knowledge about breeding or lineage maintenance, to make intensify the silkworm race breeding techniques learnt by counterparts, and to make the counterparts pertinent in race maintenance, guidance is necessary.

###### (Anticipated results based on extension)

Exact maintenance of excellent characteristics of the races will be done and as the parent race with excellent characteristics are distri-

buted to P1 and P3 farms for multiplication, Silkworm Seed Production Centre can produce the homogeneity hybrid silkworm eggs with similar excellent characteristics and at farmers level excellent quality reeling cocoons could be produced.

(Objectives)

The guidance on silkworm breeding will be given by expert with a lot of experience is necessary.

(Required necessary period of extension)

Ten months

#### (4)-c) Selection of hybrids

(Necessity of extension)

Application has been submitted for the parent race and its hybrid. Experimental rearing(field trial) has to be done for the new hybrid race to know the regional variation and seasonal variation as well as similar experimental rearing(field trial) is necessary for the new excellent hybrid combination which is under breeding process. Guidance is necessary for such experimental rearing field trial.

(Anticipated results based on the extension)

Where the rearing conditions differs due to region or season, to rear in such place or season a suitable hybrid combination will be established. The region and season will be expanded where there is possibilities of rearing bivoltine hybrid race.

(Objectives)

The guidance on silkworm breeding will be given by expert with a lot of experience is necessary guide.

(Required necessary extension period)

Ten months.

### 2. Development of Silkworm Disease Control

#### (3)-b) Study on disinfection technology

In the present item's proposed objectives [decision on the silkworm rearing bed disinfecting method and disinfectant under the Indian rearing conditions], [Decision of bed disinfection method] will be remain. However, if this item is enforced as a part of remaining item in silkworm rearing technology [3. (2)-f; Application experiment], it would be more effective. Accordingly, in this field, total subject task will essentially reach at the proposed objective and the time which requires extension will get disappear.

### 3. Development of Silkworm Rearing Technology

#### (2)-f) Field trial

(Necessity of extension)

Based on the development rearing technology system, experimental

rearing, by using the newly evolved bivoltine hybrid races, will be carried out in other sericultural areas of Karnataka state other than Mysore and it is also necessary to do the same even in other state like Tamil Nadu, Kerala, Andhra Pradesh, etc., following to the plan and results, it is necessary to guide on the improvement of technology system and modification of study. Practically, the possibilities of introducing rearing house, rearing equipment, rearing tray and based on its disinfection technology and relation of hygienic condition's maintenance/management, etc., guidance is necessary.

(Anticipated results based on the extension)

Regarding technology development, picking up the problems in area will be done and based on the improvement and modifications obtaining the technology system which could be diffused in each sericultural area will be completed.

(Objectives)

The guidance on the field of rearing will give by expert with a lot of experience on is necessary.

(Required necessary extension period)

Ten months

(3)-b) Studies on the environmental conditions for mounting

(Necessity of extension)

Investigation will be done about the effect of temperature and humidity during mounting on the cocoon filament/raw silk quality by reeling. While keeping view on the facilities and Indian weather condition and based on the mounting condition improvement, it is necessary to look for a plan for improvement cocoon filament quality and guidance for the same is necessary.

(Anticipated results based on extension)

High raw material cocoon will be produced, based on the high cocoon price, farmers harvesting cocoon will increase. Again, based on the reeling efficiency will contribute for high quality raw silk productivity increase. On basis of all these, farmer and reeler's confidence on bivoltine sericulture will increase, diffusion will become easy.

(Objectives)

Expert with a lot of experience in the field of silkworm rearing will give guidance and based on the cooperation of silkworm rearing counterparts and CSIRI counterparts, this will be enforced.

(Required necessary extension period)

Six months.

#### 4. Development on Mulberry breeding and Cultivation Technology

##### (1)-e) Field trials

###### (Necessity of extension)

In order to the Indo-Japanese system of mulberry cultivation using S36 variety, in order to investigate the regional suitability for bivoltine rearing, guidance is necessary to have cultivation experiment at Regional Sericultural Station of each region.

###### (Anticipated results based on the extension)

As a variety for young silkworm rearing, a recommendable climetical condition or the region will be specified for cultivation.

###### (Objectives)

The guidance for mulberry cultivation will be given by the expert (6-10 months) with a lot of experience.

###### (Required necessary extension period)

Ten months

##### (2)-g) Field trial

###### (Necessity of Extension)

In regard to selected mulberry variety(S36), in order to investigate the regional suitability as a variety for late age silkworm, the guidance on mulberry cultivation experiment is necessary at Regional Sericultural Station at each region for carrying out experiment.

###### (Anticipated results based on extension)

As a variety for late age silkworm rearing, a recommendable weather conditions or the regions will be specified for cultivation.

###### (Objectives)

The guidance on mulberry cultivation will be given by experts(6-10 months) with a lot of experience in cultivation is necessary.

###### (Required necessary extension period)

Ten months.

#### 5. Development of Silkworm Seed Production Technology

##### (1)-b) Development of hibernation technique

###### (Necessity of extension)

Guidance on investigating or study the special characteristics of the races concerned with handling of the eggs for artificial preservation or artificially getting hatched of the hibernating eggs of the parent race of the hybrid combination and its newly authorized hybrid race.

###### (Anticipated results based on the extension)

The characteristics (peculiarities) concerned to the hibernation of the eggs of new silkworm race will be offered to the technical staffs of silkworm egg production centre or silkworm egg producers, and based

on the utility of these in egg preservation, it would become possible to obtain stabilized high hatchability.

(Objectives)

The team leader will extend his guidance.

(Required necessary extension period)

Five months.

#### (1)-d) Development of preservation schedule

(Necessity of extension)

In regard to parent eggs of the hybrid combinations for which authorization is requested will be subjected to experiments on common acid treatment, acid treatment after short term or long term chilling, artificial wintering etc. Then with the combination of all these an experiment on preservation method will be carried out. By following the results obtained in order to design a preservation schedule by which a planned hatching and distribution, guidance is necessary.

(Anticipated results based on extension)

A schedule will be planned, which is necessary for supplying the parent eggs produced in a favourable season for rearing of parent race, which could be got hatched and distribute at all times on demand. Seed cocoon planned production as well as seed cocoon price, and egg supply's stability will be designed.

(Objectives)

The team leader will give guidance, but sending a short term(2-3 months) expert and cooperation is necessary.

(Required necessary extension period)

Ten months.

#### 6. Development of Silk Reeling Technology

##### (1)-b Development of cocoon testing technology

(Necessity of extension)

Guidance is necessary on reeling technology for cocoon quality assessment.

(Anticipated results based extension)

Based on the reeling results of cocoon quality assessment, improvement will be done on cocoon quality assessment method and on the basis of introducing cocoon transaction in composite way, there is possibilities of stability in cocoon price.

(Objectives)

Sending a short term(3 months) expert for cooperation is necessary.

(Required necessary extension period)

Six months.



(2)-c) Development of raw silk reeling technology

(Necessity of extension)

Guidance is necessary to improve the technical package which combined various procedures related to reeling techniques suitable to India, by trials of the package in the state reeling unit etc. and picking up the technical problems necessary for its practical utilization in the field.

(Anticipated results based on extension)

Package of reeling technology (including cocoon assorting, cocoon cooking, re-reeling etc.) will be improved which could be distributed in the field. Again, reeling facilities will be modified and Indian traditional multiends reeling machine will be improved which could be utilized for reeling of bivoltine cocoon.

(Objective)

Sending of short term(3 months) expert for cooperation is necessary.

(Required necessary extension period)

Ten months

8. Summary of Evaluation and Recommendations

8-1 Summary of Evaluation

The Joint Evaluation Survey Team has agreed to reach the following conclusion on the Project activities for the past 5 years:

- (1)The Japanese side has made efforts to implement the Project, in accordance with R/D and DIP, through dispatch of experts, acceptance of Indian trainees, provision of equipment and machinery and payment of local cost.
- (2)The Indian side has made efforts to manage the Project effectively through manning of staff necessary for the implementation, provision of land and buildings, and construction of facilities. The team would like to appreciate the efforts by the Indian side to have facilitated the smooth progress of the Project through the proper management of the Project, the necessary acquisition of the budget, manning of the proper number of able counterparts etc.

(3)Summary of Cooperation Activities

1)Development of Silkworm Breeding Technology

As the actual conditions of the Indian environment and sericulture are grasped, and at the same time breeding technologies suitable to India have been developed, bivoltine hybrid races which are superior in respect of both pupation and cocoon shell rate have been selected. The counterparts have acquired these breeding technologies and have learned to conduct the survey and research themselves.

However, regarding the silkworm races developed in this Project, and those races which have the possibility of being developed in future, the tasks remain unsolved as to consideration of high temperature tolerance, development of maintenance method of superior character and adaptability to different places and seasons.

#### 2) Development of Silkworm Disease Control Technology

The diagnosis of virus and pebrine diseases have been developed, and their control method has been also developed. The counterparts have acquired the technologies about them, and have learned to make the survey and research themselves. The subject on decision of disinfection method of silkworm bed has remained unfinished, but it will be more effective, it is considered, to study this subject in practical use test in silkworm rearing field. Therefore, it is judged that all the targets of subjects in this field have been achieved.

#### 3) Development of Silkworm Rearing Technology

The actual conditions of silkworm rearing in the field have been grasped and young age as well as old age silkworm rearing methods have been standardized. And the mountages and mounting method fitted for the Indian conditions have been decided and the suitable cocoon collection method have been developed. However, the developed rearing technologies system will first have to be verified at various sericultural areas in many districts, using the newly developed bivoltine hybrids and thereafter it will have to be improved or modified. And regarding the mounting method, taking into account the Indian weather condition and rearing facilities, there still remains the necessity for considering the measure to improve the quality of cocoon fiber by improving the mounting environment.

#### 4) Development of Mulberry Breeding and Cultivation Technology

The survey was conducted on the actual condition of mulberry for the young age as well as old age silkworm, and the technologies for breeding, cultivation, harvesting, transport etc. have been developed. And the mulberry variety(S36) was selected. Counterparts have acquired these technologies.

However, regarding the mulberry variety(S36), there still remains the necessity for conducting the area adaptability test for its practical use.

#### 5) Development of Silkworm Seed Production Technology

Technologies for basic preservation of silkworm seed, rearing of basic silkworm, control of pebrine disease in silkworm seed production centre and mass production of silkworm seed have been developed.

However, while regarding the hibernation egg preservation technology, the task of research on race characteristic remains, regarding the formulation of management process of silkworm egg preservation, the task of formulation of preservation schedule which enables the intentional yearly hatching and distribution remains unsolved.

#### 6) Development of Reeling Technology

The survey on the actual condition of the Indian reeling technology was conducted, actual condition was grasped. And based on the results, the technologies of cocoon quality evaluation, dried cocoon and its storage method, reeling, raw silk testing, all of which technologies are suited to India, have been developed, and the introduction of these technologies to the field was made. The counterparts have acquired these technologies.

However, regarding cocoon quality evaluation method and silk reeling technology, there still remains the necessity for modifying them to those fitted to the Indian environment.

Generally speaking, almost all the targets have been achieved.

In future, the technical cooperation will be continuously given to those unfinished subjects, improvement of the results of the Project to the more practical ones suitable to the Indian environment, and preparation of various manuals.

#### 8-2 Recommendation and Proposal

The Joint Evaluation Team has agreed to recommend to the both Governments to extend the technical cooperation period by another ten (10) months after the expiration of 5 years of cooperation period, stipulated by R/D of the Project for the purpose of rendering the technical cooperation to the following subjects :

##### (1) Development of Silkworm Breeding Technology

##### (3)-a Breeding of Robust Silkworm Race

##### (Summary)

Selection of hybrid combination possessing robustness. Study, improvement and guidance of investigation method of high temperature tolerance.

(3)-d - Development of Breed Maintenance Method

(Summary)

Development of scientific and objective maintenance method of the developed races and training of breeding staff.

(4)-c Selection of Hybrids

(Summary)

The experimental rearing and guidance will be made on the newly evolved silkworm races in the different areas and different sericultural seasons.

(2) Development of Silkworm Rearing Technology

(2)-f Field Trials

(Summary)

By using the newly evolved bivoltine hybrid races, the experimental rearing will be practiced in the sericultural belt out side Mysore region.

The study and guidance will be made on the formulation of implementation plan and improvement and modification of technologies system.

(3)-b Study on the Control Method of Mounting Environment

(Summary)

The study and guidance will be made on the measures to improve the quality of cocoon fiber by improving the mounting environment.

(3) Development of Mulberry Breeding and Cultivation Technology

(1)-c Field trials ( Mulberry variety for young age )

(Summary)

The guidance will be made on the experiment of cultivation of the mulberry variety(S36) to test the regional suitability.

(2)-g Field trials( Mulberry variety for late age )

(Summary)

The guidance will be made on the experiment of cultivation of the mulberry variety(S36) to test the regional suitability.

(4) Development of Silkworm Seed Production Technology

(1)-b Development of hibernation technique

(Summary)

The guidance will be made on the study of artificial hatching of hibernating silkworm eggs and special characteristics related to artificial wintering of the newly evolved and authorized combination's parent races and hybrid races.

(2)-d Formulation of Management Process of Silkworm Seed Preservation

(Summary)

Guidance will be made on the formulation of the preservation schedule which enables the intentional yearly hatching and distribution of the basic seed of which the application for authorization has been submitted.

(5) Development of Reeling Technology

(1)-b Development of Testing Method of Cocoon Quality

(Summary)

Guidance will be made on reeling technology for cocoon quality testing.

(2)-c Development of Raw Silk Reeling technology

(Summary)

Guidance will be made on improving a series of technologies related to the reeling to those suitable to the Indian conditions.

However, the Joint Evaluation Survey Team would like to stress that the extended period of cooperation should have special emphasis on the following items:

- (1) In order to achieve the Project objective in the field, the technologies developed under the Project shall be integrated systematically for field adoption in different regions.
- (2) In order to extend the bivoltine sericulture technologies to the sericultural farmers, to put in order, authorization of silkworm races, thorough implementation of moth examination for the control of pebrine, criteria for evaluation of qualities of bivoltine cocoon, systems on the criteria for trading of cocoon and raw silk, raw silk testing organization, extension system, and so on.

**Survey Schedule**  
(November 20 to December 3, 1995)

ANNEX 1.

S.NO	Date & Day	Time	Schedule	Remarks
1	Nov.20 (Mon)	22:50	Ar. New Delhi TG-315	Halt at Delhi
2	21 (Tue)	Morning Aft'noon	Consultation with JICA Office, Courtesy call on Embassy of Japan Courtesy call on Textiles & Finance Ministries	Ditto
3	22 (Wed)	06:45 09:15 10:00 10:45 11:30 15:00 17:00	Lv. New Delhi IC-803 Ar. Bangalore Ar. Hotel Ramanashree Comforts (Bangalore) Courtesy call on CSB Visit to CSTRI & NSSP (Grainage) Visit to SSTL Ar. Hotel	Halt at B'galore
4	23 (Thu)	09:00 12:00 14:00 14:30	Lv. Hotel (Bangalore) Ar. Hotel Ramanashree Comforts (Mysore) Lv. Hotel Ar. CSR&TI Meeting with Japanese experts and Observation of CSR&TI's Facilities	Halt at Mysore  Dinner Party by Dr. Y. Ohtsuki at Ramanashree at 7:30 pm
5	24 (Fri)	10:00  14:30	Interview with Experts & C/ps in the Field of Silkworm Breeding and Silkworm Disease Control Lunch ( from Ramanashree Comforts) The 1st Meeting of Joint Japanese & Indian Evaluation Committee	Halt at Mysore
6	25 (Sat)	08:30 10:00 11:00 13:00 14:30 17:00	Lv. Hotel Ar. Ramanagaram cocoon market Visit to reeling factories Lunch at Taj Residency Visit one farmer in Bangalore Lv. Bangalore	Ditto

8	27 (Mon)	09:30 12:30 13:30	Interview with Experts & C/Ps in the Field of Sw.Rearing and Mulberry Breeding & Cultivation Lunch ( from Ramanashree Comforts ) Lv.CSR&FI to see farmers around Mysore	Halt at Mysore
9	28 (Tue)	09:30 ~ 17:00	Interview with Experts & C/P in the Field of Silkworm Seed Production and Silk Reeling Lunch (from Ramanashree Comforts )	Ditto
10	29 (Wed)	09:00 12:00 14:00	Lv.Hotel Ramanashree Comforts(Mysore) Ar.Hotel Ramanashree Comforts(Bangalore) The 2nd meeting of Joint Evaluation Committee (Discussion about Joint Evaluation Report, preparation of the final draft ready for signing)	Halt at B'galore
11	30 (Thu)	10:00  15:00	The final meeting of Joint Evaluation Committee ( Approval of the Joint Evaluation Report ) Signing of the Minute of Joint Evaluation Committee  Extraordinary Joint Committee Meeting Approval of the signed Joint Evaluation Report as well as signing Minute of Joint Committee Meeting	Ditto  Dinner Party by Dr.H .Yanagawa at Taj Residency at 7:30 pm
12	Dec. 1 (Fri)	06:45 09:15	Lv.Bangalore IC-804 Ar.New Delhi Making report on the evaluation results to JICA Office ,Embassy of Japan ,Textiles and Finance Ministries	Halt at Delhi
13	2 (Sat)	22:40	Lv.New Delhi AI-308	
14	3 (Sun)		Ar.Tokyo	

4. 討議議事録等

ANNEX-2

4-1 討議議事録

THE RECORD OF DISCUSSIONS  
BETWEEN  
THE JAPANESE IMPLEMENTATION SURVEY TEAM  
AND  
THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF INDIA  
ON  
THE TECHNICAL COOPERATION  
FOR  
THE BIVOLTINE SERICULTURE TECHNOLOGY DEVELOPMENT PROJECT  
IN  
INDIA

The Japanese Implementation Survey Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Keiji Jono visited India from April 7 to April 17, 1991 for the purpose of working out the details of the technical cooperation programme concerning the Bivoltine Sericulture Technology Development Project (hereinafter referred to as "the Project") in India.

During its stay, the Team exchanged views and held a series of discussions with Indian authorities concerned regarding desirable measures to be taken by both Governments for successful implementation of the Project.

As a result of the discussions, both parties agreed to recommend to their respective Governments the matters referred to in the document attached hereto.

NEW DELHI, INDIA  
April 16, 1991

*Keiji Jono*

Keiji Jono  
Head,  
Implementation Survey Team,  
JICA, JAPAN

*P. Shankar*

P. Shankar  
Joint Secretary,  
Ministry of Textiles,  
INDIA.



THE ATTACHED DOCUMENT

I. COOPERATION BETWEEN BOTH GOVERNMENTS

1. The Government of Japan and the Government of India will cooperate with each other in implementing the Project for the purpose of developing practical technologies required for bivoltine sericulture in the Indian environment, thereby contributing to promotion of the sericulture industry of India.
2. The Project will be carried out at the Central Sericultural Research and Training Institute (hereinafter referred to as "CSR&TI") in Mysore as the main project site and the Silkworm Seed Technology Laboratory (hereinafter referred to as "SSTL"), the Central Silk Technology Research Institute (hereinafter referred to as "CSTRI") and the Seed Production Centre of the National Silkworm Seed Project (hereinafter referred to as "NSSP") in Bangalore as the sub-sites of the Project.
3. The Project will be implemented in accordance with the Master Plan which is given in Section I of the ANNEX.

II. DISPATCH OF JAPANESE EXPERTS

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide at its own expense the services of the Japanese Experts, as listed in Section II of the ANNEX, through normal procedures under the Colombo Plan Technical Cooperation Scheme.
2. The Japanese Experts and their families will be granted in India, privileges, exemptions and benefits no less than those accorded to the experts of third countries working in India under the Colombo Plan Technical Cooperation Scheme.

III. PROVISION OF MACHINERY AND EQUIPMENT

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide at its own expense

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such machinery, equipment and other materials (hereinafter referred to as "the Equipment") necessary for implementation of the Project as listed in Section III of the ANNEX through normal procedures under the Colombo Plan Technical Cooperation Scheme.

2. The Equipment will become the property of the Government of India upon being delivered C.I.F. (Cost, Insurance and Freight) to the Indian authorities concerned at the ports and/or airports of disembarkation and will be utilized exclusively for implementation of the Project in consultation with the Japanese Experts referred to in Section II of the ANNEX.

#### IV. TRAINING OF INDIAN PERSONNEL IN JAPAN

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to receive at its own expense Indian personnel connected with the Project for technical training and/or study tours in Japan through normal procedures under the Colombo Plan Technical Cooperation Scheme.
2. The Government of India will take necessary measures to ensure that the knowledge and experience acquired by the Indian personnel from technical training and/or study tours in Japan will be utilized effectively for implementation of the Project.

#### V. SERVICES OF INDIAN PERSONNEL

1. In accordance with the laws and regulations in force in India, the Government of India will take necessary measures to secure at its own expense the necessary services of Indian Personnel for the Project as listed in Section IV of the ANNEX.
2. The Government of India will allocate the necessary number of suitably qualified counterparts to each Japanese Expert to be dispatched by the Government of Japan for effective and successful transfer of technology under the Project.

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## VI. MEASURES TO BE TAKEN BY THE GOVERNMENT OF INDIA

1. In accordance with the laws and regulations in force in India, the Government of India will take necessary measures to provide at its own expense:
  - (1) Land, buildings and facilities as listed in Section V of the ANNEX,
  - (2) Supply or replacement of machinery, equipment, instrument, vehicles, tools, spare parts and other materials necessary for implementation of the Project other than those provided through JICA under Section III above, and
  - (3) Transportation facilities and travel allowances for the official travel of Japanese Experts within India.
2. In accordance with the laws and regulations in force in India, the Government of India will take necessary measures to meet:
  - (1) Expenses necessary for the transportation of the Equipment within India as well as for installation, operation and maintenance thereof,
  - (2) Custom duties, internal taxes, handling and any other charges imposed on the Equipment and which are not exempted from such payment in India, and
  - (3) All running expenses necessary for implementation of the Project.

## VII. ADMINISTRATION OF THE PROJECT

1. For effective and successful implementation of the Project, a Joint Committee will be established with the functions and composition as referred to in Section VI of the ANNEX.
2. The Joint Secretary in-charge of sericulture, Ministry of Textiles, will bear overall responsibility for implementation of the Project, and will be the Chairman of the Joint Committee referred to in Section VI of the ANNEX.

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3. The Member Secretary of the Central Silk Board, Ministry of Textiles (hereinafter referred to as "CSB") will be the Project Manager and will be responsible for drawing up an annual work plan and periodic progress reports in conjunction and consultation with the Japanese Team Leader for presentation to the Joint Committee.
4. The Japanese Team Leader will provide necessary recommendations and advise to his counterpart, the Project Manager, on managerial and technical matters of the Project.
5. The Co-ordinator of the Project at the CSB Central Office will be appointed by the Project Manager and will co-ordinate the Project's activities and liaise for the collaboration of involved CSB institutions at the main and sub-project sites. He will also monitor the progress of implementation of the Project, which will be jointly reviewed by the Project Manager and the Japanese Team Leader once every three months.
6. As the Co-ordinators of the Project's sites, the Directors or the top officer in-charge of CSR&TI, SSTL, CSTRI, and NSSP will be responsible for the co-ordination and implementation of the programmes assigned to their respective institutions.
7. The Japanese Co-ordinator will assist the Japanese Team Leader in managerial and administrative matters. He will also provide necessary recommendations and advise to his counterpart, the Co-ordinator of the Project at the CSB Central Office.
8. Other Japanese Experts, as the counterparts of the Co-ordinators at the Project sites where they are assigned, will give necessary technical guidance and advice to the respective counterparts and the Indian personnel on matters pertaining to implementation of the Project.

#### VIII. CLAIMS AGAINST JAPANESE EXPERTS

1. The Government of India undertakes to bear claims, if any arise, against the Japanese Experts engaged in the Project resulting from, occurring in the course of, or otherwise connected with, the discharge of their

## VI. THE JOINT COMMITTEE

### 1. Functions

The Joint Committee will meet at least once a year and whenever necessity arises, and work :

- (1) To draw the Annual Work Plan of the Project in line with the Tentative Implementation Programme formulated under the framework of this Record of Discussions,
- (2) To review the achievements of the above-mentioned Annual Work Plan as well as the overall progress of the Project, and
- (3) To review and exchange views on major issues arising from or in connection with the Project.

### 2. Composition

#### (1) Chairman :

Joint Secretary, Ministry of Textiles

#### (2) Members :

##### 1) Indian side :

- a) Project Manager
- b) Co-ordinator of the Project at the Central Office, CSB
- c) Co-ordinator at CSR&TI, CSB
- d) Co-ordinator at SSTL, CSB
- e) Co-ordinator at CSTRI, CSB
- f) Co-ordinator at NSSP, CSB
- g) Representative, Department of Economic Affairs, Ministry of Finance

##### 2) Japanese side :

- a) Team Leader
- b) Co-ordinator
- c) Representative, JICA India Office

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- d) Experts appointed by the Team Leader
- e) Other concerned personnel who will be dispatched by JICA if necessary

Note : Officials of the Embassy of Japan may attend the Joint Committee as observers.

#### VII. EVALUATION OF THE PROJECT

Evaluation of the Project will be undertaken towards the end of the Project period jointly by JICA and the Indian authorities concerned.

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## ANNEX

### I. MASTER PLAN

#### 1. Objectives and Scope of the Project

- (1) The Project will aim, through technical cooperation between India and Japan, to develop the practical technologies required to improve the quality and yield of bivoltine silk and thereby help the promotion of sericulture industry, which plays an important role in the national economy and rural development of India. Developed technologies deriving from the Project are expected to contribute to an increase in the production of bivoltine silk to meet the domestic demand.
- (2) The scope of the Project will encompass and be limited to the fields and activities specified in Section 2 below. The activities are aimed for the development of practical technologies in bivoltine sericulture. The Project's outcome will be disseminated by CSB to the producers through on-going national sericultural project activities. However, the extension of developed technologies deriving from the Project is the Indian Government's responsibility.
- (3) The Project will be the only programme under the CSB with the scope described above and it may not be duplicated by any other CSB organizations.

#### 2. ACTIVITIES OF THE PROJECT

To attain the objectives of the Project, Japanese technical cooperation will be rendered in the form of technology transfer and/or technical advice through the dispatch of Japanese experts, training of Indian personnel in Japan and provisions of equipment necessary to pursue the activities in the areas listed below :

- (1) Development of Silkworm Breeding Technology
- (2) Development of Silkworm Disease Control Technology
- (3) Development of Silkworm Rearing Technology
- (4) Development of Mulberry Breeding and Cultivation Technology
- (5) Development of Silkworm Seed Production Technology
- (6) Development of Silk Reeling Technology

## II. JAPANESE EXPERTS

1. Team Leader
2. Co-ordinator
3. Experts in the fields of :
  - (1) Silkworm Breeding
  - (2) Silkworm Disease Control
  - (3) Silkworm Rearing
  - (4) Mulberry Breeding and Cultivation
  - (5) Silkworm Seed Production

### Note :

- i. The Team Leader may serve concurrently as an expert in any field mentioned above II-3.
- ii. Long-term Japanese Experts to be dispatched including the Team Leader, the Co-ordinator and Experts from among the fields mentioned in II-3 above will not exceed six (6) in total at any given time. "Long-term" is defined as one year and over.
- iii. Short-term experts in the fields relevant to the activities of the Project listed in Section I.2. above, may be dispatched when the necessity arises for smooth implementation of the Project. "Short-term" is defined as less than one year.

## III. LIST OF EQUIPMENT

- (1) The Equipment includes machines, tools and other materials necessary for the activities of the Project referred to in Section I.2. above. A list of items and specifications of the Equipment will be made in consultation with the Japanese Experts.
- (2) Vehicles for the use in field activities.

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#### IV. LIST OF INDIAN PERSONNEL

##### 1. Counterparts :

- (1) Project Manager
- (2) Co-ordinators;
  - 1) Co-ordinator of the Project at the Central Office, CSB
  - 2) Co-ordinator at CSR&TI, CSB
  - 3) Co-ordinator at SSTL, CSB
  - 4) Co-ordinator at CSTRI, CSB
  - 5) Co-ordinator at NSSP, CSB
- (3) Counterpart Researchers in the Fields of;
  - 1) Silkworm Breeding
  - 2) Silkworm Disease Control
  - 3) Silkworm Rearing
  - 4) Mulberry Breeding and Cultivation
  - 5) Silkworm Seed Production
  - 6) Silk Reeling Technology
  - 7) Others if deemed necessary

##### 2. Technical Personnel :

- (1) Technicians,
- (2) Laboratory Assistants
- (3) Mulberry Farm Assistants
- (4) Others if deemed necessary

##### 3. Administrative Personnel :

- (1) Clerical and Administrative Staff
- (2) Drivers
- (3) Labourers
- (4) Others if deemed necessary

#### V. LIST OF LAND, BUILDING AND FACILITIES

##### 1. Buildings and Facilities :

- (1) CSR&TI, (Main Project Site)
  - (a) Bivoltine Breeding Laboratory
  - (b) Bivoltine Hybrid Testing Laboratory

- (c) High Temperature Testing Unit
- (d) Moth Inspection and Test Reeling Unit
- (e) Young-age Bivoltine Silkworm Rearing House
- (f) Late-age Bivoltine Silkworm Rearing House
- (g) Bivoltine Pathology Laboratory
- (h) Laboratory Animal House
- (i) Horticulture Division
- (j) Workshop
- (k) Others if deemed necessary

(2) SSTL (Sub-Project Site)

- (a) Seed Preservation Laboratory
- (b) Pebrine Testing Laboratory
- (c) Seed Crop Rearing House
- (d) Mini-Grainage
- (e) Others if deemed necessary

(3) CSTRI (Sub-Project Site)

- (a) Reeling Division
- (b) Silk Conditioning & Testing Laboratory
- (c) Others if deemed necessary

(4) HSSP Seed Production Centre (Sub-Project Site)

- (a) Seed Production Centre, Bangalore
- (b) Others if deemed necessary

2. Land :

(1) CSR&TI (Main Project Site)

- (a) Mulberry gardens
- (b) Experiment area for model bivoltine silkworm rearing houses
- (c) Others if deemed necessary

(2) SSTL (Sub-Project Site)

- (a) Mulberry gardens
- (b) Others if deemed necessary

(3) Others if deemed necessary

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official functions in India except for those arising from the wilful misconduct or gross negligence by the Japanese Experts.

**IX. MUTUAL CONSULTATION**

1. There will be mutual consultations between the two Governments on any major issues arising from or in connection with this Attached Document.

**X. TERM OF COOPERATION**

1. The duration of technical cooperation for the Project under this Attached Document will be five (5) years from Jun 1, 1991.

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TENTATIVE IMPLEMENTATION PROGRAMME  
FOR  
THE TECHNICAL COOPERATION  
FOR  
THE BIVOLTINE SERICULTURE TECHNOLOGY DEVELOPMENT PROJECT  
IN  
INDIA

Within the scope of the Record of Discussions signed on April 16, 1991, the Japanese Implementation Survey Team and the authorities concerned of the government of India have jointly formulated the Tentative Implementation Programme for smooth implementation of Technical Cooperation for the Bivoltine Sericulture Technology Development Project (hereinafter referred to as "the Project") as annexed hereto.

This Tentative Implementation Programme is subject to the condition that the necessary budget will be allocated for the Project and also subject to change in the course of Project implementation within the framework of the Record of Discussions.

NEW DELHI, INDIA  
April 16, 1991

*Keiji Jono*

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Keiji Jono  
Head,  
Implementation Survey Team,  
JICA, JAPAN

*P.S.S. Thomas*

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P.S.S. Thomas  
Member Secretary,  
Central Silk Board,  
Ministry of Textiles, INDIA

A N N E X

TENTATIVE IMPLEMENTATION PROGRAMME FOR DIVOLTING SERICULTURE TECHNOLOGY DEVELOPMENT PROJECT

Item	1st year	2nd year	3rd year	4th year	5th year
(Technical Cooperation Period)	Jun 1, 1991				May 31, 1996
I. PROJECT ACTIVITIES					
1. DEVELOPMENT OF SILKWORM BREEDING TECHNOLOGY					
(1) Preparatory Investigations					
a) Field Surveys					
b) Evaluation of existing breeds					
c) Evaluation of existing hybrids					
(2) Development of Breeding Plan Designing Methods					
a) Evaluation of breeding plans					
b) Breeding strategy development					
(3) Development of Pureline Breeding Technology					
a) Breeding for robustness					
b) Breeding for high silk content					
c) Breeding for high silk quality					
d) Development of breed maintenance methods					

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Item	1st year	2nd year	3rd year	4th year	5th year
(4) Development of Hybridization Techniques					
a) Development of combining methods					
b) Studies on hybrid evaluation methods					
c) Selections of hybrids					
2. DEVELOPMENT OF SILKWORM DISEASE CONTROL TECHNOLOGY					
(1) Field Survey					
a) Field Surveys					
(2) Development of Diagnostic Methods for Viral Diseases					
a) Collection and isolation of viral pathogens					
b) Standardisation of bioassay methods for viral pathogens					
c) Studies on immuno-serological diagnosis techniques					
(3) Development of Control Measures against Viral Diseases					
a) Infectivity and pathogenicity tests					
b) Studies on disinfection techniques					
c) Development of manual for viral disease control					

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Item	1st year	2nd year	3rd year	4th year	5th year
(4) Development of Diagnostic Methods for Microsporidian Diseases					
a) Collection and isolation of pathogenic microsporidians					
b) Identification of microsporidians					
c) Studies on immuno-serological techniques					
(5) Development of Control Measures against Microsporidian Diseases					
a) Infectivity and pathogenicity tests					
b) Studies of disinfection methods					
c) Development of manual for microsporidian disease control					
d) Development of Pebrine inspection techniques					
3. DEVELOPMENT OF SILKWORM REARING TECHNOLOGY					
(1) Development of Silkworm Rearing Technology for Young-age Silkworms					
a) Field surveys					
b) Examination of food value of mulberry leaves					
c) Development of rearing methods					
d) Development of rearing manual					

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Item	1st year	2nd year	3rd year	4th year	5th year
(2) Development of Rearing Technology for Late-age Silkworms					
a) Field surveys					
b) Examination of food value of mulberry leaves					
c) Development of transport and storage methods of mulberry shoots					
d) Studies on feeding methods					
e) Studies on rearing environment maintenance					
f) Field trials					
g) Development of rearing manual					
(3) Development of Mounting and Cocoon Harvesting Technology					
a) Development of apparatuses and mounting techniques					
b) Studies on the environmental conditions for mounting					
c) Development of apparatuses and technology for cocoon harvesting					
d) Development of mounting and cocoon harvesting manual					



Item	1st year	2nd year	3rd year	4th year	5th year
4. DEVELOPMENT OF MULBERRY BREEDING AND CULTIVATION TECHNOLOGY					
(1) Development of Mulberry Technology for Young-age Silkworm Rearing					
a) Studies on breeding methods					
b) Screenings and selections					
c) Development of cultivation technology					
d) Development of harvesting and transporting methods					
e) Field trials					
f) Development of standard technical manual					
(2) Development of Mulberry Technology for Late-age Silkworms					
a) Field surveys					
b) Studies on the breeding methods					
c) Screenings and selections					
d) Development of cultivation technology					
e) Development of harvesting and transporting methods					
f) Studies on improvement of existing cultivation practices					
g) Field trials					
h) Development of standard technical manual					

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Item	1st year	2nd year	3rd year	4th year	5th year
5. DEVELOPMENT OF SILKWORM SEED PRODUCTION TECHNOLOGY					
(1) Development of Silkworm Seed Preservation Technology					
a) Studies on silkworm eggs					
b) Development of hibernation techniques					
c) Development of chilling and acid treatment methods					
d) Development of preservation schedules					
(2) Development of Seed Crop Rearing Technologies					
a) Development of mulberry cultivation techniques for seed crop rearing					
b) Development of young and late-age silkworm rearing technology for seed crops					
(3) Development of Pebrine Control Practices for Seed Production Centres					
a) Field Surveys					
b) Development of moth examination techniques					
c) Development of Pebrine control manual for seed production centres					

Item	1st year	2nd year	3rd year	4th year	5th year
(4) Development of Mass Production Technology of Bivoltine Eggs					
a) Development of loose egg production methods					
b) Studies on incubation methods					
c) Development of packing and transportation techniques of silkworm eggs					
d) Field trials					
e) Development of production programme and manual for seed production centres					
6. DEVELOPMENT OF SILK REELING TECHNOLOGY					
(1) Development of Cocoon Testing, Drying and Storage Technology					
a) Field surveys					
b) Development of cocoon testing programme					
c) Development of cocoon drying and storing technology					
(2) Development of Reeling Technology					
a) Field surveys					
b) Development of cocoon cooking techniques					
c) Development of raw silk reeling technology					
d) Development of raw silk re-reeling technology					

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Item	1st year	2nd year	3rd year	4th year	5th year
(3) Development of Silk Testing Technology					
a) Field surveys					
b) Studies on raw silk conditioning methods					
c) Studies on raw silk testing and grading programme					
d) Development of design and operation manual for silk conditioning and testing house					

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Item	1st year	2nd year	3rd year	4th year	5th year
<b>II. JAPANESE CONTRIBUTIONS</b>					
1. Dispatch of Long Term Experts					
(1) Team Leader: * may serve as an expert in any field of (3) to (7) below					
(2) Co-ordinator					
(3) Silkworm Breeding Expert					
(4) Silkworm Disease Control Expert					
(5) Silkworm Rearing Expert					
(6) Mulberry Breeding and Cultivation Expert					
(7) Silkworm Seed production Expert					
2. Dispatch of Short Term Experts * may be dispatched when necessity arises					
3. Equipment Provision					
4. Indian Counterpart Training in Japan * Maximum of 5 persons per year may be accepted with Japanese expense					
5. Dispatch of Missions					
	Detail Programming	Annual consultation	Annual consultation	Annual consultation	2valuation

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Item	1st year	2nd year	3rd year	4th year	5th year
<b>III. INDIAN CONTRIBUTIONS</b>					
1. Assignment of Personnel					
(1) Project Manager					
(2) Co-ordinator of the Project at CSB Central Office					
(3) Co-ordinator at the Project Sites					
a) Co-ordinator at CSR&TI					
b) Co-ordinator at SSTL					
c) Co-ordinator at CSTRI					
d) Co-ordinator at NSSP					
(4) Counterpart Researchers :					
a) Silkworm Breeding Researchers					
b) Silkworm Disease Control Researchers					
c) Silkworm Rearing Researchers					
d) Mulberry Breeding and Cultivation Researchers					
e) Silkworm Seed production Researchers					
f) Silk Reeling Technology Researchers					

Item	1st year	2nd year	3rd year	4th year	5th year
(5) Administrative and Technical Personnel					
2. Local Running Cost					
3. Land, Building and Facilities					

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(x)

Dispatch of Japanese Experts  
(1) Long Term Experts

ANNEX 3.

Fiscal Year	Name (Specialty)	Year	1991	1992	1993	1994	1995	1996
	1) Dr. Kiyosi Kitaura (Team Leader, Mulberry Breeding and Cultivation) (Coordinator)		18/7		14/4			
	2) Mr. Jiro Obitu (Silkworm Breeding)		18/7			17/7		9/6
	3) Mr. Yasuhisa Mano (Silkworm Rearing)		18/7		4/9			
	4) Dr. Tamio Inokuchi (Silkworm Disease Control)		5/9		16/10			
	5) Dr. Tadasi Fujiwara (Silkworm Seed Production)		17/10		16/10			
	6) Mr. Kenichi Tajima (Team Leader)		17/10		27/5			9/6
	7) Dr. Yosiki Otuki (Mulberry Breeding and Cultivation)				29/7			9/6
	8) Mr. Kiyoto Hasegawa (Silkworm Disease Control)				28/10		27/10	
	9) Dr. Susumu Utumi (Silkworm Seed Production)				28/10		27/10	
	10) Mr. Toshio Hasiguchi (Silkworm Rearing)					26/5		25/5
	11) Mr. Akiyosi Muroga (Silkworm Breeding)						5/4	9/6
	12) Dr. Kunio Takamiya (Silkworm Breeding)							

(2) Short Term Experts

Fiscal Year	Name (Specialty)	Year	1992	1993	1994	1995	1996
1991	1) Mr. Shouhei Isii (Silk Testing)		30/1—8/3				
	2) Dr. Chiyuki Takabayasi (Silk Reeling)		30/1—22/3				
1992	1) Dr. Takeru Sato (Silkworm Disease Control)		17/7—9/8				
	2) Mr. Haruhiko Fujita (Mulberry Breeding And Cultivation)		6/9—15/10				
	3) Mr. Haruo Kinoshita (Silk Reeling)		6/9—3/12				
	4) Dr. Hiromi Takizawa (Silkworm Seed Production)			27/1—14/3			
	5) Mr. Yuji Matuura (Silkworm Rearing)			27/1—26/3			
	6) Dr. Tosio Yamamoto (Silkworm Breeding)			10/3—1/5			
1993	1) Dr. Osamu Ninagi (Silkworm Breeding)			14/10—26/12			
	2) Dr. Kozo Tubouchi (Silk Reeling)			14/10—26/12			
	3) Mr. Daiyu Ito (Mulberry Cultivation)			2/12—28/2			

(1)



Fiscal Year	Name (Specialty)	Year	1993	1994	1995	1996
1993	4) Mr. Masao Kato (Silkworm Rearing) 5) Mr. Akio Koyama (Mulberry Breeding And Cultivation)			16/2-20/4 16/2-20/4		
1994	1) Mr. Hisasi Tuboi (Silk Reeling) 2) Mr. Makoto Suzuki (Mulberry Breeding And Cultivation) 3) Dr. Hitosi Watanabe (Silkworm Disease Control) 4) Dr. Yukio Tanaka (Silkworm Breeding) 5) Dr. Sigeji Kiribayasi (Silkworm Rearing)			6/11-18/12 15/12-1/3	8/11-5/3 8/1-5/3 8/1-24/3	
1995	1) Dr. Tosiki Tamura (Silkworm Breeding) 2) Dr. Mutuo Miki (Silkworm Rearing) 3) Mr. Tosiniko Watanabe (Silk Reeling)				5/7-20/9 5/7-4/10 5/11-31/3	

(2)

Acceptance of Counterpart Trainees in Japan

ANNEX 4.

Fiscal Year	Name (Specialty)	Year	1991	1992	1993	1994	1995	1996
1991	1) Dr. S.N. Chaterjee (Silkworm Breeding) 2) Mr. Chandrasekharaiah (Silkworm Seed Production) 3) Mr. Murtuza Baig (Silkworm Disease Control) 4) Dr. Vinod B. Mathur (Silkworm Rearing) 5) Dr. P.uttaswamy Gowda (Silkworm Seed Production) 6) Mrs. Vijayalakshmi Rao (Silkworm Seed Production)		29/5-1/12 29/5-1/12 26/11 26/11 26/11 26/11	28/10 28/10 28/10 28/10				
1992	1) Mr. H. K. Basavaraja (Silkworm Breeding) 2) Mr. Bhanuprakash Raj (Silk Reeling) 3) Mr. B. Nataraju (Silkworm Disease Control) 4) Mr. B. S. Angadi (Silkworm Seed Production) 5) Dr. A. Sarkar (Mulberry Breeding And Cultivation)			15/6 15/6 23/11 23/11 23/11	3/3 3/3 31/8 31/8 29/9			
1993	1) Mr. Nirmal Kumar (Silkworm Breeding) 2) Mr. G. Hariraj (Silk Reeling) 3) Dr. K. K. Rajan (Silkworm Rearing) 4) Dr. Ramakant (Mulberry Breeding And Cultivation) 5) Dr. G. Vemananda Reddy (Silkworm Seed Production)				12/7 12/7 25/10 25/10	5/4 7/6 4/10 24/10 7/2-20/12		
1994	1) Dr. Gangesh Bahadur Singh (Silkworm Rearing) 2) Mr. Nimmanapalli Malreddy (Silkworm Breeding) 3) Mr. Aswanth Reddy (Silk Reeling) 4) Theeyancheri Othayoth Sasidharan (Pebrin Control For Seed Production)					18/4-16/12 18/4-16/12 18/4-15/11 29/8-5/3		
1995	1) Mr. Subash V. Naik (Silk Reeling) 2) Mr. Syed Abdul Aqueel (Mulberry Cultivation) 3) Dr. Nair Suresh Kumar (Silkworm Breeding) 4) Miss A. Meenal (Silkworm Rearing) 5) Dr. Ananthalakshmi Kumari (Silkworm Disease Control)						8/5-7/11 8/5-7/11 11/5-10/12 11/5-10/12 28/8	27/2

Utilization and Provision of Equipment & Machinery in 91/92  
 Costing More Than ¥1.6 Million  
 (BSTD Project)

ANNEX 5.

No.	Name of Equipment Including Its Model, Capacity etc.	Nos Provided	Nos Disposed	Nos Existing	Utilization	Place Where It Is Utilized or Kept	Unit Price in ¥,000	Number in Sticker	Remarks
3-04	自動減個体培養機 ザルトリクス Automatic Cocoon Rearing System	1	0	1	A	B1	2,220	3-3-04-B-1	
7	トヨタ ランドクルーザー トヨタ Toyota Land Cruiser	3	0	3	A	CSR&TI 2.S1	2,210	3-7-C-1 3-7-C-2 3-7-S-1	

M: Mulberry Cultivation Section, B: Breeding Section, R: Rearing Section, P: Pathology  
 Section, S: Silkworm Seed Technology Laboratory, C: CSR&TI

Utilization and Provision of Equipment & Machinery in 91/92  
 Costing More Than ¥100 Thousand and Less Than ¥1.6 Million  
 (BSTD Project)

NO.	Name of Equipment Including Its Model, Capacity etc.	Nos Provided	Nos Disposed	Nos Existing	Utilization	Place Where It Is Utilized or Kept	Unit Price In ¥1,000	Number in Stock	Remarks
1-02	桑州機 共栄社 MR40型 Mulberry Leaf Hackler	1	0	1	A	M	634	3.1-02-M-1	
2	動力鋸 御島 KC4型平和号 Motor Power Leaf Chopper Model KC-4(220V.)	2	0	2	A	B1, R1	570	3.2-B-1 3.2-R-1	
3-01	電子式記録天秤 ガルトリクス LC34000P型 Electronic Counter Scales Sartorius Model LC 34000P (220V) with adapter, printer etc.	2	0	2	A	B1, R1	557	3.3-01-B-1 3.3-01-R-1	
4-01	電子式自記温度計 日本計量器 NWR-9003E型 Electronic Thermo-Hydrograph Nihonkeiryouki Model NWR-9003E	8	0	8	A	B2, R2, P2, S2	105	3.4-01-B-1 3.4-01-B-2 3.4-01-R-1 3.4-01-R-2 3.4-01-P-1 3.4-01-P-2 3.4-01-S-1 3.4-01-S-2	
4-03	動力噴霧器 御島 KEH-15型 Motor Power Sprayer Model KEH-15	3	0	3	A	R1, B1, S1	256	3.4-03-B-1 3.4-03-B-1 3.4-03-S-1	
4-07	収露手取機 御島 MK-1型 Cocoon Harvester Floss Remover Model MK-1	1	0	1	A	R	235	3.4-07-R-1	
5	ホモジナイザー 日本精機 AM-11型 Homogenizer Nihon Seiki Model AM-11	2	0	2	A	P1, S1	432	3.9-P-1 3.9-S-1	
6	イキュバタ 御島 MIR-552型 Incubator Sanyo model MIR-552	4	0	4	A	B3, R1	750	3.6-B-1 3.6-B-2 3.6-B-3 3.6-R-1	
8	乾燥記録機 研科科学 DF-62型 Dry Oven Yanaco Nagaku Model DF-62	3	0	3	A	M1, B1, P1	600	3.8-M-1 3.8-B-1 3.8-P-1	

M:Mulberry Cultivation Section, B:Breeding Section, R:Rearing Section, P:Pathology Section, S:Silkworm Seed Technology Laboratory, C:CSR&TI,

Utilization and Provision of Equipment & Machinery in 91/92  
 AS Unaccompanied Bagesages  
 Costing More Than ₹100 Thousand  
 (BSTD Project)

No.	Name of Equipment Including Its Model, Capacity etc.	Nos. Provided	Nos. Disposed	Nos. Existing	Utilization	Place Where It Is Utilized or Kept	Unit Price in ₹ 1,000	Number in Stock	Remarks
K-01	7-HP. डायोन-WORD PROCESSOR SOIFCANAWARD ALPHA 65W	1	0	1	A	CI (Coordinator's Room)	164	3-X-01-C-1	

M:Mulberry Cultivation Section, B:Breeding Section, R:Rearing Section, P:Pathology Section, S:Silkworm Seed Technology Laboratory, C:CSR&TI

Utilization and Provision of Equipment & Machinery in 92/93  
 Costing More Than \$1.6 Million  
 (BSTD Project)

No.	Name of Equipment Including Its Model, capacity etc.	Nos. Provided	Nos. Disposed	Nos. Existing	Utilization	Place Where It Is Utilized or Kept	Unit Price in \$ 1,000	Number in Sticker	Remarks
29	自動個體秤量機 物量計, Automatic Cocoon Weighing System	1	0	1	A	B1	2,244	4-29-B-1	
15	母蛾磨碎機 種口撿滅 Silkworm Moth Smashing Machine Model: BM-20	1	0	1	A	B1	5,787	4-15-B-1	
11	米質検査装置 新増汎工業 Thread Evenness and Cleaness Inspecting Apparatus, SMM-001	1	0	1	A	B1	11,070	4-11-B-1	
07	一粒繰り米機 新増汎工業 Mono Cocoon Reeling Machine	1	0	1	A	B1	2,200	4-07-B-1	
04	培養用光合成測定装置 Ligor 社 Portable Photosynthesis System (LI-6200)	1	0	1	A	M1	6,300	4-04-M-1	
05	養蠶育用恒温恒湿装置 中央製作所 Temperature & Humidity Control Equipments for Silkworm Rearing (SERICATRON)	8	0	8	A	B3, R3, S2	4,422	4-05-B-1 4-05-B-2 4-05-B-3 4-05-R-1 4-05-R-2 4-05-R-3 4-05-S-1 4-05-S-2	

M: Mulberry Cultivation Section, B: Breeding Section, R: Rearing Section, P: Pathology Section, S: Silkworm Seed Technology Laboratory, C: CS&TI

Utilization and Provision of Equipment & Machinery in 92/93  
 Costing More than ¥100 Thousand and Less than ¥1.6 Million  
 (BSID Project)

No.	Name of Equipment Including Its Model, Capacity etc.	Nos Provided	Nos Disposed	Nos Existing	Utilization	Place Kept	Unit Price in ¥ 1,000	Number in Stock	Remarks
05-1	軟水器、中央製作所、HS-20 Water Softener, HS-20	3	0	3	A	B1, R1, S1	200	4-05-1-B-1 4-05-1-R-1 4-05-1-S-1	
06	台車式桑柄育種器、側島、1段式 Single Joso Rearing Device	4	0	4	A	R4	399	4-06-R-1 4-06-R-2 4-06-R-3 4-06-R-4	
10	冷動遠心分離機、トミ、RL-101 Refrigerated Centrifuge Main body (RL-101)	1	0	1	A	P1	858	4-10-P-1	
12	倒立顕微鏡 ⇒ TMS-F13 Inverted Microscope (TMS-F13)	1	0	1	A	P1	782	4-12-P-1	
16	刈り払い機、佐藤農機 EM-20 Hammer knife Mowing Machine (EM20)	1	0	1	A	M1	565	4-16-W-1	
17-1	恒温器、サニョ MIR-552 Sanyo Incubator MIR-552	6	0	6	A	P4, M1, S1	781	4-17-1-P-1 4-17-1-P-2 4-17-1-P-3 4-17-1-P-4 4-17-1-W-1 4-17-1-S-1	
17-2	恒温器、サニョ MIR-252 Sanyo Incubator MIR-252	4	0	4	A	R2, S2,	508	4-17-2-R-1 4-17-2-R-2 4-17-2-S-1 4-17-2-S-2	
17-3	恒温器、サニョ MIR-152 Sanyo Incubator MIR-152	4	0	4	A	S4	362	4-17-3-S-1 4-17-3-S-2 4-17-3-S-3 4-17-3-S-4	
18	乾燥培地機、科学 DF-62 Dry Oven, Yamato Kagaku Model DF-62	1	0	1	A	B1	657	4-18-B-1	
23	クリーンベンチ、科学 (CAF-1300BN) Clean Bench (CAF-1300BN)	1	0	1	A	S1	1,110	4-23-S-1	
24	加湿器、工業 200W2 Humidifier	8	0	8	A	B4, R2, P2	152	4-24-B-1 4-24-B-2 4-24-B-3 4-24-B-4	

9	耕起機 久保田 TI-55NB, Mini Tractor Kubota, II-55NB	1	0	1	A	M1	467	4-24-R-1 4-24-R-2 4-24-P-1 4-24-P-2	
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M: Mulberry Cultivation Section, B: Breeding Section, R: Rearing Section, P: Pathology Section, S: Silk worm Seed Technology Laboratory, C: CSR&II<sup>(2)</sup>



Utilization and Provision of Equipment & Machinery in 92/93  
 AS Unaccompanied Baggages  
 Costing More Than ¥100 Thousand  
 ( BSID Project )

No.	Name of Equipment Including Its Model , Capacity etc.	Nos Provided	Nos Disposed	Nos Existing	Utilization	Place Where It Is Utilized or Kept	Unit Price in ¥ 1,000	Number in Sticker	Remarks
X-01	ワードプロセッサ Word Processor SSOF PWP-5SIG NEC	1	0	1	A	C1 (Leader's Room)	116	4-K-01-C-1	
K-02	ワードプロセッサ Word Processor SSOF CANOWARD ALPHA65W	1	0	1	A	C1 (Coordinator's Room)	140	4-K-02-C-1	
K-10	ビデオカメラ Video Camera CCD-TRI	1	0	1	A	S1	161	4-K-10-S-1	
K-11	ワードプロセッサ 文芸 Word Processor Bungo Mini NEC	1	0	1	A	S1	122	4-K-11-S-1	

M: Mulberry Cultivation Section, B: Breeding Section, R: Rearing Section, P: Pathology  
 Section, S: Silkworm Seed Technology Laboratory, C: CSR&TI

Utilization and Provision of Equipment & Machinery in 93/94  
 Costing More Than ¥1.6 Million  
 (BSTD Project)

No.	Name of Equipment Including Its Model, Capacity etc.	Nos Provided	Nos Disposed	Nos Existing	Utilization	Place Where It Is Utilized or Kept	Unit Price in ¥ 1,000	Number in Sticker	Remarks
1	桑田豆蛾検査装置, Separator of Pebrin from Mass of Moth, Main Unit, Model SPM-2	1	0	1	A	S I	6,110	5-1-S-1	
2	浸透圧計, Osmotic Pressure Meter, Model Om-801	1	0	1	A	M I	1,810	5-2-M-1	
3	ワルブル管圧計, Warburg's Manometric Apparatus Model: MB-R with Transformer	1	0	1	A	S I	2,870	5-3-S-1	
4	超音波洗浄器, Ultrasonic Cleaner, Model: CA-7359	1	0	1	A	S I	1,675	5-4-S-1	
5	繭切開器, Breeding Cocoon Cutting Machine	1	0	1	A	S I	2,790	5-5-S-1	
6	小樽透過機, Small Reel Permeation Device	1	0	1	A	T I	4,242	5-6-T-1	
7	葉面積計, Leaf Area Meter, Model: 3LS-COMP	1	0	1	A	M I	3,130	5-7-M-1	
8	繭検査用自動繰糸機, Automatic Silk Reeling Machine, Compact Type, for Cocoon Testing Model CT-52	1	0	1	A	T I	34,500	5-8-T-1	

M:Mulberry Cultivation Section, B:Breeding Section, R:Rearing section, P:Pathology Section, S:Silkworm Seed Technology Laboratory, T:CTRI

Utilization and Provision of Equipment & Machinery in 93/94  
 Costing More Than \$100 Thousand and Less Than \$1.6 Million  
 (BSID Project)

No.	Name of Equipment Including Its Model, Capacity etc.	Nos. Provided	Nos. Disposed	Nos. Existing	Utilization	Place Where It Is Utilized or Kept	Unit Price in \$ 1,000	Number in Stock	Remarks
1-01-02-03	トヨタ用空気清浄機, Air Conditioner for Toyota Land Cruiser	3	0	3	A	C 2, S 1	323	5-1-01-C-1 5-1-02-C-2 5-1-03-S-1	
2	炭酸ガス発生器, CO2 Incubator MCO-175	1	0	1	A	P 1	1,040	5-2-P-1	
3	回転式マイクロトーム, Rotary Microtome, Model PR-50	1	0	1	A	S 1	590	5-3-S-1	
4	ガス発生器, Multi-Gas Incubator MCO-175M	1	0	1	A	S 1	1,470	5-4-S-1	
5-01-02	7チャンネルパイペット, Multi-Channel Pipet Model 8800	2	0	2	A	M 2	107	5-5-01-M-1 5-5-02-M-2	
6-01-02-03	電子式温度湿度計, Electronic Thermo-Hygrometer, Model 8-C	3	0	3	A	B 1, R 2	753	5-6-01-B-1 5-6-02-R-1 5-6-03-R-2	
7-01-02	分光光度計, Spectrophotometer, Model U-1100	2	0	2	A	R 1, M 1	730	5-7-01-R-1 5-7-02-M-1	
8	分光光度計付属品, 70% 分注器, Sample Sipper, Accessory for Spectrophotometer	2	0	2	A	R 1, M 1	142	5-8-R-1 5-8-M-1	
9	立体顕微鏡, Stereo Microscope, SMZ-1-3	1	0	1	A	M 1	218	5-9-M-1	
10	自記雨量計, Rain Gauge	1	0	1	A	M 1	176	5-10-M-1	
11	電気泳動装置, Slab Electro Phoresis	1	0	1	A	M 1	92	5-11-M-1	
12	電気泳動装置用乾燥機, Slab Gel Drier, EG-220	1	0	1	A	M 1	161	5-12-M-1	
13	電気泳動装置用動力装置, Power Unit, PS-520	1	0	1	A	M 1	118	5-13-M-1	
14	電気泳動装置用手動ポンプ, Handy Pump, VP-15	1	0	1	A	M 1	202	5-14-M-1	
15	オートクレーブ, Autoclave, Model EA-240M111	1	0	1	A	P 1	585	5-15-P-1	
16	遠心分離装置, Centrifugal Settling Apparatus, Model H-100E, Type TOKU	1	0	1	A	S 1	639	5-16-S-1	
17-1-2	電子顕微鏡, Electron Microscope, Type R	2	0	2	A	S 2	222	5-17-1-S-1 5-17-2-S-2	

M: Mulberry Cultivation Section, B: Breeding Section, R: Rearing Section, P: Pathology Section, S: Silkworm Seed Technology Laboratory, C: CSR&I, I: CSIRI

No.	Name of Equipment Including Its Model, Capacity etc.	Nos Provided	Nos Disposed	Nos Existing	Utilization	Place Where It is Utilized or Kept	Unit Price in ₹ 1,000	Number in Stock	Remarks
18	浸透圧計用7777, Printer, Model: P-180 for Osmotic Pressure Meter, Model: OM-801	1	0	1	A	M 1	294	5-18-M-1	
19-1 -2 -3	動力ぎ桑機, Leaf Chopper, Model: KC-4	3	0	3	A	S 1, R 2	551	5-19-1-S-1 5-19-2-R-1 5-19-3-R-2	
20-1 -2 -3 -4 -5	赤外線水分計, Infrared Moisture Meter, Model: FD-230	5	0	5	A	B 1, P 1, R 1, M 1, S 1	585	5-20-1-B-1 5-20-2-P-1 5-20-3-R-1 5-20-4-M-1 5-20-5-S-1	
21-1 -2	張力計, Tension Meter, Model: Te - 11	2	0	2	A	T 2	1,484	5-21-1-T-1 5-21-2-T-2	

M: Mulberry Cultivation Section, B: Breeding Section, R: Rearing Section, P: Pathology  
Section S: Silkworm Seed Technology Laboratory, T: CSIRI

Utilization and Provision of Equipment & Machinery in 93/94  
As Unaccompanied Baggages  
Costing More Than ₹100 Thousand  
(BSID Project)

No.	Name of Equipment Including Its Model, Capacity etc.	Nos Provided	Nos Disposed	Nos Existing	Utilization	Place Where It Is Utilized or Kept	Unit Price in ₹ 1,000	Number in Stock	Remarks
K-01	7-F/0t7*-Word Processor NEC Bungou Mini 1557	1	0	1	A	C 1 (Leader's Room)	194	5-R-01-C-1	
K-02	7-F/0t7*-Word Processor NEC Bungou Mini 55E	1	0	1	A	C 1 (Mulberry Expert)	174	5-R-02-C-1	
K-03	7-F/0t7*-IBM THINKPAD 550EJ	1	0	1	A	C 1 (Pathology Expert)	445	5-R-03-C-1	
K-04	7-F/0t7*-Word Processor NEC Bungou Mini	1	0	1	A	S 1 (SSP Expert)	173	5-R-04-S-1	

M:Mulberry Cultivation Section, B:Breeding Section, R:Rearing Section, P:Pathology Section, S:Silkworm Seed Technology Laboratory, C:CSR&TI

Utilization and Provision of Equipment & Machinery in 94/95  
 Costing More Than ¥1.6 Million  
 (BSTD Project)

No.	Name of Equipment Including Its Model . Capacity etc.	No. Pro- vided	No. Dis- posed	No. Exi- sted	Utilizat- ion	Place Where Equipment Is Utilized	Unit Price In ¥1,000	Number in Sticker	Remarks
1	寒卵保存用冷蔵装置 (付属品付) 冷蔵温度: -5C-15C Refrigerator Ovipositi With Accessories Control Limit: -5C~15C	2	0	2	A	B1, S1	4,980	6-1-B-1 6-1-S-1	
2	超遠心分離機 (特別付属品付) Ultra Centrifuge Separa- tion CP56G11 AC220V	1	0	1	A	P1	6,270	6-2-P-1	
3	超遠心分離機付属品 P56ST Swing Roter P56ST With Special Accessories	1	0	1	A	P1	1,800	6-3-P-1	
4	総合気象観測装置 DS-801型 Meteorological Station. Model DS-801	1	0	1	A	M1	7,130	6-4-M-1	
5	ボークブル気象観測装置 LT-1000S Datalogger LT-1000S	1	0	1	A	M1	2,485	6-5-M-1	
6	超低温庫 MDF-492AT Ultra-Low Temperature Freezer MDF-492AT	1	0	1	A	S1	1,900	6-6-S-1	
7	多糸繰糸機 Grouping Ends Machine for Cocoon Filaments AC220V 50Hz Single Phase	1	0	1	A	T1	8,455	6-7-T-1	
8	実務用煮繭機 Cocoon Cooking Appar- atus	1	0	1	A	T1	3,450	6-8-T-1	
9	恒温培養培養装置 Multiple Rotary- Shacubator S305R	1	0	1	A	M1	3,050	6-9-M-1	

M: Mulberry Cultivation Dept. B: Breedings Dept. R: Rearing Dept. P: Pathology Dept.  
 S: Silkworm Seed Technology Laboratory. T: CSRI

Utilization and Provision of Equipment & Machinery IN 94/95  
 Costing More Than ¥ 100 Thousand and Less Than ¥ 1.6 million  
 (BSTD Project)

No.	Name of Equipment Including Its Model, Capacity etc.	No. Provided	No. Disposed	No. Existing	Utilization	Place Where Equipment Is Utilized	Unit Price In ¥ 1,000	Number in Sticker	Remarks
1	動力噴霧器 (付属品付き) Motor Power Sprayer KEH-15	4	0	4	A	R1, B1, P1, S1	185	6-1-R-1 6-1-B-1 6-1-P-1 6-1-S-1	
2	給水装置 (付属品付き) GS-200 Automatic Water Distribution Apparatus GS-200, with Standard Accessories	2	0	2	A	R1, S1	558	6-2-R-1 6-2-S-1	
3	クリーンベンチ (トランスフォーマー、付属品付き) PCH-1303BN Clean Bench with Transformer & Accessories PCH-1303BN	2	0	2	A	P1, M1	1,110	6-3-P-1 6-3-M-1	
4	恒温器 (ヤマト DF-62) 付属品付き Constant Temperature Oven DF-62	2	0	2	A	R1 S1	505	6-4-R-1 6-4-S-2	
5	位相差顕微鏡 OPTIPHOT-2 X2F-25-21 (AC220V) NIKON PHASE CONTRAST-2 MICROSCOPE OPTIPHOTO-2 Model X2F-ph-21 AC220V	1	0	1	A	P1	1,010	6-5-P-1	
6	位相差顕微鏡 付属品 NIKON MICROGRAPHIC ATTACHMENT MICROFLUX TYPE AFX-DX=DWA AC220V	1	0	1	A	P1	660	6-6-P-1	
7	分光光度計 UV-1201V SPECTROPHOTOMETER MAIN UNIT UV-1201V	1	0	1	A	M1	580	6-7-M-1	
8	実体顕微鏡 SZ-10A NIKON MICROSCOPE SMZ-10A	1	0	1	A	B1	486	6-8-B-1	

M: Mulberry Cultivation Dept. B: Breeding Dept. R: Rearing Dept. P: Pathology Dept.  
 S: Silkworm Seed Technology Laboratory, T: CSIR

9	実体顕微鏡付高品 MICROFLEX 型 AFX-DX-DWA NIKON PHOTO-MICROGRA- PHIC ATTACHMENT MICROFLEX TYPE AFX-DX-DWA	1	0	1	A	B1	667	6-9-B-1	
10	回転台 (特別付属品付き) LR-85 ROTARY MICROTOME LR-85 With Special Accessa- ries	1	0	1	A	PI	769	6-10-P-1	
11	インキュベーター AFR-111S INCUBATOR AFR-111S With Standard Accessa- ries	1	0	1	A	PI	161	6-11-P-1	
12	振盪装置 1K41W 特別付属品付 INCUBATOR SHAKER 1K41W SPECIAL ACCESSARIES	1	0	1	A	PI	846	6-12-P-1	
13	電子式濃度計 DM-303 DIGITAL DENNSITOMETER DM-303	1	0	1	A	S1	1,582	6-13-S-1	
14	純水製造装置 GS-590 DEMINERALIZER GS-590	1	0	1	A	PI	943	6-14-P-1	



Utilization and Provision of Equipment & Machinery in 94/95  
 AS Unaccompanied Baggages  
 Costing More Than ₹ 100 Thousand  
 ( BSTD Project )

No.	Name of Equipment Including Its Model , Capacity etc.	Nos. Provided	Nos. Disposed	Nos. Existing	Utilization	Place Where It is Utilized	Unit Price In ₹ 1,000	Number in Sticker	Remarks
K-01	ワープロ兼ミニ 5UV Word Processor Bunso Mini SUV NEC	1	0	1	A	R1	140	6-K-1-R-1	
X-02	同上 Ditto	1	0	1	A	B1	140	6-K-2-B-1	
X-03	電子秤 Electronic Balance BP110S With Cable	1	0	1	A	T1	181	6-K-3-T-1	
X-04	サーモプリンター Thermo-Printer AP-210 With Sensor BS-21 AC Adapter	1	0	1	A	T1	112	6-K-4-T-1	
X-05	PH X-ケ- PH82-31 PH Meter PH 82-31	1	0	1	A	T1	103	6-K-5-T-1	

M: Mulberry Cultivation Dept, B: Breeding Dept, R: Rearing Dept, P: Pathology Dept,  
 S: Silkworm Seed Technology Laboratory, T: CSIRI

## Local Cost Affairs of JICA in US \$

ANNEX 6.

Fiscal Year	General Expenses	Total	Remarks
91	25,350.78	25,350.78	
92	70,360.98	70,360.98	
93	118,417.55	118,417.55	
94	97,379.64	97,379.64	
Total	311,508.95	311,508.95	

Table For Posting Indian Counterparts ANNEX 7.

FIELD	C/P Name	Arrangement of Counterparts					Training, Japan		Remarks									
		Year	91	92	93	94	95	Year		Main Institute								
	Month	4	7	0	1	4	7	0	1	4	7	0	1	4	7	0	1	※ National Institute of Sericultural And Entomological Science
	Chaterjee	—	—	—	—	—	—	—	—	91	NISES ※	—	—	—	—	—	—	Transferred
	M.N. Iyenger	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Transferred
	M.K. Ahsan	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Transferred from outside
	C.S. Nagaraja	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Transferred
	Basavaraja	—	—	—	—	—	—	—	—	92	NISES	—	—	—	—	—	—	
	Nirmal Kumar	—	—	—	—	—	—	—	—	93	Ditto	—	—	—	—	—	—	
	N. Malreddy	—	—	—	—	—	—	—	—	94	Ditto	—	—	—	—	—	—	
	K.P. Jayaswal	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Transferred
	K. Girichar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Suresh Kumar	—	—	—	—	—	—	—	—	95	Ditto	—	—	—	—	—	—	
	M.K. Majumder	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	K. Kumar	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Transferred from outside
	M.V. Samson	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Transferred
	M.N. Iyenger	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	Transferred from outside

S	Murtuza Baig					91	NISES	
D	B. Nataraju					92	Ditto	
	S. N. Rao							
C	K. V. V. Kumari					95	University	Training at Kyushu University
	Shivaprasad							
	T. Sasidharan							Transferred
	T. S. Kumar							Transferred from outside
	C. K. Kamble							Transferred from outside
S	V. B. Mathur					91	NISES	
	R. K. Rajan					93	Ditto	
	G. B. Singh					94	Ditto	
	A. Meenal					95	Ditto	
	K. I. Joshi							Transferred
	Himantharaj							
M	A. Sarkar					92	NISES	
B	Maja Rajan					94	Ditto	
C	Balakrishna							
	Basavaiah							Transferred
	T. Mogili							

M	Ramakant								93	NISES	
B	S.A. Aqueel								95	Ditto	
C	Chandrashek- harsiah								91	Ditto	Transferred
S I L K W O R M											
	A. Manjula										
	G. V. Reddy								93	NISES	
	P. Gowda								91	Ditto	Transferred
	Ramanja 'yulu										
	R. N. Datta										Transferred
	R. N. Singh										
	T. Singh										Transferred
	Sashidharan								94	University	Training at Kyushu University
	N. M. B. Saheb										
	S. V. Rao								91	NISES	
	B. S. Angedi								92	Ditto	
	Vijaya Kumar										
	B. N. Lak 'aiah										
R E E L I N G											
	B. Raj								92	NISES	Transferred
	G. Hariraj								93	Ditto	
	S. V. Naik								95	Ditto	



## Indian Contributions ,Operating Cost (US\$)

Year	Laboratry Construction Including Infra- structure	Equipment & Furniture	Total
91	671,574.19	220,500.00	892,074.19
92	783,503.22	257,250.00	1,040,753.22
93	447,716.13	147,000.00	594,716.13
94	335,787.09	110,250.00	446,037.09
Total	2,238,580.63	735,000.00	2,973,580.63

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
(1) Preparatory investigation										
a) Field survey						Indian actual situations and the defects of Indian bivoltine hybrid races and parent races will be pointed out.	A	1) Field survey was executed at some areas of traditional sericultural states viz. Karnataka, Tamil Nadu, Andhra Pradesh, West Bengal and Uttar Pradesh. Under new sericultural states, few places have been covered. Identification of difficult aspect of Indian environment and defect of Indian hybrid/breeds. 2) C/P have learned the defect identification methods.	1) Survey work will be continued in main sericultural states.	Survey work will be carried out by educating farmers on bivoltine sericulture technology.
b) Evaluation of existing breeds						Ways and means will be found to study the special characteristics of Indian parent breeds and its improvements.	A	1) Among the existing popular breeds, the performance of NB4D2 was satisfactory, whereas the performance of oval breeds was not satisfactory. 2) More emphasis should be given during breeding in developing good oval lines to match with dumbbell lines for hybrid exploitation. 3) Counterparts have learnt the evaluation methods.	(Completed)	
c) Evaluation of existing hybrids						The defects of the Indian bivoltine hybrids races will be picked up and confirm the characters to be improved.	A	1) The Indian bivoltine hybrids were found to be less in pupation rate, cocoon shell ratio and post cocoon parameters. 2) It is indicated that breeding for robustness, cocoon quality and silk quality improvement is necessary.	(Completed)	



1. DEVELOPMENT OF SILKWORM BREEDING TECHNOLOGY (2)

Item of work	Year					Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th					
(2) Development of breeding plan designing methods										
a) Evaluation of breeding plans						The assessment of the breeding methods being used till now will be carried out.	A	1) It was found that in the earlier breeding plans due importance was not given for the post cocoon parameters. 2) Breeding resource material was limited. 3) Counterparts were made to understand the various methods of evolving silkworm breeds.	(Completed)	
b) Breeding strategy development						Most suitable breeding method will be developed.	A	1) Development of new breeding method by crossing the imported commercial hybrids of Japan and backcrossing with existing Indian breeds. 2) Counterparts have understood the importance of evolving breeds by using oval x oval and dumbbell x dumbbell breeds. 3) Using the above new technique productive breeds have been developed.	1) Using the new technique, the development of productive breeds will be continued.	

1. DEVELOPMENT OF SILKWORM BREEDING TECHNOLOGY (3)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
(3) Development of pure line breeding technology										
a) Breeding for robustness						Robust and high yielding silkworm breeds under Indian environmental conditions will be developed.	B	1) Keeping pupation scale, breeding lines/hybrids with robustness have been selected 2) Testing of new breeds/hybrids for high temperature tolerance was conducted. 3) Counterparts have understood the breeding method for high temperature tolerance and also screening methods.	1) Testing of new breeds and their hybrids for high temperature tolerance will be continued. 2) The breeds have been developed which can be used for commercial exploitation.	
b) Breeding for high silk content						High silk content silkworm races will be evolved.	A	1) Five new lines were bred which exceeds 24% of cocoon shell ratio. 2) Counterparts have understood the breeding methods for high silk content.	1) Selection and breeding will be continued by Indian counterparts.	
c) Breeding for high silk quality						1) The weakness of the popular Indian races will be improved. 2) Silkworm races with 90-92 points neatness and uniform filament will be evolved.	A	1) Breeds have been developed with good post cocoon parameters. 2) Breeds have been developed with low boil off loss. 3) Breeds have been developed with neatness > 98.	1) Selection and breeding will be continued.	
d) Development of breed maintenance method						1) A fixed standard method to maintain the developed races will be established. 2) A characteristic maintenance method for evolved races will be developed.	B	1) After field survey, it was observed that the maintenance of approved breeds was not satisfactory. 2) Breed maintenance methods were developed.	1) Breeds maintenance/multiplication methods for new breeds will be developed.	

1. DEVELOPMENT OF SILKWORM BREEDING TECHNOLOGY (4)

Item of work	1991	1992	1993	1994	1995	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
	1st	2nd	3rd	4th	5th					
(4) Development of hybridization techniques								3) Guideline regarding the maintenance/multiplication of breeds were prepared and circulated. 4) Counterparts have understood the breed maintenance method.		
a) Development of combining methods						Identification of potential hybrids.	A	1) After F5 generation, all breeding lines were subjected for hybrid testing. 2) Two selected hybrids are subjected for authorization during 1995. 3) Counterparts have understood the methods for the identification of potential hybrids.	1) Selection of potential hybrids will be continued.	
b) Studies on hybrid evaluation methods						Study on assessment method of the suitable excellent hybrid races as per objectiveness of the breeding will be carried out.	A	1) Index method was developed for the identification of breeds/ hybrids. 2) The index method is being used at present. 3) Counterparts have understood the index method.	1) Hybrid evaluation methods will be continued by Indian counterparts.	
c) Selection of hybrids						Suitable silkworm races for hilly areas, plain areas and seasons will be selected.	B	1) Potential F1 hybrids are selected. 2) Selection method of hybrid combination have been well understood by Counterparts.	1) The good combiners will be sorted out. Field testing of selected hybrids at farmers / RRS / REC will be continued. 2) Season and region specific hybrids will be identified.	

2. DEVELOPMENT OF SILKWORM DISEASE CONTROL TECHNOLOGY (I)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remarks
(1) Field Survey										
a) Field Survey						Standard model for forewarning the occurrence of silkworm diseases will be prepared.	B	1) Actual incidence of silkworm diseases in farmer level was grasped. 2) In some of the seed producing areas still contaminated status of pebrine was proved. 3) Influence of seasonal factor on the individual farmer rearing condition and on the incidences of BmPV, BmIFV and BmDNV-1, 2 diseases were established. 4) C/Ps learned the methods of field survey on silkworm diseases.	1) Results are used for the preparation of manual on the control of silkworm diseases.	
(2) Development of diagnostic method for viral diseases										
a) Collection and isolation of viral pathogens						Purification and identification of viruses will be carried out.	A	1) Isolation, multiplication and purification of BmIFV and BmDNV1 were completed. 2) Method on the purification of BmDNV2 was determined. 3) C/Ps have learned the methods of purification and identification of viruses.	1) Separation and characterization of BmDNV2 will be carried out.	
b) Standardisation of bioassay methods for viral pathogens						The specific infectivity of virus will be confirmed.	A	1) Bioassay methods for infectivity of BmIFV and BmDNV1 were standardised and IC50 values were calculated. 2) Synergistic enterococci on the incidence of BmIFV flacherie were isolated and their induced factors were established. 3) C/Ps have understood the nature of spread and	1) Calculation of IC50 values for BmDNV2 will be determined using bioassay method. 2) Technique for control the synergistic enterococci on the incidence of BmIFV will be	

2. DEVELOPMENT OF SILKWORM DISEASE CONTROL TECHNOLOGY (2)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remarks
c) Studies on serological diagnosis techniques						Diagnostic method for viral diseases will be developed.	A	1) Various anti-viral IgGs were purified and characterised. 2) Immunodiagnostic assay methods were established for the detection of viral diseases. 3) C/PS have acquired the techniques for the diagnosis of viral diseases.	Investigated.  (Completed)	
(3) Development of control measure against viral diseases										
a) Infectivity and pathogenicity tests						Infectivity, loss of virulence and pathogenicity to different instars of silkworm will be determined.	A	1) Infectivity and pathogenicity of BmDNV1 were studied. 2) Bivoltine races bred by BSTD team were examined for resistance to BmDNV1.	1) Survival condition and infectivity of BmDNV2 will be investigated.	
b) Studies on disinfectant techniques						Bed disinfectant method and disinfectant suitable for Indian rearing conditions having effectiveness on viral disease will be determined.	B	1) The cowdung smeared tray was determined as the main source of viral disease infection. 2) The effectiveness of various disinfectants in use currently against BmNPV-polyhedra in the rearing trays smeared with cowdung were not found. 3) Effect of bleaching powder solution was strengthened by adding slaked lime to disinfect the BmDNV-polyhedra. 4) Disinfecting power of bleaching powder solution was increased by adding sodium bicarbonate.	1) Strengthening of bleaching powder solution on disinfecting action to BmNPV will be studied. 2) Survival places and intermediate carriers of viral pathogens in sericultural environment will be studied and effective preventive methods will be established.	

2. DEVELOPMENT OF SILKWORM DISEASE CONTROL TECHNOLOGY (3)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remarks
c) Development of manual for viral disease control								5) C/Ps have learned the disinfection techniques for silkworm pathogens. 6) C/Ps realized that application of cowdung in rearing environment was unreasonable and altered as like to guide the prohibition of cowdung smear in sericulture farms.	3) Infection in the rearing seat and causes for melting of cocoons will be studied and their preventive measures will be established.	
(4) Development of diagnostic methods for microsporidian diseases							A	1) Fundamental material for making manual on the viral disease control were determined.	1) Manual on control of viral diseases suitable for Indian condition will be prepared.	
a) Collection and isolation of pathogenic microsporidians							A	1) Different microsporidians, NIK-3h and NIK-4m were isolated from silkworm. 2) New microsporidians NIK-1m(1) was isolated from butterfly. 3) C/Ps have learned the methods of collection and purification of microsporidian from infected insects.	(Completed)	
b) Identification of microsporidians							A	Collection and purification of microsporidians from infecting silkworm and agricultural pests will be carried out.	1) C/Ps have completed the studies on morphological and histopathological identification of isolated microsporidians.	1) Morphological and histopathological identification of newly isolated microsporidians will be continued.

2. DEVELOPMENT OF SILKWORM DISEASE CONTROL TECHNOLOGY (4)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of Achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remarks
c) Studies on serological techniques						Diagnostic kit for identification of different microsporidians will be developed.	B	1) C/Ps were acquired the methods for the preparation of monoclonal antibody for strain discrimination. 2) Strain discrimination was done by using specific antibodies. 3) Specific surface proteins were isolated from <i>N. bombycis</i> and NIK-4m and their antibodies were prepared.	1) Specific antibodies for different isolated microsporidians will be generated.	
(5) Development of control measures against microsporidian diseases										
a) Infectivity and pathogenicity tests						The infectivity and infection pattern of different microsporidians will be confirmed.	A	1) Infectivity and pathogenicity of 4 microsporidians was determined. 2) Transovarial transmission was positive in NIK-2r, NIK-1s and NIK-3h, and negative in NIK-4m. 3) In egg incubation period <i>N. bombycis</i> was primarily multiplied in yolk cells and followed by midgut cells. 4) C/Ps were learned the determination methods of infectivity and pathogenicity of microsporidians.	(Completed)	
b) Studies of disinfection methods						Suitable disinfectants and chemicals for the control of different microsporidians will be confirmed.	B	1) The effectiveness of present ly used disinfectants i.e. as like bleaching powder and formalin, against <i>N. bombycis</i> spores in the disinfection of rearing tray smeared with cowdung was tested and found not effective.	1) Development of effective disinfectants and disinfection measures will be continued.	In enlightenment about prevention of pebrine disease,

2. DEVELOPMENT OF SICKFORM DISEASE CONTROL TECHNOLOGY (5)

Item of work	1991	1992	1993	1994	1995	Goal of Achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remarks
	1st	2nd	3rd	4th	5th					
c) Development of manual for microsporidian disease control								2) The disinfecting effect of bleaching powder was not perfect, when mixed with cowdung in the rearing trays. 3) Various currently used disinfectants were found that they killed pebrine spores present in the free state. 4) C/Ps have acquired the methods for determination of disinfecting action, which is useful for search of new effective chemicals.		it will be guided the farmers that the use of cowdung in rearing environment is unreasonable.
						Guidance manual for the control of microsporidia n diseases will be prepared.	A	1) Fundamental data were prepared to make standard manual on microsporidian disease control. 2) Tendency to control pebrine disease at farmer level was inspected thoroughly and achieved.	1) Standard guidance manual will be prepared for technical persons in item (5)-c and (5)-d.	
d) Development of pebrine inspection methods						Suitable pebrine inspection technique for detection will be developed.	A	1) Presently available sampling methods in mother moth inspection were found to be suitable in control of pebrine disease. 2) C/Ps have acquired the mother moth inspection technique.	(Completed)	



3. DEVELOPMENT OF SILKWORM REARING TECHNOLOGY (1)

Item of Work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of Achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
(1) Development of silkworm rearing technology for young age worm										
a) Field survey						The problems and weak points in young silkworm rearing at field level will be pointed out.	A	1) Field survey was done in each state of Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Uttar Pradesh, Rajasthan and West Bengal and actual problems of silkworm rearing at farmer's place was clearly understood. 2) Counterparts have been clearly learnt the field investigation method.	1) The problems in bivoltine rearing in the sericultural belt will be identified.	The field survey will be done along with work of educating and diffusion.
b) Examination of food value of mulberry leaves						Suitable mulberry variety for young silkworm rearing will be identified.	A	1) Based on the Biological examination/test assessment has been done with 13 Indian mulberry varieties. It was confirmed that from the results the two varieties V1 and S66 are suitable for young silkworm rearing. 2) Counterparts have learnt the feed value testing method.	(Completed)	
c) Development of rearing methods						Suitable rearing method for Indian environmental condition will be developed.	A	1) Seven types of chawki rearing methods were examined. 2) With the results, it was confirmed that is the (Pratin par) wrapping rearing method of maintaining the moisture content of the supplied leaves and results obtained were good. It also showed that the wrapped rearing could replace the previous methods of using foam pads for keeping the humidity. 3) Counterparts have learnt the development technique of rearing method.	(Completed)	

3. DEVELOPMENT OF SILKWORM REARING TECHNOLOGY (2)

Item of Work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of Achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
d) Development of rearing manual						Standardisation of rearing technology for young age rearing will be done.	A	1) A draft on young silkworm rearing manual has been prepared.	1) Certain improvement of the draft will be done.	
(2) Development of rearing technology for late age silkworm										
a) Field survey						The problems and weak points in late age silkworm rearing at field level will be pointed out.	A	1) Field survey was done in state of Karnataka, Andhra Pradesh, Tamil Nadu, Kerala, Uttar Pradesh, Rajasthan and West Bengal and the problems encountered by the farmers during rearing was clearly understood. 2) Counterparts have learnt the field investigation techniques.	1) Identification of field problems and solving them will be continued.	The field survey will be done along with work of educating and diffusion.
b) Examination of food value of mulberry leaves (for late age silkworm)						Suitable mulberry variety for late age silkworm will be identified.	A	1) Based on biological examination/test, assessment has been done with 18 Indian mulberry varieties. It was confirmed the results that the two varieties V1 and S36 are suitable for late age silkworm also. 2) Counterparts have learnt the feed value investigation method.	(Completed)	
c) Development of transport and storage method of mulberry shoots						Suitable transport and storage methods for mulberry shoots will be developed.	A	1) Based on different covering materials (polythene sheet, gunny cloth, fertilizer bag sheet) the mulberry shoots were covered and was transported from a distance, which takes 30 minutes upto rearing house. Shoot preservation method and	(Completed)	

3. DEVELOPMENT OF SILKWORM REARING TECHNOLOGY (3)

Item of Work	1991 1992 1993 1994 1995					Goal of Achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
	1st	2nd	3rd	4th	5th					
c) Studies on feeding methods						Suitable feeding method and feeding frequency will be determined.	A	<p>shoot quality were tested. With the results, it was confirmed that the mulberry shoots covered with polythene sheet was found suitable for transporting mulberry shoot.</p> <p>2) Counterparts have learnt the development techniques of suitable mulberry shoot transportation and preservation methods.</p> <p>1) It was confirmed that 2-3 times feeding/day in shoot rearing is good/sufficient. 2) It was also confirmed that 3 feedings/day is necessary during high temperature with dryness. 3) Counterparts have become well versed with shoot feeding/shoot preservation techniques.</p>	<p>1) An experiment will be carried out to find the quantity of mulberry shoots with leaves required during 5th instar by shoot rearing.</p>	
e) Studies on rearing environmental maintenance						Methods for maintenance of ideal temperature and humidity in rearing house will be determined.	A	<p>1) It was clearly confirmed that 24°C temperature environment is good for having good rearing results with quality cocoons. 2) Counterparts have gained knowledge about the rearing environment management method.</p>	<p>1) Based on Indian techniques, study on the effects of temperature and humidity management method will be carried out.</p>	
f) Field trials						Rearing methods suited to different agroclimatic conditions will be determined.	B	<p>1) The field trials were repeated at the selected farmers level in Mysore area and studies on the developed technology at farmers' level was carried out. 2) Counterparts have gained knowledge about field trial conducting methods and evaluating methods of results obtained.</p>	<p>1) The field trial will be conducted at Anantapur (AP), Salem (TN), Chamarajanagar (Karnataka) and Coonoor (TN).</p>	

3. DEVELOPMENT OF SILKWORM REARING TECHNOLOGY (4)

Item of Work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of Achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
g) Development of rearing manual						Standardisation of rearing technology for late age rearing will be done.	B	1) manual preparing for late age worm rearing is under progress.	1) Manual for late age silk-worm rearing will be completed.	
(3) Development of mounting and cocoon harvesting technology										
a) Development of apparatus and mounting techniques						Suitable mounting and mounting methods suited to Indian conditions will be developed.	A	1) It was confirmed that the excellent reeling results could be obtained from the cocoons produced by Japanese rotary mountages as compared to Chandrike. 2) Jobarai mounting method is developed and it was confirmed that the working duration could be reduced. 3) Counterparts have gained the knowledge about mounting by using rotary mountages with Jobarai method.	(Completed)	
b) Studies on the environmental conditions for mounting						Effect of temperature and humidity in different season during spinning will be confirmed.	B	1) The pupation and emergence period under different temperature condition was investigated by using Serikatron. Suitable mounting and harvesting time also was established. 2) It was clearly established that during spinning 1m/sec air velocity is good and necessary. 3) Counterparts have gained the knowledge regarding management of environmental conditions during mounting and spinning.	1) After certain modifications in Serikatron for humidity control, experiments will be carried out to know the effect of humidity on spinning, cocoon quality and tatters.	

3. DEVELOPMENT OF SILKWORM REARING TECHNOLOGY(S)

Item of Work	Year					Goal of Achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th					
c) development of apparatus and technology for cocoon harvest						Suitable and proper cocoon harvesting method will be developed.	A	1) Indigenous cocoon harvester was developed to harvest cocoon from rotary mountage and cocoon harvesting test was carried out and compared with cocoon harvester provided by Japan. 2) Developed cocoon harvester used for rotary mountage saves 40-60% of working hours in comparison to manual labor. 3) Counterparts have learnt the work procedure of cocoon harvest.	(Completed)	
d) Development of mounting and cocoon harvesting manual						Mounting and harvesting method will be standardized and guidance manual will be prepared.	B	1) Mounting and cocoon harvesting manual is under progress.	1) The manual will be completed.	

4. DEVELOPMENT OF MULBERRY BREEDING AND CULTIVATION TECHNOLOGY (1)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
(1) Development of mulberry technology for young age silkworm							A	1) Artificial crossing using the genetic resources of the CSR&II was conducted. A total of 70 cross combinations were tried for five times. 2) C/ps have learnt the breeding techniques of mulberry.	1) Effective breeding techniques are to be clarified based on the crossing data obtained.	
a) Studies on breeding methods for young age bivoltine silkworm						Suitable mulberry varieties for young age silkworm will be developed through different breeding techniques.				
b) Screening and selection						The nursery selection procedure is to be standardised.	B	1) Raising of about ten thousand of hybrid plants and evaluation of their economic characters have been carried out. 2) Promising progenies were selected and 30 progenies are going to be tested in the second selection (line selection). 3) C/ps have learnt the selection and propagation techniques.	1) The individual selection will be continued and selected plants will be tested in the line selection. 2) Adaptability of existing varieties and lines to young age silkworm will be clarified. 3) Effective selection procedure will be standardised.	
c) Development of mulberry cultivation technology						An agronomical package with respect to spacing, manuring & irrigation is to be established.	A	1) Effects of the planting spaces and fertilizers on leaf yield and quality are clarified under irrigated conditions. By this experiment, basic data for developing the agronomical package were obtained. 2) C/ps have learnt the analyzing method of the productive structure of mulberry fields and managing method of soil water condition.	1) An agronomical package of mulberry cultivation for young age silkworm will be developed.	

4. DEVELOPMENT OF MULBERRY BREEDING AND CULTIVATION TECHNOLOGY (2)

Item of work	1991	1992	1993	1994	1995	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
	1st	2nd	3rd	4th	5th					
d) Development of harvesting & transporting method						An efficient harvesting methods and transporting system which keep the leaves fresh are to be developed.	A	1) Various mulberry harvesting methods for young age silkworm have been examined. 2) Preliminary result was obtained on the efficient transport system. 3) C/ps have learnt the harvesting methods of the mulberry for young age silkworm.	1) The experiment on harvesting methods will be continued to develop efficient method. 2) The efficient transporting system will be developed.	
e) Field trials						Region specific varieties are to be developed.	B	1) On the superior line S36, testing on regional adaptability at RSRSS is under progress.	1) The test of regional adaptability will be conducted.	
f) Development of standard technical manual						All recommendation will be prepared and the standard manual is to be compiled.	A	1) A draft of the standard manual was prepared.	1) Recommendation will be compiled and standard manual will be prepared. 2) Standard manual will be published.	
(2) Development of mulberry technology for late age silkworm										
a) Field survey						The existing practices will be understood.	A	1) Existing cultivation practices were surveyed at various districts and actual conditions of them were clarified.	1) Cultivation practices will be clarified more definitely.	Clarification will be done through the trials at farmers fields.
b) Studies on the breeding methods						Suitable mulberry varieties for late age silkworm are to be developed through different breeding techniques.	A	1) Five times artificial crossing using the genetic resource of the CSR&I was conducted. A total of 70 cross combinations were tried. 2) C/ps have learnt the breeding techniques of mulberry.	1) Effective breeding techniques are to be clarified based on the crossing data obtained.	

4. DEVELOPMENT OF MULBERRY BREEDING AND CULTIVATION TECHNOLOGY(3)

Item of Work	1991	1992	1993	1994	1995	Goal of Achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
	1st	2nd	3rd	4th	5th					
c) Screening and selection						Selection procedure is to be standardised.	B	<p>1) Raising of the hybrid plants and evaluation of their economic characters have been carried out.</p> <p>2) Promising progenies were selected and 30 progenies are going to be tested in the line selection.</p> <p>3) Among the existing strains, VI was selected as the most promising line under the shoot harvesting method.</p> <p>4) C/ps have learnt the selection and propagation technique.</p>	<p>1) The individual selection will be continued and the selected plants will be tested in the line selection.</p> <p>2) Effective selection procedure will be standardised.</p>	
d) Development of cultivation technology						An agronomical package for mulberry cultivation for late age silkworm is to be established.	A	<p>1) Under irrigated condition, effects of the planting spaces and fertilizer doses on the shoot harvesting(A type) were clarified and a technical package was prepared.</p> <p>2) C/ps have learnt the method of field management and the training method of mulberry.</p>	<p>1) A new technical package composed of shoot harvesting B type will be developed.</p>	
e) Development of harvesting and transportation method						An efficient harvesting and transporting system which keep the leaves fresh are to be established.	A	<p>1) Efficient shoot harvesting methods(A, B type) were developed.</p> <p>2) Using the polyethylene bag which keep the leaves fresh, transporting system was examined.</p> <p>3) C/ps have learnt the shoot harvesting methods.</p>	<p>1) The field trial on the shoot harvest method(B type) will be completed.</p> <p>2) The efficient transporting system will be developed.</p>	
f) Studies on improvement of existing cultivation practices						An innovated technology for existing mulberry fields is to be developed.	A	<p>1) Using existing mulberry field of CSR&amp;TI, improving methods were examined and the plans for improvement were obtained.</p> <p>2) C/ps have learnt the improving methods of low productive mulberry fields.</p>	<p>1) The plans will be tested at fields to confirm the effect.</p>	



4. DEVELOPMENT OF MULBERRY BREEDING AND CULTIVATION TECHNOLOGY (4)

Item of Work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of Achievement	Score	Present Status and Attainment	Activities on Remaining Period	Remark
g) Field trial						The package with selected varieties is to be transferred to different agro-climatic zones.	B	1) Adaptability to the different environment conditions was tested on the improved lines and varieties using pot plants. 2) The regional adaptability testing is under preparing on the agronomical package with promising line S36. 3) C/ps have learnt the screening method of tolerant varieties to stressed conditions.	1) Pot plant experiment will be continued to clarify the adaptability of existing lines and varieties to the environmental conditions. 2) The regional variety and package adaptability testing will be started to recommend the superior regional variety and package.	
h) Development of standard technical manual						All recommendation will be prepared and the standard manuals to be compiled.	A	1) Studies from a) - g) are under progress. 2) A draft of standard manual was prepared.	1) Recommendation will be compiled and standard manual will be prepared. 2) Standard manual will be published	

5. DEVELOPMENT OF SILKFORM SEED PRODUCTION TECHNOLOGY (1)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
(1) Development of bivoltine egg preservation technology										
a) Studies on the silkform eggs						Suitable embryonic stage for preservation of diapausing eggs will be identified.	A	<p>1) Identifying technology of the embryonic development by stage has been standardised.</p> <p>2) Under the optimal temperature condition, table of the embryonic development stages has been prepared for the few silkform races by counter-part.</p> <p>3) In accordance to the new hibernation schedule, the embryonic development of the hibernated eggs were observed and obtained useful data for the improvement of hibernation schedule.</p> <p>4) In order to study the intermediate care method suitable to India, the intermediate care temperature and embryonic development was investigated.</p>	<p>1) The same type of experiment will be continued with newly developed silkform races, CSR2, CSR4 and CSR5. The special feature of these races will be studied separately.</p>	
						Physiological and biochemical changes during hibernation will be determined.	A	<p>1) Under different condition the egg protein that helps the development during diapause and the glycogen quantity variation investigation was carried out.</p> <p>2) The results are under analysis for physiological significance and spacial feature of the races.</p> <p>3) Counterpart has learnt the analysing method of protien and glycogen on silkform eggs.</p>	<p>1) Progress in diapause stage and stimulation studies during embryonic development and biochemical changes concerned to the new races will be studied.</p>	

5. DEVELOPMENT OF SILKWORM SEED PRODUCTION TECHNOLOGY (2)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
b) Development of hibernation technique						Specific schedule for different period of preservation will be formulated.	B	<p>1) The existing bivoltine races in India, NB4D2, CCl and KA were used. The aestivation period was 20-60 days and cold storage duration was 60-110 days with the combination of both treatments, the hatchability of the eggs were observed. In order to have hatchability as per plan, the preservation schedule was prepared.</p> <p>2) In case the hatchability ratio was low, based on either cold storage prolongation or a light acid treatment method was developed for the improvement of hatchability.</p> <p>3) As a second trial with a combination of aestivation period and cold storage period of 141-221 days schedule was prepared and is under progress.</p> <p>4) Counterpart has learnt a standard hibernation technique.</p>	<p>1) The second trial will be carried out.</p> <p>2) Similar studies on new races will be conducted.</p>	
c) Development of chilling and acid treatment						Short and long term chilling and acid treatment will be developed.	A	<p>1) By using the present Indian popular race NB4D2 &amp; CCl, acid treatment condition has been evolved to achieve high hatchability.</p> <p>2) Counterparts have learnt standardizing of short term chilling and long term chilling and acid treatment techniques.</p>	<p>1) Different types of chilling and acid treatment combination will be studied and the chilling and acid treatment technique will be developed for silkworm races with permissible range limit.</p>	

5. DEVELOPMENT OF SILKWORM SEED PRODUCTION TECHNOLOGY (3)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
d) Development of preservation schedule						Schedule for short and long term preservation of eggs will be standardized.	B	1) Studies from subitems a-c are currently under progress and in order to plan the short term, long term preservation treatment of silkworm eggs, are being accumulated.	1) The remaining experiment under the a-c will be carried out, and in order to have suitable preservation package for diapausing eggs throughout the year, a preservation schedule will be prepared.	
(2) Development of seed crop rearing technique										
a) Development of mulberry package for seed crop rearing						Systematization of mulberry cultivation for seed crop rearing will be done.	A	1) Mulberry plantation of S36, S13 and TR10 varieties by adopting Indo-Brazil and Indo-Japan spacing schedule has been done. The yield difference investigation under various pruning treatment has been done. There is a difference in the yield based on variety and pruning methods. In 60cm pruning S36, in 30cm pruning S13 has shown high yield respectively. 2) Using these varieties biomass studies has been started and presently the analysis of the results are under progress. 3) The counterparts have learnt the pruning methods used for parent race silkworm rearing.	1) The results will be compiled and suitable mulberry cultivation system will be prepared for seed crop rearing.	

5. DEVELOPMENT OF SILKWORM SEED PRODUCTION TECHNOLOGY (4)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
b) Development of young and late age silkworm rearing technology						Seed crop rearing technology will be standardized.	A	1) By using several mulberry varieties, moulting test was conducted to select suitable mulberry variety for seed crop. As a suitable variety for young silkworm rearing SI8 and for late age silkworm rearing TR10 were selected. 2) The feed regulation experiment for studying suitable feed quantity for late age worms was performed and the results are analysed including the hatchability. 3) The counterparts have learnt the feed value testing method as well as suitable feed quantity test method.	1) The same experiment will be carried out by using new silkworm races to study the suitable quantity of feed during late age.	
(3) Development of pebrin control practices for seed production centers a) Field Survey						In order to take appropriate control measures a system of forwarding the occurrence of pebrine in seed area in different season will be established.	A	1) Regular seasonal survey to record the incidence of pebrin disease during different seasons at all the stages of basic seed multiplication, in addition to commercial seed production centers/grainages of Tamilnadu and Andrapradesh state were conducted. 2) The counterparts have learnt the investigation method and they have been putting it into practice.	1) Survey/Investigation will be continued by the counterparts. 2) The investigation data will be analysed season wise, occurrence and its infection rate will be confirmed and summarised.	

5. DEVELOPMENT OF SILKWORM SEED PRODUCTION TECHNOLOGY (5)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining period	Remarks
b) Development of sampling and moth examination technology						Procedure of sampling and examination of mother moths for accurate detection of pebrine disease will be standardized.	A	1) Standard mother moth examination technique is developed. 2) The standard mother moth examination technique is being followed in all the commercial grainages. The evaluation of the sampling technique is being studied. 3) Counterparts have learnt single moth examination method and sampling mother moth examination.	1) The evaluation of the sampling technique suggested by expert will be continued and compared to the existing sampling technique. After completion of the simulation studies a suitable sampling method will be initiated.	
c) Development of pebrine control package for seed production centers						Moth examination system for production of basic and commercial seed will be established.	A	1) Standardisation of mother moth examination technique has been done and it is being in parent or hybrid seed production centres. 2) Guideline for mother moth examination technique has been prepared for printing. The same is under progress.	1) A comprehensive detailed guideline booklet will be prepared including the sampling technique. 2) The guideline booklet will be distributed to the silkworm seed preparation center in each region.	
(4) Development of mass egg production technology of bivoltin eggs								1) The important equipments needed for loose eggs production such as loose egg washing tray, egg drying unit, winnowing unit etc. has been fabricated. 2) Loose egg production method has been standardised. 3) The loose eggs prepared by counterpart has been distributed to certain area on experimental basis for rearing. 4) A comprehensive guideline have been prepared.	(Completed)	Certain newly developed equipments were supplied to SSFC Bangalore and Dehradun. It is being used effectively.
a) Development of loose egg production						Standard technique for loose egg production will be developed.	A			

5. DEVELOPMENT OF SILKWORM SEED PRODUCTION TECHNOLOGY (6)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining period	Remarks
b) Studies on incubation method.						The method of incubation under tropical condition will be standardized.	A	1) The silkworm egg incubation experiment was conducted under optimal and varied climatic condition. 2) The studies on embryonic growth and hatchability of the silkworm eggs incubated under adverse condition (30°C & 30%RH), it was observed that it affects the hatchability. 3) Counterparts have learnt the handling of silkworm eggs during incubation.	1) From the results of incubation experiments the bioassay study will be carried out and whichever treatment showed high hatchability and high rearing performance, the incubation technique will be standardized and appraised.	
c) Development of packing and transportation technique of eggs						The egg transportation technique will be developed.	A	1) Loose egg packing and incubation covers have been developed. 2) The egg transportation boxes of various capacity have also been fabricated. 3) The developed equipments have been supplied to NSSP for testing the practical utility.	1) The egg transportation test will be carried out. 2) Practical utility of these will be studied and side by side further improvement will be done.	The improved equipments diffusion at users level will be planned.
d) Field trials						The existing method of bivariate egg production will be improved.	A	1) The egg production technique have been demonstrated in seed production centres of NSSP. 2) Based on the feed back improvements were carried out.	1) Guidance and propagation of large scale loose egg production technique in the commercial grain age will be undertaken.	The training in large scale egg production have been conducted for the different grain ages.

5. DEVELOPMENT OF SILKWORM SEED PRODUCTION TECHNOLOGY (7)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining period	Remarks
e) Development of production programme and package for seed production.						A standard manual for the production of bivoltine hybrid eggs will be prepared.	A	1) Comprehensive guideline on loose egg production techniques has been compiled.	1) The manual prepared on management of loose egg production will be circulated to all graineurs.	Based on the diffusion of this technique, a rationalization of large scale egg production will be planned.



6. DEVELOPMENT OF SILK REELING TECHNOLOGY (1)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
(1) Development of cocoon testing drying and storage technology a) Field survey						Collection of information pertaining to the existing methods and problems thereon to achieve quality and productivity	A	1) Field survey was done and understood the present conditions.	(Completed)	Counterparts will do the investigation if it is necessary.
b) Development of cocoon testing programme						A cocoon testing programme suitable to Indian condition would be developed	B	1) A standard cocoon quality test method has been developed. 2) The developed standard cocoon quality testing method is being diffused at the field level by counterpart through DCTC. 3) Leaf-let for standard cocoon quality testing method has been prepared by counterparts.	1) The diffusion of standard cocoon testing method will be continued in CSTRI and DCTC. 2) To introduce cocoon quality testing, the required reeling techniques have been developed, and cocoon testing method will be improved suitable to India.	
c) Development of cocoon testing and storage technology						While keeping in view the cocoon storing condition, suitable hot air drying condition will be determined.	A	1) A hot air drying procedure/method has been developed. With the cocoon dried in this procedure, a examination of cocoon preservation and reeling are being done. 2) Counterparts have modified and improved the sun drying method.	1) Studies on low temperature cocoon drying and reeling condition suitable to India will be examined. 2) A plan for diffusing the developed low temperature drying method at the field level will be designed.	

6. DEVELOPMENT OF SILK REELING TECHNOLOGY (2)

Item of work	1991	1992	1993	1994	1995	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
	1st	2nd	3rd	4th	5th					
(2) Development of reeling technology a) Field survey						The problems of present technology level and planning will be understood.	A	1) Field survey was done and present conditions were understood. 2) The counterparts have picked up the problems concerned to diffusion plan of reeling technique of bivoltine cocoons and have solved it.	(Completed)	The Indian counterparts will do investigation if it is necessary.
b) Development of cocoon cooking techniques						Appropriate cooking method suitable to Indian bivoltine cocoons will be developed.	B	1) As a suitable cocoon cooking method, 2 pan or 3 pan cocoon cooking method has been developed. 2) This 2 pan or 3 pan cocoon cooking method' diffusion is being done to the reelers with multient reelers.	1) The diffusion of 2 pan or 3 pan cocoon cooking method at the field level will be continued. 2) A stabilized pressurized cocoon cooking method will be developed.	
c) Development of raw silk reeling technology						Suitable modification of the machine and process parameters to work out appropriate reeling technology for bivoltine cocoon to achieve the production of superior grade silkyarn will be carried out.	B	1) Improvement on existing multient reelers machines were done. (These machines are effectively used in the field) 2) Size denier detector has been developed by keeping the Japanese denier indicator as model. (Commercial production of this device being planned) 3) The counterparts have understood the reeling techniques and if bivoltine hybrid cocoon evolved in this project is used, they can produce 2A and above grade raw silk.	1) To develop reeling technology suitable to the Indian conditions, the improvement on the denier indicator developed will be carried out and introducing of this in the cottage basins will be carried out.	

6. DEVELOPMENT OF SILK REELING TECHNOLOGY(3)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
d)Development of raw silk re-reeling technology						Proper re-reeling technology to have the quality of bivoltine silk improved will be developed.	B	1)A ten small reel permeation chamber of small size (with motorised vacuum pump equipment) has been developed. 2)A small size manually operated permeation chamber is under developmental stage. 3)In order to avoid the drop of raw silk quality, long skein bundling apparatus has been developed.	1)Development will be continued to find suitable permeating chemicals. 2)Studies will be continued to improve the re-reeling process. 3)Permeation chamber used with manually operated pump will be completed and it will be diffused in the field level.	
(3)Development of silk testing technology										
a)Field survey						The existing testing procedures and the quality of Indian silk will be understood.	A	1)The field survey was done and the present conditions of the field was well understood.	(Completed)	Indian c/p will do the investigation if it is necessary.
b)Studies on raw silk conditioning method						Raw silk conditioning method for implementation in raw silk markets will be standardized.	A	1)Raw silk conditioned weight testing method has been standardized. 2)Counterparts have learnt the raw silk testing method.	1)The raw silk conditioning method will be diffused through every silk conditioning and testing house(SCTH) every region.	In every SCTH. equipments for raw silk conditioning weight testing are provided with the help of the same raw silk testing is being done.

6. DEVELOPMENT OF SILK REELING TECHNOLOGY(4)

Item of work	1991 1st	1992 2nd	1993 3rd	1994 4th	1995 5th	Goal of achievement	Score	Present Status and Attainment	Activities in Remaining Period	Remark
c) Studies on raw silk testing and grading programme						Suitable testing and grading methods for Indian silk will be evolved.	A	1) Method of grading raw silk by visual inspection, number of winding breaks and points on size deviation has been developed (Indian method) 2) This method has been adopted in all SCITs from 1992. 3) A testing system has been completed enabling to test the necessary parameters/items required by the Indian reelers, weavers and traders.	1) The necessity of testing and grading of raw silk to international level all with parameters will be explained to the reelers, weavers/fabric manufactures and traders.	
d) Development of design and operational manual for silk conditioning and testing houses						Based on the above studies a suitable operational manual will be developed for raw silk testing house.	A	1) A suitable testing manual for the present Indian condition has been prepared. 2) The prepared manual would be distributed to the reelers and weavers.	1) In order to have raw silk testing and grading, the manual with all necessary parameters have been prepared for SCITs.	

Research achievement

Breeding of bivoltine silkworm hybrid CSR2 x CSR5	
Department	: Silkworm Breeding
Expert	: Y. Mano, K. Takamiya
Counterparts	: H.K. Basavaraja N. Mal Reddy R.K. Datta

Abstract:

Robust hybrid and easy to handle by farmers under hygienic conditions. Hybrid with high cocoon shell ratio, high raw silk recovery and quality.

Both the parent races CSR2 and CSR5 were evolved from Japanese commercial bivoltine hybrid Shunrei x Shogetsu.

Characteristic features:

1. CSR2 x CSR5 hybrid bivoltine cocoons are white in colour and robust with high shell ratio and silk recovery.
2. Filament length is more with high raw silk % and neatness of more than 93.
3. This hybrid has been applied for authorisation.

Remarks:

1. Rearing to be conducted under hygienic conditions
2. Consumption of leaf is 20% more compared to multi x bivoltine

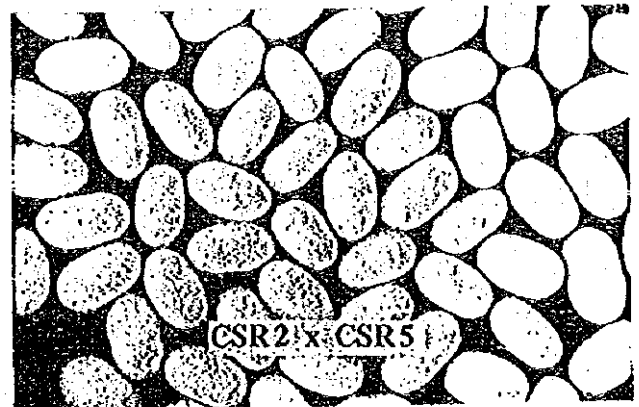
Key words: Bivoltine silkworm race, Breeding, robustness

Performance of new hybrid in the laboratory

Hybrid	Hatchability (%)	Larval Period (D:hr)	Pupation Ratio (%)	Cocoon Yield (kg)
CSR2 × CSR5	95.4	23:00	97.1	19,740
KAX NB4D2	95.8	23:00	93.8	19,089

Hybrid	Cocoon Wt. (g)	Cocoon Shell Wt. (cg)	Cocoon Shell Ratio (%)
CSR2 × CSR5	2.03	48.7	24.1
KAX NB4D2	1.99	40.7	20.5

Hybrid	Filament Len. (m)	Raw Silk (%)	Filament Size (d)	Reelability (%)	Neetness (point)
CSR2 × CSR5	1218	20.5	3.08	79	95.3
KAX NB4D2	1035	17.2	3.00	81	93.3



## Research achievement

Breeding of bivoltine silkworm hybrid CSR2 x CSR4	
Department	: Silkworm Breeding
Expert	: Y. Mano, K. Takamiya
Counterparts	: S. Nirmal Kumar N. Suresh Kumar M.M. Ahsan

### Abstract:

Robust hybrid and easy to handle by farmers under hygienic conditions. Hybrid with high cocoon shell ratio, high raw silk recovery and quality.

The parent race CSR2 was evolved from Japanese commercial bivoltine hybrid Shunrei x Shogetsu, while CSR4 was evolved by using Japanese hybrid BN18 x BCS25 and crossed with Indian bivoltine NB4D2.

### Characteristic features:

1. CSR2 x CSR4 hybrid bivoltine cocoons are white in colour and robust with high shell ratio and silk recovery.
2. Filament length is more with high raw silk % and neatness of more than 93.
3. This hybrid has been applied for authorisation.

### Remarks :

1. Rearing to be conducted under hygienic conditions
2. Consumption of leaf is 20% more compared to multi x bivoltine

Key words : Bivoltine silkworm race, Breeding, robustness.