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EDITORIAL

Avec ce numéro 25-2 de SERICOLOGIA se termine la publication des textes et interventions présentés lors du XI^{Ve} Congrès de la C.S.I. Le prochain numéro retrouvera le visage habituel de SERICOLOGIA. Toutefois, certains changements vont être apportés.

SERICOLOGIA sera consacré en priorité à des articles de synthèse couvrant la littérature la plus récente dans des domaines qui concernent la sériciculture (les vers à soie, les mûriers, l'élevage, la filature, la soie, etc) et quelles que soient les disciplines (physiologie, génétique, biologie cellulaire, physique, écologie, économie, etc) et à des études techniques et scientifiques qui concerneront des résultats nouveaux.

De plus, compte-tenu de la quantité de manuscrits reçus à la rédaction, les articles seront désormais soumis à l'avis de spécialistes choisis parmi le Conseil de Rédaction et/ou le reste de la communauté internationale séricicole.

Des formules sont également à l'étude pour introduire de nouvelles rubriques et pour améliorer la lecture de la "Revue Signalétique".

Enfin, à partir du prochain numéro, SERICOLOGIA ne sera envoyé (par avion) qu'aux services officiels des Etats Membres, aux Editeurs en échange de leur revues et aux Membres Associés de la C.S.I. (individuels et collectifs). Aussi, si la lecture de SERICOLOGIA vous est utile, n'oubliez pas d'adhérer le plus rapidement possible comme Membre Associé.

* * *

G. C.

EDITORIAL

With this issue 25(2) of SERICOLOGIA we complete the publication of the papers and reports presented in the XIVth I.S.C. Congress. In the next issue we will come back to the usual presentation yet with some modifications.

SERICOLOGIA will preferably issue synopses giving the most recent literature in the fields dealing with sericulture (silkworms, mulberries, rearing, reeling, silk etc) whatever subject they may concern (physiology, genetics, cellular biology, ecology, economy etc) and technical and scientific research works giving new data.

Moreover, on account of the numerous manuscripts that we receive for publication, specialists chosen among the Editorial Board and/or the rest of the international sericultural community will be requested to read and give their opinion on the articles submitted.

We are also considering the introduction of new headings and the improvement of the presentation and reading of the "Bibliography".

At last, from the next issue onwards, SERICOLOGIA will be exclusively sent (by air mail) to Member States official services, Editnrs in exchange for their journals and Associate Members of I.S.C. (private and collective). Therefore, if you find SERICOLOGIA interesting, do not forget to join I.S.C. as Associate Member.

G. C.

XIVe CONGRES SERICICOLE INTERNATIONAL
XIVth INTERNATIONAL SERICULTURAL CONGRESS

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SECTION FILATURE ET ARTISANAT
SILK REELING AND HANDICRAFT SECTION

*

Chairman : A.P. BHATIKAR

COMPARATIVE STUDIES ON THE PROPERTIES OF BOMBYX MORI MULTIVOLTINE
AND BIVOLTINE RAW SILK PRODUCED IN INDIA

ETUDES COMPARATIVES DES PROPRIETES DE LA SOIE GREGE INDIENNE
PRODUITE PAR DES VERS A SOIE POLYVOLTINS ET BIVOLTINS DE BOMBYX MORI

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INTRODUCTION

Indian silk industry has been found to have two major drawbacks viz. low productivity and poor quality. During the last decades persistent efforts are being made through research and developmental activities to overcome the same. One of the major steps towards this has been to switch over from multivoltine to bivoltine silk production. Over the years, it has been found that Karnataka State has a lion's share in the total silk production of India. In fact, the target of production in Karnataka alone has been found to be 4600 tonnes of which at least 1000 tonnes should be of bivoltine type for the year 1984-85.

In order to overcome the technical and managerial problems, various steps have been taken up by the Government of Karnataka under the World Bank Financial Assistance. Further, to popularise bivoltine raw silk production, suitable reeling machineries have been set up by a Public Sector undertaken as an eye-opener to the raw silk producers in the Private Sector toward modernization.

Now the question that is pertinent for popularization of bivoltine raw silk production should be to look for the comparison of the textile properties of bivoltine and multivoltine raw silk and subsequently highlight those properties which really depict the superiority of bivoltine raw silk. Preliminary work in this direction gave encouraging results and are therefore, presented in this paper.

MATERIAL AND METHOD

Two lots of cocoons each from bivoltine and multivoltine varieties were stifled by hot air drying and reeled under identical processing conditions to produce the raw silk yarn. Some of the properties of these yarns were evaluated using serigraph and Instron single thread tensile tester. Similarly, the average denier was also estimated for these samples.

RESULTS AND DISCUSSIONS

Table-1 gives the data on tensile properties of multibivoltine and bivoltine yarn of 20/22 as determined by Instron tensile tester. It can be seen from the table 1 that the tenacity for bivoltine raw silk is comparatively on the higher side and concomitantly the elongation (%) also shows a reverse trend for these samples. However, it can be remarked that similar tests carried out using skeins by serigraph did not bring out the differences as depicted by Instron testing. Furthermore, one of the very important textile properties "Initial Modulus" could not be determined either by serigraph or serimeter test. Therefore, the initial modulus for the two types of yarns were also determined using Instron. It has been found that the initial modulus for bivoltine yarn is greater than that of multibivoltine yarn. Therefore, it seems that the bivoltine silk apart from better yield, has superior properties as an apparel textile when compared to multibivoltine silk. Further work to confirm these results has been planned in this institute. It is hoped that by evaluation of these properties using single filament (bave), it could be possible to ascertain the superiority of bivoltine in addition to high yield.

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Authors express their sincere thanks to Prof. N.K. Choudhary, Department of Chemical Technology, University of Bombay, Matunga, Bombay-400 019 for permission to make use of experimental facilities and to Prof A.R. Kasturi Bai, Director, K.S.S.D.I for the encouragement and the permission to present this paper.

* * *

Characteristics	Multibivoltine silk	Bivoltine silk
Tenacity (g/d)	3.67	4.5
C.V. (%)	7.2	7.2
Elongation (%)	23.6	17.4
C.V. (%)	14.7	20.4
Initial modulus (g/d)	117	138.4
C.V. (%)	5.8	3.5

Table 1. Yarn characteristics for multibivoltine and bivoltine varieties
(instron testing)

SILK REELING AND HANDICRAFTS

FILATURE ET ARTISANAT

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INTRODUCTION

In India silk reeling itself is a sort of handicraft since personal skill is involved in taking out filament from cocoon and from a silk thread in charkha, cottage basin or even in filature basins. In India there is a traditional reeling technique known as charkha. Production of charkha silk is about 50% of the total silk production in the country. There are quite a few charkhas in Karnataka and Andhra Pradesh producing very fine mulberry raw silk even 13/15 d with local multivoltine hybrid cocoons. It looks fascinating if we see how such a fine quality raw silk is produced on such crude charkha. On account of personal skill/craftsmanship such fine quality silk can be produced. Similarly fine silk fabrics with rich designs are produced on crude handlooms in India. There are such rich designed fabrics like silk sarees (Peethambara), scarves and carpets produced on a simple country device, handlooms in the country especially in Banaras, Kashmir and Kanchipuram. In non-mulberry sector, fascinating yarns and fabrics are produced from Eri, Tasar and Muga cocoons in Assam, Bihar, West Bengal, Orissa and Madhya Pradesh. A very simple country device is used in reeling and weaving. All these devices are manually operated. In fact the entire non-mulberry silk reeling and weaving sector is of man operated device, i.e. the entire industry is of handicraft type.

MULBERRY SILK REELING

Silk reeling is yet to be modernised in India, whereas in sericulturally advanced countries like Japan, a very sophisticated reeling process is adopted and almost all the reeling units are installed with automatic reeling machines. In India, there are three distinct reeling devices in mulberry sector, namely Charkha - a crude sys-

tem of reeling comprising of about 15,000 units whose production contribution is about 50% of the total production, Cottage basin system - improved over charkha comprising of about 6000 units whose production contribution is about 38% of the total silk production - and Multi-end (filature) basin system - supposed to be the modern version in India, comprising of about 4000 installed basins out of which 2000 are active and whose production contribution is about 10% of the total silk production. Dupion silk production is about 2%.

Even the so-called filature system of the present which is mostly under public sector undertaking is not upto the desired level of working standard. However, efforts are being made to improve the standard of reeling industry. Systematic research studies on cocoon processing such as stifling of cocoons and cooking have been made in Central Silk Technological Research Institute, Bangalore, on multi-end as well as automatic reeling machine with both improved quality multivoltine and bivoltine cocoons in order to work out the feasibility of introducing modern automatic silk reeling under Indian conditions.

There are about 4-5 small automatic reeling units, each of 40 ends capacity, in the country. Reeling performance of cocoons of locally evolved bivoltine races on this automatic reeling machine is encouraging and the quality of raw silk come upto international standard grade A to 2A. From the yield (renditta) point of view, the multi-end (filature) reeling machine has also been found to be satisfactory for bivoltine cocoons as in the case of automatic reeling machines. With adoption of hot air stifling and three-pan cooking system, the reeling performance of bivoltine cocoons on multi-end machines has been found to be quite encouraging. For multivoltine hybrid cocoons, the filature technique, i.e. steam stifling, open pan cooking and reeling on multi-end reeling, has been found to be satisfactory.

CHARKHA

The main reason why charkha is still dominating in Indian silk-reeling industry is that bulk of raw silk produced is used in the handloom industry wherein the cost factor of the raw material has to be kept as low as possible for the rate of the finished product saleable. Secondly the establishment of charkha unit does not need any big investment or special skill and this enables charkha silk to be sold at a minimum price which is very much wanted by the handloom industry. Thirdly, the inferior quality multivoltine and defective cocoons available at lower prices can be reeled more economically on charkha than on cottage basin or multi-end basins.

The charkha reeling system is the Italian version or floating system of reeling which is associated with 1) reeling of cooked cocoons which float in the reeling basin, 2) high speed reeling, 3) high basin temperature reeling and 4) less number of reeling ends. This version of reeling will improve the reelability of inferior and defective cocoons without considering the quality of silk. Charkha which is a simple device (its appearance may be comparable to Japanese old sedentary reel or zagurikikai) consists of a large cooking cum reeling pan where boiling water is kept. The cocoons are cooked in it and filaments collected in a bunch after brushing are passed through a hole on an ordinary thread guide device. Afterwards, the thread is crossed with another co-thread for forming a chambon type croissure in order to agglutinate the filaments and remove the water from the body of the thread. Then it is passed through a distributor before it is wound on to a large wooden reel. Four threads are maintained in this device. One person rotates the reel by hand and another person sitting near the cooking pan manipulates the cocoon cooking and reeling. Charkha silk is generally coarse and suffers from many defects since no improvement devices such as button/slub catcher and standard croissure system in reeling are used. Also charkha silk is not re-reeled. The production of silk per charkha per day is about one kilogram. There is no standard (uniform) mechanism for charkha. Charkha

varies in construction from region to region. So attempts have been made to standardise the charkha in Central Silk Technological Research Institute, Bangalore. The Institute has already developed an improved charkha wherein working conditions and quality of raw silk are better.

IMPROVED CHARKHA

1. Cooking basin: Appropriate cooking pan with a separation for cooking and reeling has been fixed. Perforated partition will enable the basin temperature to be maintained at boiling point and also the reeler feels it easy to work and reel the cocoons simultaneously.

2. Slub catcher: Improved slub catchers have been incorporated in the place of Tharapatti so that the major defects such as waste slubs, etc, be avoided. Efficient casting and piecing of thread takes place.

3. Croissure: Tavellette type of croissure has been provided. So all the four threads are independent in working, resulting in compact and circular thread formation and effective removal of water from the thread.

4. Passage of thread: Passage of thread has been maintained as long as nearly two metres. So driage of thread is better. In addition, improved heating device has been incorporated. Charcoal/wood fire is kept in the perforated metal plate which is covered, so that hot surface of the metal cover would cause driage of silk thread on the swift.

5. Driving: Chain typer driving system has been incorporated resulting in easy rotation of reel.

6. Improved collapsable swift of 1½m periphery has been used.

7. Traverse: Traverse system has been improved so as to obtain better coiling in the hank. Such improvements in the charkha have resulted in better working conditions and producing of quality raw silk without affecting production.

Improved Charkha is shown in Plate 1.

COTTAGE BASIN

This reeling device is an improved version of the charkha and it is indigenously designed on the principle of Japanese multiend reeling machine. Here cocoon cooking is done separately in a boiling water basin and reeling is done in a hot water basin attached to the reeling bench. Normally, each basin has 6-8 ends and each thread is first passed through a button to clean the slubs and waste. Then it is independently passed through a tavellette type of croissure which is more efficient than that in charkha. After the croissure, the thread passes through a traverse guide and finally on to a small reel. Re-reeling is done to prepare standard sized hanks from small reels. So the quality of silk is superior to charkha silk. Cocoons of superior quality like bivoltine can be reeled on this device. But the cottage basin is generally hand-driven and the alignment of the basin is not sufficiently perfect. With the result, production of superior quality silk conforming to international standard is not possible.

Small establishments consisting of a minimum upto 10 basins are economical. Nowadays even bigger units upto 40 basins are being installed using power for running the basins. Apart from introduction of power, there is no improvement in the fabrication of the machine in the case of bigger unit. Sometimes the boiler-generated steam

is used for heating the water in cooking and reeling basins and also to stifle the cocoons. The production of silk per day per basin is about 800 gm. Most of the cottage basin units are under private management (the author has prepared projects on cottage basin, multi-end and automatic reeling for standard economical units).

MULTI-END FILATURE BASIN

This reeling device is a further improved version of the cottage basin and is power driven. Boilers are installed and steam is used for cooking and reeling purpose and also for cocoon stifling in the special steam chambers. Since recently, however, hot air drying methods are being introduced for bivoltine cocoon in some of the filature units in the country to improve the working efficiency and quality of reeled silk. Normally cocoon cooking is done according to single pan system as in the case of cottage basin. Three pan cooking system evolved by our Institute wherein the cocoons are subjected to varying temperatures associated with hot air stifling has been found to be suitable for bivoltine cocoons on the multi-end basin and it is followed in a few filatures in the country. In filature basin there are some additional attachments such as jettebout which picks up the filaments to increase the efficiency of cocoon feeding, the distribution system is further improved and individual brake motion for each reel is also provided so that the overall working efficiency of the basin be enhanced. Improved re-reeling with diamond formation is used. Normally each basin consists of 10 ends. The author has been successful in improving the design of the existing multi-end basin so as to increase the working efficiency and quality of raw silk.

In principle the multiend filature basin is supposed to be a modern device in India and it is possible to use superior quality cocoons like bivoltines on these machines with better performance. Most of the filatures are under public sector undertaking. The bigger are 6 units in Karnataka consisting of an average of about 200 basins each, two in Jammu & Kashmir - one in Jammu with about 150 basins and another in Srinagar with about 600 basins and one of 100 basins in Malda (West Bengal). The other smaller filature units (20-40 basins) include two units in Dehradun (U.P.), 3-4 in Andhra Pradesh, one unit in Nurpur (H.P.) and one unit in Yeshwantnagar (M.P.). Most of the filatures are installed with the Japanese version multiend basins as discussed above. However, in Kashmir, most of the basins are of the Italian version (direct reeling) i.e. back reeling on a large standard reel. Raw silk production per day per basin is varying from 600 to 800 gm. in the above filature units and the quality of the silk is superior to that of cottage basins. A comparison between charkha, cottage basin and multiend basin is made in Annexure 1.

NEW EXPERIMENTAL STUDIES

With considerable improvement brought about since recently in the quality of cocoons resulting from improved techniques of silkworm rearing and introduction of bivoltine hybrid races, scope for improving the reeling efficiency and the quality of raw silk has considerably increased. Therefore, systematic experiments have been undertaken as follows since the last few years on the feasibility of using such improved cocoons of both bivoltine hybrids and improved multivoltine x bivoltine hybrid cocoons. These experiments have been carried out on both the multiend silk reeling basins available in the country as well as the Japanese automatic reeling machine (model reeling unit). The automatic reeling machine is composed of a pressurised cocoon boiling machine, an automatic cocoon feeder and a mechanical brushing unit. In addition, it is equipped with an automatic denier control device wherein human error in maintaining the uniformity of denier is avoided to a large extent and thereby ensuring a minimum size deviation.

The automatic reeling system is a Japanese version or sunken system which is associated with 1) reeling of cooked cocoons which sink under water in the reeling bath, 2) low speed reeling, 3) low basin temperature and 4) a large number of reeling ends. This version of reeling is suitable for better quality cocoons in producing quality raw silk.

1. Comparative reeling studies of commercial importance

Bivoltine and multivoltine cocoons were commercially reeled on an automatic reeling machine adopting hot air cocoon drying and pressurized cocoon cooking methods. The average reeling data are given in Table 1.

<u>Cooking sequence</u>	<u>Bivoltine</u>	<u>Multivoltine</u>
1) Soaking	at 75°C for ½ minute	at 70°C for ½ minute
2) Side steaming	at 85°C for 4-5 minutes	at 70-80°C for 4 minutes
3) Soaking	at 75°C for ½ minute	at 70°C for ½ minute
4) Main steaming	at 98-100°C for 10-12 minutes	at 95-96°C for 9-11 minutes
5) Stop steam valve	for ½ minute	nil
6) Boil	in boiling water for ½ minute	at 95-96°C for ½ minute
7) Spray cold water	until 75°C for 4-5 minutes	until 70°C for about 4 min.

The cocoons were filled with hot water so as to sink in the reeling bath by the above cooking technique. Brushing was done by mechanical unit. Reeling was done on 40-end automatic reeling machine (even with low pressure and shorter duration of cooking for multivoltine cocoons, it was noticed in some of the lots that the cocoons were oversoftened and sometimes cocoons were collapsed because of the pressurised system which, in fact, is not really needed for multivoltine cocoons).

Discussion:

Bivoltine cocoons: From Table 1, the overall actual renditta (B) of bivoltine cocoons was 6.9 indicating that the bivoltine cocoons were quite good for reeling on an automatic reeling machine since the filament length was adequately longer than 1030m and the non-breakable filament length was of 913m with a denier of 2.30d. Reelability percentage was 70, waste percentage was 14.1; considering this satisfactory performance, bivoltine cocoons were as good as to achieve fairly comparable reeling results to Japanese results. As expected, the overall average size deviation was very good (1.278) indicating that the working of an automatic cocoon feeding device was very efficient in its functioning. From Table 2, the quality of silk stood at A-2A grade except for winding breaks. The reeling performance of bivoltine cocoons on automatic reeling was better as compared to that of filature (multi-end) technique wherein cocoons were steam stifled and cooked with open pan system.

Multivoltine cocoons: The average actual renditta (B) was 10 with a reelability percentage of 60. The average waste percentage was 23.2. The reeling performance of multivoltine cocoons on automatic reeling was the same as in the silk filature (multi-end) technique. It indicates that the reeling technique applied for multivoltine cocoons in silk filatures is satisfactory.

It is also seen from Table 1 that the average denier of multivoltine raw silk was coarser than that of bivoltine cocoons although the indicator was the same in both cases. Obviously it was because of the fact that the filament length of multivoltine cocoons was shorter than that of bivoltine cocoons. Secondly, it was observed many times that two cocoons were fed at one time instead of one cocoon at one time. This was because of the fact that the volume of multivoltine cocoons was small particularly after brushing on account of high percentage of floss and as such two cocoons used to sit on the feeding cup and whenever the indicator acted for feeding cocoon, the two cocoons would be fed to the jettebout, instead of one at one time. Further, it was observed that quite a few cocoons used in the cup collapsed due to the pressurised cooking.

Due to these above mentioned reasons, besides raw silk denier being coarser, the average size deviation was higher (1.430) as compared to that of bivoltine raw silk (1.278).

Even coarser raw silk, the average production rate was lower (3.971 kg per 7 hours/40 ends) as compared to that of bivoltine raw silk (4.378 kg). One more point was experienced during these studies with multivoltine cocoons that since cocoon take up rate was higher in multivoltine cocoons reeling on account of shorter filament length, it was difficult to supply with the brushed cocoons continuously. So with these results, only one section i.e. 20 ends reeling was to be maintained for some time. Since the action of the automatic device was at higher frequency rate, the wear and tear would be more in an automatic unit for multivoltine cocoon reeling. Also reeling speed was to be lowered down as compared to the case of bivoltine cocoon reeling.

So it may be concluded that the reeling performance of multivoltine (improved multivoltine crosses in the present studies) on an automatic unit was not as satisfactory as in the case of bivoltine cocoons. In fact, filature (multiend) reeling technique for multivoltine cocoons seemed satisfactory.

2. Comparative reeling performance of bivoltine cocoons on an automatic reeling machine and on a filature type multiend reeling machine

The bivoltine cocoons were reeled on an automatic reeling machine with pressurised cooking and the cocoons from the same lot were comparatively reeled on multiend reeling machine with pressurised and also three-pan cooking system.

Process of cooking

Firstly pressurised cooking sequence both for automatic and multiend reeling as described earlier for bivoltine cocoons was followed.

Brushing was done afterwards in mechanised brushing unit at boiling point in case of an automatic reeling machine but hand brushing was followed in cooking pan at boiling point in the case of multiend machine.

Secondly bivoltine cocoons were reeled on an automatic reeling machine with pressurised cooking system as against reeling on multiend reeling machine with three-pan cooking system.

Three pan cooking system

Cocoons were taken in a wire mesh cage and cooked in the first pan at lower temperature $65\pm 5^{\circ}\text{C}$ for one minute and then in the second pan at boiling point for about $1\frac{1}{2}$ minute and finally at $65\pm 5^{\circ}\text{C}$ for one minute. The cooked cocoons were hand brushed at boiling point. The comparative reeling results are given in Table 3 and 4 respectively.

In both the above experiments the bivoltine cocoons were stifled by hot air method.

Discussion

From table 3, the average values of renditta (7.4 and 7.5) and reelability percentage (72 and 72) obtained in automatic and multiend reeling systems respectively indicated that there was no difference in the yield on both machines. Therefore, the pressurised cooking associated with hot air stifling should also be used on multiend machine for bivoltine cocoons for large filatures in the place of open pan system for labour saving. However, hand brushing should be replaced by individual mechanical brushing unit attached to the reeling basin.

The average production of raw silk per end per day on 7 hours working was 99 gm. on an automatic reeling machine for 20.42 denier raw silk as compared to 100 gm. on multiend reeling machine for 24.39 denier raw silk which was very coarse but the production per 40 end automatic reeling machine maintained by 4 persons including cooking was 3.963 kg. per day indicating about 1 kg. silk production for 20.42 denier per person per day whereas the production per 10 end multiend machine maintained by 1½ persons including cooking was 1 kg. per day indicating about 670 gm. silk production per person per day that too with very coarse raw silk (24.39 denier). Hence it is evident that for the same denier raw silk the production per person would be considerably higher on an automatic unit (although the unit under present study was very small having only 40 ends and it would be still enhanced on a commercial automatic reeling machine of 200 or 400 ends). The average size deviation was very good (0.960) in the raw silk reeled on an automatic machine as against 2.204 in the case of multiend reeling machine.

From table 4, the renditta was lower (6.9) on multiend reeling machine with three pan cooking system as compared to 7.4 on an automatic machine with pressurised cooking system. Correspondingly reelability percentages were 72 and 67 respectively. Therefore, it indicated that the yield (renditta) was better in multiend machine with three pan cooking system. The production rate for 21.14 denier per end per 7 hours working was lower (69 gms) as compared to that (90 gms) in the case of automatic reeling machine with still finer raw silk of 19.99 denier. Also the size deviation was higher (2.14) with the multiend machine as against 1.530 in an automatic reeling machine.

Thus based on renditta, the three pan cooking system on multiend machine appeared to be most suitable for bivoltine cocoons. But this system requires more persons as compared to pressurised cocoon cooking system (the pressurised cocoon cooking system used for the present study with one operator could feed 100 ends or 10 multiend basins). So labour saving would be in the order of 4 per 10 basins. Small filature units with three pan cooking system would therefore be useful for multiend machine for cooking of bivoltine cocoons, since there would be saving of half (0.5) renditta. (Reeling efficiency and quality of raw silk are not very much required at present in Indian reeling conditions). The pressurised cooking associated with hot air stifling should also be used on multiend machine for bivoltine cocoons for large filatures. However hand brushing should be replaced by individual mechanical brushing unit attached to the reeling basins.

These studies have clearly shown that the multiend reeling machines can be satisfactorily used in the Indian filatures from the point of view of yield (renditta) for even superior quality cocoons such as bivoltine cocoons either with three pan cooking system or with pressurised cooking system associated with hot air stifling method.

3. Comparative reeling performance of bivoltine and multivoltine cocoons on an automatic reeling machine (with pressurised cooking system) and filature (10 end reeling machine with open pan cooking)

In this study cocoons from the same lots of both bivoltine and multivoltine were reeled on an automatic and multiend reeling machine. In automatic reeling technique cocoons were stifled by hot air method and cooking was done with pressurised system whereas in filature reeling technique steam stifling and open pan cooking systems were followed and reeling was done on 10 end basin in filature. The comparative results are given in table 5. The cooking sequence in pressurised system for both bivoltine and multivoltine cocoons was followed as discussed in earlier experiments and open pan cooking system was similar to the present filature system (i.e. subjecting the cocoons at boiling point for about 2-3 minutes and then brushing by hand in the same open basin).

Discussion:

Bivoltine cocoons: There was no significant difference in renditta between automatic reeling technique (8.1) and filature reeling technique (8.2). The slight higher renditta of 0.1 in the case of filature reeling might be on account of steam stifling and open pan cooking system.

Multivoltine cocoons: There was a significant difference in renditta between automatic reeling technique (10.4) and filature technique (9.9). Reeling performance of multivoltine cocoons on automatic reeling machine was not satisfactory indicating that pressurised cooking system was not very much suitable for soft built multivoltine cocoons which get overcooked resulting in more wastage.

Conclusion

From these new reeling experiments it could be concluded that automatic reeling technique is quite suitable for bivoltine cocoons in both yield/efficiency and quality of raw silk whereas it is not suitable for multivoltine cocoons. Secondly, bivoltine cocoons can also be reeled without loosing any yield on multiend reeling machine provided they are stifled by hot air method followed by three pan cooking in small filatures and in large units pressurised cooking system may be followed.

For multivoltine cocoons the present filature technique i.e. steam stifling, open pan cooking and reeling on either cottage basin or multiend basin may be continued.

NON-MULBERRY SILK REELING

TASAR SILK REELING

The tasar cocoon is very hard and compact unlike the mulberry cocoon. It can not satisfactorily be softened by boiling in plain water. The poor solubility of sericin in water and alkaline/acidic solutions due to the presence of tannin substances makes the cooking and degumming of tasar cocoons difficult. Wet basin reeling of tasar is not advantageous.

Traditional method of cocoon cooking: The cocoons are wrapped in silk waste especially at the peduncle end to prevent shell from bursting and are treated in a boiling alkaline medium for 4-5 hours. This technique involves much labour and the reeling results are poor.

Improved technique: Enzymatic decomposition of the sericin at low temperature renders it soft enough for reeling. Solutions of cocoonase, papain, trypsin, pepsin and biopril-50 have been tried. The last one has been found to be most efficient because it not only provides uniform softening but also reduces the cooking/steaming period. Different applications of this new cooking technique for *A. mylitta* and *A. proylei* are given below:

A. mylitta

The cocoons are first boiled in plain water for 1 to 1½ minute and then steamed at 15 lg/sq. inch for 40 to 60 minutes after which they are left in the chamber and the pressure is gradually released. The cocoons are then loosely wrapped in a porous cloth and soaked in 0.1 to 0.2% biopril-50 (proteolytic enzyme) solution for 20 to 22 hours, initially at 40 to 50°C and later at room temperature. After being spread out on a bed the cocoons are semi-dried and then deflossed for dry basin reeling. This method gives about 65% reelability with Daba and Bogai (1976) (if the cocoons are preboiled with soap + soda solution, concentration of biopril-50 may be lower).

A. proylei

The technique is basically the same as the one described for *A. mylitta* except that the cocoons are boiled and steamed for one minute and 30 minutes respectively and 0.025 to 0.050% biopril-50 solution is used for soaking. This application of cooking technique gives upto 55% reelability. The cooking procedures described above are for dry basin reeling. However because the filament of *A. proylei* is finer (4-5D) than that of *A. mylitta* (8-10D) and the shell is not very hard, they can be reeled like mulberry cocoons on wet basin but with slightly poor results.

Reeling operations:

Tasar reeling is actually the semi-spinning version i.e. filaments are collected and twisted by hand or by ring traveller system without draft.

Reeling appliances:

a) Natwa: This appliance is a hand swift made of bamboo and wood. The reeler, sitting cross legged, reels a number of filaments and winds them on the natwa after imparting twist to the composite yarn by hand. This is such a slow process that a reeler can only reel about 80 cocoons in eight hours; however, because it ensures better control of the individual cocoon filaments, the resulting yarn is of good quality. Despite low productivity, it is widely used because of its simplicity and small investment cost.

b) Pedal reeling machine: Normally 5 or 6 cooked/deflossed cocoons of Daba or 9 to 10 of *A. proylei* are fed into the basin per end to produce respectively 60/65 denier or 40/45 denier thread. The filaments are passed together over the delivery roller from which they pass on to the bobbin through the final thread guide. Twisting and winding take place simultaneously by means of a ring and a traveller on the ring rail.

There are about 600 tasar reeling machines in the country, mainly in Bihar, Orissa and Madhya Pradesh. These machines are pedal driven with 4 spindle capacity. The production per day per machine is about 150 gms only in the case of Daba cocoons. However, the author has improved the mechanism (1976) so that the production rate has been increased to more than two times as compared to the above ordinary version. The comparative reeling performance is given in table 6.

c) Improved 'CTRS' reeling machine: Designed on the spinning principle, CTRS reeling machine is also pedal driven and 4 spindled, has a wooden swift (50 cm in circumference) for delivering the composite silk yarn to the fast rotating bobbin fixed on these spindles. There is a small step-pulley on the spindle driving shaft for changing the spindle speed when necessary. The wooden swift besides increasing the delivery rate also reduces lapping by lessening the contact of the raw silk thread with the wood surface. All the working points are fitted with ball bearings for a very smooth operation. The machine is also equipped with various other devices which help to increase its efficiency.

Reeled silk is normally used for warp in combination with Ghicha, Katia, noil and baikal yarns as weft.

Ghicha yarn: ghicha is spun by hand mostly from unreelable tasar cocoons after cooking in reeling process. Threads are drafted by hand and rolled on an earthen pot to make coarse yarn.

Katia: Katia is spun from tasar silk waste produced during reeling. It is normally spun on pedal operated spinning charkha. Katia yarn is more compact on account of better twists in the yarn.

Noil yarn: The yarn is spun out of noil waste produced in spun silk mills like cotton waste yarn or woolen yarn.

Matka: Matka yarn is spun by hand out of mulberry pierced and unreelable cocoons after degumming.

Balkal yarn: Balkal yarn is hand spun out of tasar cocoon peduncles, after they are boiled in alkaline solution and opened up.

MUGA SILK REELING

The muga cocoon can be reeled owing to its closed shell and the continuous filaments. Stifling (drying) of cocoon is similar to that of tasar. The cocoons are cooked in 0.5% alkaline solution (Na_2CO_3) for about half a minute and transferred to reeling basin containing tepid water with a little soda. Normally the filaments of 6 to 7 cocoons are fed on to the reeling device for warp and 10 to 12 cocoons for weft.

Reeling appliances:

a) Bhir: The Bhir is a very simple reeling appliance consisting of a basin to serve as the water bath for the cocoons and a roller with a large wheel at one end for wrapping. The filaments of cooked cocoons are joined by an operator (feeder) and pass into one hand of the reeler who in turn feeds the thread on to a wooden roller (reel). The reeler rotates the roller intermittently and imparts twist by rubbing the yarn between his fingers before it is wound on the reel. The feeder and reeler face each other with the reeling appliance between them. The process is actually one end reeling by 2 persons.

About 500 cocoons are reeled per day to produce about 120-150 gms of silk. The waste is nearly equal to the quantity of silk produced and the reelability is about 50%. The pedalled Bhir is slightly improved over the hand operated model as the reeler can use both hands for reeling thereby ensuring a better quality of silk, but this appliance likewise engages two persons in one end reeling and hence production is limited.

b) Das type muga reeling machine: This mechanical reeling machine requires only one operator. As it is foot operated, the reeler can use both hands for cocoon feeding and reeling. The reeled silk is wound on the bobbin and a uniform rate of twist is imparted by the spindle and flyer. Nevertheless because only one end reeling is possible, the production is likewise limited. Recently some experiments of muga reeling on multiend reeling basin were taken up. Muga cocoons can be reeled in conditions similar to mulberry cocoons excepting that some alkaline medium is required in the reeling basin. Secondly the silk reeled on multiend machine will have no twist unlike in the regular muga reeling appliances. However, twist can be imparted after reeling on separate twisting machine whose cost may be compensated by increase in the production in multiend reeling machine.

ERI SILK SPINNING

Because eri cocoons are open mouthed, the filament is discontinuous and thus it can be used only for spinning. Like tasar, the cocoons vary in colour, size and softness. The soft cocoons are better for mechanical spinning and the bigger cocoons for hand spinning. The cocoons are graded accordingly.

Degumming:

Rather than being cooked as in reeling, eri cocoons are degummed. The sericin (about 11%) is washed out making the fibres loose enough to be stretched for the drafting operation.

Traditional methods: In Assam, ash obtained from banana leaf, wheat stock, paddy straw, mung or pieces of green papaya, is commonly used instead of soda or potash to degum the cocoon. However, this process does not completely dissolve the sericin. The cocoons loosely tied in cloth are boiled in a 10% Na₂CO₃ solution for 45 minutes to one hour. The individual cocoons are then stretched or opened in plain water into thin sheets. Three or four such sheets are joined to make a "cake" which is dried and used for spinning.

Improved method: Clean eri cocoons are loosely tied in porous cloth and the bundle is immersed in an alkaline bath of 20% soap with 2% soda maintaining a 1:60 ratio of liquid and cocoons are boiled for one hour and then washed and reboiled in fresh water for 30 minutes. The degummed cocoons are thoroughly washed twice and squeezed for drying (1970).

Spinning:

Hand spinning: Hand spinning, which is very common in north-eastern states of India, is either intermittent (mule spinning principle) or continuous (ring spinning principle). The takli is commonly used for intermittent spinning and the spinning wheel for continuous spinning; Both types of spinning involve the same basic operations: drafting, twisting and winding.

Takli spinning: The takli consists of a spindle with disc-like base. The spinner holds the cocoon "cake" in the left hand, drafts and then feeds the strand with right hand to the spindle. The spindle is occasionally rotated by the right hand to impart twist after certain length of yarn is spun. The spinning is discontinued in order to wind the yarn on the spindle.

Improved spinning appliance: Although takli is very simple and cheap, its output is quite low. Improved spinning equipment has been developed on the continuous spinning principle with simultaneous drafting, twisting and winding.

The N.R. Das spinning wheel is pedal driven and has a flyer system. A large pedal wheel drives the top step wheel which in turn drives the double flanged bobbin. The spindle and flyer are mounted horizontally on a wooden platform with an automatic traverse mechanism. The continuous rotation of the bobbin gives the yarn a uniform twist and simultaneously ensures uniform distribution of yarn coils as they are wound on the bobbin. Both drafting and feeding of fibres can easily be controlled.

The Trivedi (flyer type) and Chowdhury spinning (ring type) wheels are also popular for eri spinning.

Recent research studies:

Experiments have been carried out to establish suitable degumming technique for mulberry and eri cocoons. Spinning trials on all types of spinning wheels have been conducted. Recently hand spinning studies on blending of mulberry and eri degummed cocoons were also undertaken and very interesting results were obtained.

Separately degummed mulberry pierced and eri cocoons were blended in 67:33 ratio and the blended material was hand spun on a pedal spinning wheel (Chowdhury type) for better economy, since mulberry pierced (superior) cocoons are costlier than eri (inferior) cocoons. The spinning results of blended material are given along with spinning results of pure mulberry and eri in table 7.

From the table 7, it is seen that the spinning performance of blended material (mulberry and eri) in the ratio of 67:33 is better as compared to spinning of pure eri and also the yarn could be of fashionable colour. So the cost of raw material could be brought down by this process (eri cocoons used in this blending study were of tapioca/rubber fed). This way the various silk waste material such as mulberry and tasar can be blended with eri in different working ratios for getting fashionable yarn with lower raw material cost.

However, quite a bulk quantity of eri cocoons is processed in spun silk mills particularly in the Govt. Spun Silk Mills, Bhagalpur and Govt. Spun Silk Mill, Jagi Road, Assam. By mill spinning techniques very fine counts of yarn are spun in the range of 60 S and 210 S whereas hand spinning technique could afford to spin 20 S and 40 S economically but cost of manufacture of handspun yarn is lowest and investment is almost nil. Hand spinning technique for eri cocoons can be advocated in rural areas as a cottage based spinning process.

HANDICRAFTS

As mentioned earlier, silk reeling and weaving in both mulberry and non-mulberry are almost practiced by hand i.e. skillness of person is more involved than the machine or equipment. Apart from silk reeling on cottage devices such as charkha, cottage basin, takli, pedal operated reeling devices and handlooms in weaving, there are some other items which come under handicrafts in silk industry as follows:

1) Utilisation of waste cocoons:

Pierced, cut and defective cocoons which are unfit for reeling would be made use of preparing garlands, flowers and also hand spun yarn. This type of work is being carried out in places where other handicrafts are in practice specially in remand homes. Even filaments from the individual cocoon after testing are being used to make flowers. However, this type of handicraft is limited in the country. It could be systematically developed so as to utilise all the waste cocoons effectively and also give employment in cottage sector.

2) Carpets:

Waste obtained in the process of noil yarn production in spun silk mill is used to produce coarse roving which is used as weft along with cotton warp to produce carpets with various designs engraved by hand interlating. Normally these carpets are made on country type device known as carpet loom placed vertically where ends are arranged and the designer goes on interlating the weft with different colours and also with some designs. Apart from this small carpets made out of the waste silk, carpets with rich designs are made in Kashmir out of spun silk yarn. There is a great demand for these silk carpets in European countries.

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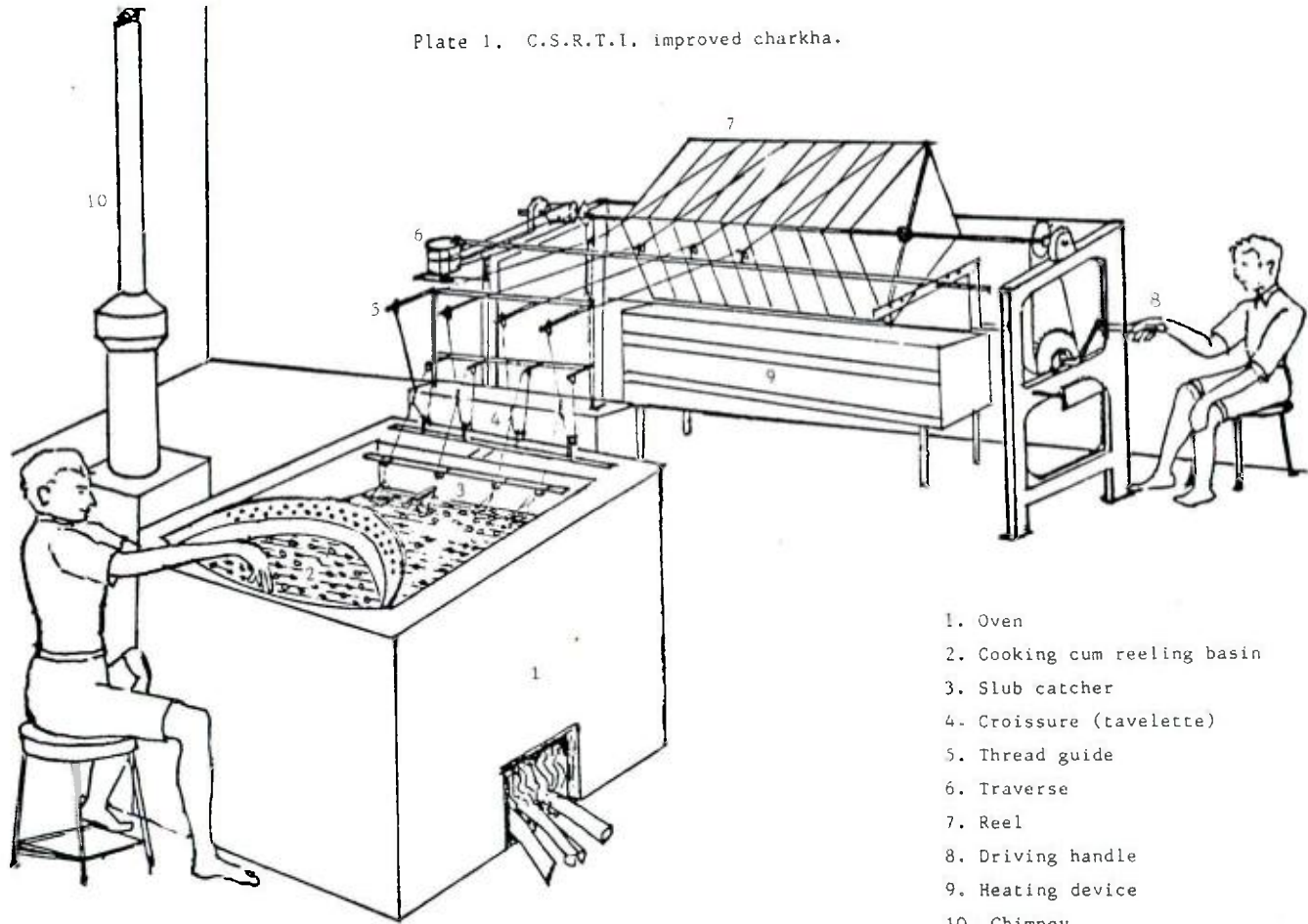
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Plate 1. C.S.R.T.I. improved charkha.



1. Oven
2. Cooking cum reeling basin
3. Slub catcher
4. Croissure (tavelette)
5. Thread guide
6. Traverse
7. Reel
8. Driving handle
9. Heating device
10. Chimney

INDIAN SILK REELING MACHINES (MULBERRY)

CHARKHA	COTTAGE BASIN	MULTIEND BASIN
Indigenous crude reeling apparatus built by wood parts (different parts like mud platform, Tharpatti, etc)	Indigenous improved reeling apparatus built by iron parts (reeling basin, croissure pulley)	Most modern machine in India (reeling basin, croissure pulleys, etc)
Hand driven	Hand/power driven	Power driven
4 ends reeling	6-8 ends	8-10 ends
Cooking and reeling basin common	Cooking basin is separate from reeling	Cooking basin is separate from reeling
High temperature (boiling) reeling	Low temperature in reeling basin	Low temperature in reeling basin
Water is heated up by direct fire below the basin	Hot water is supplied to the basins through pipes. Sometimes steam is provided	Steam is used for heating water
Only one oval shaped copper or earthen basin is fitted on the oven with mud construction, some charkhas have chimneys to avoid excess smoke to the reeler/cooker		(Steam is useful particularly in cooking as there is agitation in the basin and cooking is effective. Penetration of water inside the shell takes place)
Cooker and reeler same	One cooker, two reelers	One cooker, two reelers
Casting of filament by hand	Casting of filament by hand only	Jettebout. So efficient rate of filament casting
No button only Tharpatti which has holes	Button used	Button used
Chambon type of croissure (inferior cohesion)	Tavellette type of croissure (better cohesion)	Tavellette type of croissure (better cohesion)
Bigger reels (59"-60" periphery)	Small reels sometimes direct reeling and the device is known as domestic basin	Small reels (24"-28"-32" periphery)

No re-reeling	Re-reeling (some cases direct reeling on bigger reels) domestic basin	Re-reeling with Grant reels
Silk production and yield higher (900-1000 g/day/reeler)	Silk production and yield slightly lower than on charkha (600-800 g/day)	Silk production and yield lower (500-700 g/day)
Waste is less (15 to 20%)	Waste is higher (25 to 30%)	Waste is higher (30 to 40%)
Low renditta (8-10)	High renditta (9-10) (with reference to the quality of cocoons used on charkha)	High renditta (10-12)
Silk quality is inferior. Suffers from poor evenness, cleanness, cohesion and winding qualities	Better	Better
Lower price	Higher price	Higher price
Cost of manufacture lowest (about Rs. 15/kg of silk)	Cost of manufacture higher (about Rs. 20-25/kg silk)	Cost of manufacture highest (Rs. 50-80/kg)
Inferior quality of cocoons may be economically reeled. Even certain defective cocoons such as urinated ones may be economically reeled	Not (desirable) with defective cocoons	Not (desirable) with inferior and defective cocoons
Private owned small units from 6-20	Private owned basins 5, 10,15,20. Sometimes more	Government owned 200-400 basins

AUTOMATIC REELING

Cocoon feeding automatic,
 Separation of pupa and dropped cocoons automatic,
 Water circulation automatic,
 40 ends model unit, constant denier system, irrespective of number of cocoons.

	Overall average	
	Bivoltine	Multivoltine
1. Single cocoon wt. (g)	1.580	1.419
2. Single shell wt (g)	0.335	0.237
3. Shell ratio (%)	21.12	16.80
4. Average filament length (m)	1030	579
5. Average non-breakable filament length (m)	913	506
6. Denier of the filament	2.30d	2.46d
7. Defective cocoon percentage	5.6	5.6
8. Renditta (A)	7.3	10.6
9. Renditta (B)	6.9	10.0
10. Reelability (%) (A)	67	57
11. Reelability (%) (B)	70	60
12. Reeling waste (%)	14.1	23.2
13. Average denier	23.16d	23.45d
14. Size deviation	1.278	1.430
15. Maximum size deviation	2.431	2.511
16. Production/7 hours/40 ends	4.378	3.971

Table 1. Reeling performance of bivoltine and multivoltine cocoons on an automatic reeling machine

Test characteristics	Bivoltine raw silk (av. of 7 lots)	Improved multivoltine cross (1 lot)
Average evenness (%)	92	89
Average low evenness (%)	83	80
Average cleanness (%)	91	87
Average low neatness (%)	84	85
Average size (denier)	21.05d	21.00d
Average size deviation (denier)	1.56d	1.50d
Average maximum size deviation (denier)	4.04d	4.51d
Winding breaks per 25 skeins	21	25
Average tenacity (g/d)	3.6	2.9
Average elongation (%)	18	19
Cohesion (strokes)	106	103
Overall grade	A-2A except winding	only one lot not dependable

Table 2. Raw silk test results reeled on an automatic reeling machine

Cocoon characters	Average	
Shell %	18.74	
Filament length	1067 _m	
Filament denier	2.28 _d	
Reeling performance (av. of 2 lots)	A	B
1. Renditta	7.4	7.5
2. Reeling waste (%)	14.0	13.0
3. Reelability (%)	72	72
4. Production/7 hrs. (kg) (A=40 ends and B=10 ends each)	3.963	1.004
5. Average size (d)	20.42	24.39
6. Size deviation	0.960	2.204

Table 3. Reeling performance of bivoltine cocoons on
 (A) automatic reeling machine with pressurised cooking
 (B) multiend reeling machine with pressurised cooking.

Cocoon characters	Average	
Shell %	20.07	
Filament length	894 m	
Filament denier	2.29d	

Reeling performance (av. of 4 lots)	Automatic reeling machine (40 ends)	Multiend reeling machine (10 ends)
1. Renditta	7.4	6.9
2. Reeling waste (%)	16.3	18.4
3. Reelability (%)	67	73
4. Production/7 hrs. (kg)	3.601	0.694
5. Average size (d)	19.99	21.14
6. Size deviation	1.530	2.140

Table 4. Reeling performance of bivoltine cocoons on an automatic reeling machine (with pressurised cocoon cooking system) as compared to reeling on multiend reeling machine (with three pan system of cooking)

Race	Shell %	Average filament length (m)	Average denier	Renditta		Reeling waste		Reelability	
				automatic machine	filature machine	automatic machine	filature machine	automatic machine	filature machine
1. Bivoltine (Average of 3 lots)	18.88	834	2.16	8.1	8.2	21.6	19.8	66	64
2. Multivoltine (Average of 3 lots)	16.02	579	2.33	10.4	9.9	32.0	21.0	61	64

Table 5. Comparative reeling performance of bivoltine and multivoltine cocoons on an automatic reeling machine and filature reeling machine

(DABA COCOONS)

Factors studied	Improved technique	old technique
1. Average length of raw silk reeled per hr/4 ends (m)	6845	2800-3400
2. Average size of raw silk reeled	62.410	600-720
3. Average production of raw silk per hr/4 ends (g)	47.3	22.5
4. Average calculated production of raw silk per 8 hr/4 ends (g)	378	180
5. Average reelability percentage of raw silk	65.6	50

Table 6. Comparative reeling data on improved reeling machine along with the existing reeling machine

Spinning particulars	Mulberry			Eri			Blended (Mulberry & Eri)		
	10 ^S	20 ^S	25 ^S	10 ^S	20 ^S	25 ^S	10 ^S	20 ^S	25 ^S
1. Average yarn yield %	93.4	89.0	88.5	66.1	55.7	53.9	81.2	79.1	74.6
2. Average waste %	6.0	10.7	10.9	33.6	44.0	45.4	17.4	19.7	23.4
3. Average actual count	10.3 ^S	19.9 ^S	25.1 ^S	9.9 ^S	20.0 ^S	25.4 ^S	10.4 ^S	18.0 ^S	24.2 ^S
4. Average production per hr (g)	11.2	6.4	5.5	7.5	5.1	4.7	11.4	7.2	5.7
5. Average production per hr (m)	197	222	236	127	173	205	193	216	236
6. Average degumming loss %	-	27.3	-	-	9.4	-	-	-	-

Table 7. Spinning performance of mulberry, eri and blended material for various counts

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ECONOMIC ISSUES IN SERICULTURE - A CASE STUDY OF KARNATAKA
DEBOUCHES ECONOMIQUES DE LA SERICULTURE - ETUDE TYPE DANS
LE KARNATAKA

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Cultivation of mulberry leaf and silkworm rearing in Karnataka dates back to the 18th century. From the beginning, Government of Karnataka played an important role of a catalyst to keep the sericulture industry going. It established a separate department in 1913-1914 to look after some of the needs and also the problems of sericulturists.¹ Encouraged by the achievements of the sericulture industry in Karnataka, among other programmes, the State Government undertook an ambitious plan for the expansion of the sericulture covering a period of five years (1980-85) through a World Bank loan. This plan envisaged introducing sericulture in certain new areas of Karnataka, so that it can serve as an important source of employment and income generation in rural areas. Government of Karnataka launched this programme in 1980 in 13 districts. For the traditionally mulberry growing areas, this programme envisages a further improvement in the existing infrastructural facilities along with extending the area under improved mulberry and also encouraging rearing of improved and bivoltine silkworm. In the non-traditional areas, the plan was to introduce sericulture activities on a large scale to bring about economic transformation in these areas. In addition to providing necessary infrastructure, the plan envisaged an effective extension facilities to popularise sericulture activities. We come across very few academic studies which can throw light on the process of socio-economic change that the society is experiencing due to the expansion of sericulture activities in the predominantly agricultural countries like India. Some of the studies which are available tend to be either too general in their analysis of the situation or they are too narrow in their approach to provide necessary insights or clues for better understanding of the issues involved in sericulture activities. However, there are some studies which are exceptions to this. When certain significant programmes concerning areas like sericulture are under implementation, it is necessary to con-

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¹ *Government of Karnataka, Karnataka State Gazetteer, Part V, Suryanath U Kamath (Chief Editor), 1982, Bangalore, p. 849.*

duct exercises from time to time on different aspects of these activities so that we are able to trace and grasp the process of socio-economic transformation that is taking place at the grass-roots level.

Keeping this in view, we are attempting here on a modest scale to get an overall view of the changes which have taken place at the household level in both traditional and non-traditional regions of the state in terms of sericulture activities. Further this note tries to find out at two points of time whether there is any change in the structure of costs and labour needs for the cultivation of mulberry leaf and silkworm rearing on the one hand and on the other, whether any change has taken place in the income earning capacities of the sericulturists. For this exercise, we are principally depending on the household data generated through periodic sample surveys which we have been undertaking at the Institute for Social and Economic Change since 1980. These data are supplemented by the information gathered through intensive field visits to some of the non-sample villages also, where sericulture is making inroads into the economic life of the rural population, particularly in the new sericulture regions of Bijapur, Raichur and Gulbarga districts. The two points of time selected for the present exercise are 1980-81 and 1983-84.

The total number of sample sericulturists households and the area under mulberry are considered for the present exercise at two points of time, however, it is not the same. The sample set selected for the year 1980-81 covered 747 sericulturists. When frequency of the household survey was switched over from annual to quarterly in 1983-84, a sub-sample of 224 out of 747 was drawn and surveyed. Thus while 1980-81 results presented here refer to those derived from the annual survey conducted in 1981 the results presented here for 1983-84 refer to those derived from the two quarterly surveys conducted in July and October 1983. Further it is important to note that though the number of samples and area covered differ between the two points of time, the results are still comparable as the samples covered belong to the same frame and as the average mulberry area under each family has not varied much even though the sample size differs (table 1). Also, the agro-climatic regions and the total number of sample villages have remained the same as between the points of time considered. We have divided the study area into five regions, and grouped regions I, II and III as traditional, and IV and V as non-traditional (for details of the names of districts which come under different regions, please see the appendix). Regionwise coverage of sample households and the area shows that a greater share of the samples lie in traditional region than in the non-traditional region.

Broadly speaking, sericulture activities at the farm-household level comprise of two distinct phases. The first phase of the activity concentrates on the cultivation of mulberry leaf and forms part of the cultivators' overall farm level (outdoor) activities. In the second phase, rearing of silkworm is taken up as part of the cultivator's overall household level (indoor) activities.

If we begin looking at the variations in costs of production of mulberry leaf by regions, varieties and sources of water by and large the trend seems to be that in most of the cases under rainfed conditions the total costs as well as the cost per kg. of leaf have shown a declining trend (table 2). But under irrigated conditions though the total costs are reported to be declining, the cost per kg. of leaf yield is increasing (table 3). This seems to be mainly due to the declining leaf yields in gross terms over the two periods. However, when we attempt to work out the costs involved in the sericulture activities we should bear in mind that, total costs calculated here include, those incurred on inputs like manure, fertilizer, irrigation costs, if any, and labour costs. Under labour costs, we have included the imputed value of family labour utilized for the activities and the paid-out cost for the hired labour. Since we have included the imputed value of family labour, we are arriving at higher total costs. As far as how leaf yields are concerned, it is necessary

to find out whether this is due to farm level inefficiency of the sericulturists or to any other natural factors which might have affected the leaf yields in particular during 1983-84. We leave it at this, since at present we do not have details to explain the reasons for the declining trend in the leaf yields at this moment.

Another interesting issue which deserves our consideration is the proportions of family and hired labour involved in the cultivation of mulberry leaf. Table 4 shows that the hired labour seems to play a very crucial role in the farm level activities of the sericulturists which is an outdoor activity. However, the co-efficient of variation worked out for these two regions on the number of mandays (in terms of family and hired labour) indicates that over the period the variation has increased for the number of mandays of family, labour from 6.44 per cent to 25.83 per cent. But this variation has decreased from 15.83 per cent to 2.34 per cent (table 4) for the hired mandays. This indicates that there has been a rise in employment opportunities for the hired labour at the farm level (outdoor) activities of the sericulturists in both the regions.

This phase of activity of cultivating mulberry leaf is closely followed by the rearing of silkworm which is mostly an indoor activity. Employment generation in this phase has a greater implication for the absorption of family labour as it keeps most of the family members fully engaged (mainly those who might have otherwise remained unemployed) through the rearing period.

With regard to changes in cocoon yields between the two points of time bivoltine variety seems to have picked up in the traditional region (table 5). Owing to failure of monsoons during the year 1983-84, we do find marginal decline in some regions in the yields of improved variety. However, there seems to be stability in both traditional and non-traditional regions in the yields of improved cocoons.

If we take a look at the labour utilization aspect of silkworm rearing, we find that over the period the dependance of family labour is increasing in both traditional and non-traditional areas (table 6). In the case of hired labour there is a marginal increase in the number of mandays required for rearing activity in the traditional area and there is a reduction in the non-traditional area. This is an important trend as it brings out the fact that the contribution of the family labour component is increasing in the rearing activity which is indoor in nature. It also implies that for the family members who were otherwise unemployed get absorbed as regular labourers in this activity.

In terms of net returns, at the outset, table 7 gives us an impression that sericulture is not a viable activity. But as we have already noted, a major portion of the total costs worked out include imputed family labour value. If we add the imputed value of wages of family labour to what we have derived as net returns (table 3), we do find that sericulture is a profitable activity. In spite of adding up of imputed values of several items including the notional wages to the family labour, the traditional region shows greater stability than the new region. Among different varieties, the improved and the bivoltine rearings showed signs of better prospects for earning higher returns than the local variety in the traditional region. In the non-traditional region the results show a mixed trend.

Added to these dimensions, our recent field visits to certain villages in Bijapur and Gulbarga districts revealed that in spite of problems of marketing, many sericulturists have been successfully producing both improved and bivoltine variety cocoons. The transition from traditional crops to new crops like mulberry has been taking place in some of these villages at a remarkably rapid rate. We came across a cross-section of farmers who have recognised the advantages of pursuing sericulture as a profitable economic pursuit. Right from large joint families of dominant caste

households having capacity to rear in batches of 500 to 600 dfls at a time, to a small holder belonging to scheduled caste express their happiness over the benefit derived from shifting to sericulture. In the so called non-traditional region of Bijapur, Gulbarga and Raichur several packets of successful sericulture have emerged. As per our observations the main factors favouring this success include extension work of the sericulture department, the availability of water and labour and above all the interest and the enterprising nature of the new sericulturists. While our sample surveys have revealed the operational details of the activities, the field visits to successful sericulture villages have revealed the great potentialities of non-traditional region for expanding these activities.

REGIONS	1980-1981		1983-1984	
	No.	Area	No.	Area
TRADITIONAL				
I	35.79	60.04	31.68	54.94
II	32.44	16.42	32.30	16.21
III	31.77	23.54	36.02	28.85
SUB-TOTAL	80.05 (598)	83.47 (1037.13)	71.88 (161)	74.43 (218.24)
Average size of mulberry holding		1.74		1.36
NON-TRADITIONAL				
IV	84.43	60.96	68.25	62.84
V	35.57	39.04	31.75	37.16
SUB-TOTAL	19.95 (149)	16.53 (205.36)	28.12 (63)	25.57 (74.99)
Average size of mulberry holding		1.38		1.19
GRAND TOTAL	100.00 (747)	100.00 (1242.49)	100.00 (224)	100.00 (293.23)
Average mulberry area		1.67		1.31

* 1983-84 figures refer to the results of two quarterly surveys conducted in July and October 1983. (Absolute figures are given in the brackets).
(area in acres)

Table 1. Distribution of sample sericulturists and area under mulberry by regions in 1980-81 and 1983-84 *

REGIONS		RAINFED			
		Local		MS	
		1980-81	1983-84	1980-81	1983-84
I	TC	484	250	734	420
	C	0.23	0.23	0.30	0.26
III	TC	1226	510	-	-
	C	0.37	0.35	-	-

(value in Rs.)

Note TC = Total Cost per acre (Rs)

C = Cost per kg (Rs)

Table 2. Cost of mulberry leaf production (per kg) by regions, varieties under rainfed conditions.

		IRRIGATED			
		Local		MS	
		1980-81	1983-84	1980-81	1983-84
TRADITIONAL					
I	TC	--	--	760	680
	C	--	--	0.22	0.40
II	TC	1365	964	1279	885
	C	0.24	0.28	0.22	0.35
III	TC	1173	1038	1492	974
	C	0.24	0.47	0.29	0.23
NON-TRADITIONAL					
IV	TC	--	--	1048	872
	C	--	--	0.22	0.38
V	TC	--	--	872	691
	C	--	--	0.34	0.69

Note : TC = Total cost per acre (Rs)

C = Cost per kg (Rs.)

Table 3. Cost of mulberry leaf production (per kg) by regions and varieties under irrigated conditions.

Particulars	1980-81		1983-84	
	Own	Hired	Own	Hired
Traditional region	36.34	57.15	20.07	43.18
Non-traditional region	30.09	44.91	28.26	44.62
Mean	35.69	54.71	22.42	43.59
Co-efficient of variation (%)	6.44	15.83	25.83	2.34

Table 4. Labour (mandays) utilisation in mulberry cultivation per acre per crop.

	Local		Improved		Bivoltine	
	1980-81	1983-84	1980-81	1983-84	1980-81	1983-84
TRADITIONAL						
I	19.74	19.46	26.33	23.88	--	39.55
II	--	24.00	19.08	25.56	--	--
III	--	--	25.12	24.00	12.14	45.00
NON-TRADITIONAL						
IV	--	--	23.92	21.45	--	15.86
V	--	--	27.16	29.41	--	17.10

Note : 1) Local variety silkworm rearing is not reported in III, IV and V regions.

2) Bivoltine silkworm rearing was not reported in most of the regions during 1980-81.

Table 5. Average cocoon yields per 100 dfls by varieties and regions.

	1980-81		1983-84	
	Own	Hired	Own	Hired
1. Traditional region	23.67	13.18	26.67	14.39
2. Non-traditional region	12.67	20.70	18.74	16.98

Table 6. Labour (mandays) utilisation in silkworm rearing.

		Total Cost		Gross returns		Net returns*	
		1980-81	1983-84	1980-81	1983-84	1980-81	1983-84
TRADITIONAL							
I	Local	279.19	473.00	345.00	507.00	68.81	34.00
	Improved	322.21	746.00	747.36	892.00	425.15	146.00
	Bivoltine	--	1281.00	--	1317.00	--	132.00
II	Local	--	555.00	--	490.00	--	-65.00
	Improved	399.44	659.00	627.57	729.00	228.13	70.00
	Bivoltine	--	782.00	--	75.00	--	-707.00 **
III	Local	--	--	--	--	--	--
	Improved	396.90	742.00	724.35	931.00	327.44	189.00
	Bivoltine	347.48	924.00	432.38	2208.50	84.90	1284.50
NON-TRADITIONAL							
IV	Local	--	--	--	--	--	--
	Improved	404.38	560.50	757.02	610.00	352.64	49.50
	Bivoltine	--	563.50	--	428.00	--	-135.50
V	Local	--	--	--	--	--	--
	Improved	527.61	937.00	815.55	797.50	287.94	-139.50
	Bivoltine	--	831.00	--	982.00	--	151.00

* Net returns presented here have been derived after including the imputed value of wages of family labour.

** Negative returns are due to failure of crops.

Table 7. Total cost, gross returns and net returns per 100 dfls by regions and varieties.

	REGIONS	DISTRICTS	TALUKAS
I	Rainfed	Mysore	Kollegal Chamarajanagar K R Nagar
II	Semi-irrigated	Mandya Bangalore	Malavalli Ramanagar Doddaballapur
III	Irrigated	Kolar Tumkur	Kolar Siddlaghatta Pavagada
IV	Inner Non-traditional	Chitradurga Hassan Bellary	Davanagere C R Patna Kudligi
V	Outer Non-traditional	Raichur Gulbarga Bijapur	Manvi Jeevargi Mudhol

Appendix
Districts and Talukas by regions of the study area.

BIVOLTINE IN THE TROPICS

LES RACES BIVOLTINES DANS LES PAYS TROPICAUX

S.R. VIJAY

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The best known classification of silkworm races is in terms of the number of generations that a race can live each year. Some among the silkworm races hatch only once a year, some others twice in a year and yet others several times in a year. Those which hatch once a year are known as univoltine, those which hatch twice are bivoltine and those which hatch several times are known as polyvoltine races. Univoltine and bivoltine races thrive in the temperate zone and polyvoltine in the tropical. Both univoltine and bivoltine silkworm races have a process by which the eggs go into dormancy. The eggs of bivoltine races for example hatch in spring and become moths early in summer to lay eggs; the eggs again hatch ten days thereafter and the second generation of moths emerges early in autumn to lay eggs. Eggs laid after autumn rest dormant and go into hibernation through the winter. Eggs of polyvoltine or multivoltine races do not rest dormant and hatch regularly after ten days. Univoltine and bivoltines races are attuned to the climatic conditions in the temperate areas and polyvoltine races are attuned to the climatic conditions in the tropics. If bivoltine eggs are reared in the tropics, the eggs go into dormancy and if they are not cold-stored the embryo therein dies in natural conditions therefore union bivoltine race cannot survive in the tropics. Polyvoltine races, if reared in the temperate zones keep hatching even during winter when there are no mulberry leaves. Such races cannot but perish in such conditions. In effect the life/generation of silkworm cycles differs significantly as between the temperate zones and the tropics.

Bivoltine silk has an edge over multivoltine silk. Silk reeled from multivoltine cocoons is very often of the 'E' Grade quality compared to 'A' and 'B' quality achieved by silk reeled from bivoltine cocoons. The quality of silk yarn is normally measured in terms of filament length per cocoon and filament thickness. In terms of this criteria silk yarn from bivoltine hybrid cocoons records a normal measurement

of 1000 to 1200 metres. Bivoltine silkyarn is also much thicker than silk reeled from multivoltine cocoons. Fabrics made of bivoltine yarn are comparatively popular throughout the world. Bivoltine cocoons also have a thicker shell and are amenable to being used in sophisticated semi-automatic reeling machines. Multivoltine cocoons are comparatively less suitable.

Apart from quality of silk, another important factor prompting a switch over from multivoltine to bivoltine is the high productivity of bivoltine hybrids. Studies in the late 1970s by C.S.R.T.I. of India pointed out that yields per 100 layings were in the region of 20 kgs. for local multivoltine races whereas, in the case of new hybrids of bivoltine, the yields were in the region of 35 kgs. It is also recognized that bivoltine races in Japan, China and Korea reach markedly higher yields to 60 to 70 kgs. per 100 layings as compared to multivoltine.

Bivoltine sericulture has certain other factors to recommend it. Unlike multivoltine silkworm eggs, bivoltine silkworm eggs can be hatched according to programme by a combination of cold storage and artificial hatching. Bivoltine silkworm eggs can be cold-stored in such a manner that when silkworm eggs, the single most important input for sericulture, are required and even if the immediately preceding season is very poor in terms of ability of the climatic conditions to support any programme for silkworm seed production, yet the eggs can be made available when conditions turn favourable. In South India, to take an example, the south-west monsoon breaks out rather abruptly close on the heels of a fairly severe summer during which time conditions are unfavourable for production of seed cocoons. The sudden outbreak of the monsoon and the good sprouting of mulberry leaves lead to a tremendous demand for silkworm seed eggs and in view of the unfavourable conditions preceding the monsoon period, silkworm eggs may not be easily made available. On the contrary, if bivoltine silkworm eggs are prepared during October/November, when silkworm seed production is at a fairly satisfactory level due to favourable conditions and cold-stored through summer, seed releases can keep step with leaf production immediately after the outbreak of the monsoon.

It is equally important to appreciate that the silkworm is highly susceptible to diseases. Synchronized rearing is a pre-requisite for successful cropping. Synchronized rearing facilitates disinfection and prevention of silkworm diseases. It also enables collective guidance by extension personnel on the methods of rearing and mulberry cultivation. Synchronized rearing, however, presupposes that silkworm seed should be released in adequate quantities on the date of "hakitite"*. Multivoltine silkworm eggs are not amenable to cold storage and the availability of multivoltine silkworm eggs cannot possibly be assured at pre-arranged dates. On the contrary, bivoltine silkworm eggs can be cold-stored and released as and when required. In effect, bivoltine sericulture in combination with cold storages and acid treatment technologies is a pre-requisite for synchronized rearing. In fact it is the absence of synchronized rearing and absence of gaps between one rearing and another that make sericulture particularly hazardous in tropical countries. Disinfection in the absence of synchronized rearing proves ineffective. Pathogenic viruses, germs and fungi spread from one rearing house to others. And once such a disease gets a start, it is difficult to stop it unless there is suspension of rearing and community disinfection.

Japan, China, U.S.S.R., South Korea, India, North Korea, Bulgaria, Brazil, Iran, Turkey, Thailand and Taiwan are the principal producers of cocoons in that order. Out of these countries, China, the largest producer of silk, produces both the multivoltine and the bivoltine type. Japan, U.S.S.R., South Korea, North Korea and Bulgaria produce bivoltine silk. India, Brazil, Iran, Turkey and Thailand produce primarily multivoltine silk. Internal variations are always alike, particularly within the larger countries which may spread over both the tropical and temperate zones.

Sericulture in Kashmir has always been bivoltine oriented and the other silk growing areas in India have been multivoltine.

A number of countries in the Tropics are indeed making efforts at switching over from multivoltine to bivoltine. The exercise is by no means simple. It implies transplanting of a race which by nature is attuned to conditions in the temperate countries, to conditions obtained in the tropical countries. The process normally implies import of races, adaptation of races to tropical conditions and release of bivoltine races in the tropical countries for rearing. Several tropical countries have embarked on such exercises, the most notable being India which is proposing to do so with assistance from the World Bank. It would be useful to review the experience.

THE SOUTH CHINA EXPERIENCES

China, being a large country, spreads into both temperate and tropical zones. The important sericulture provinces in China are Sichuan, Zhejiang, Ziangsu and Guangdong. Guangdong falls under the tropical belt. Upto eight cocoon crops are reared between January and October every year. The other areas enjoy temperate climate and sericulturists in those areas rear bivoltine silkworms between May and October during spring, summer and autumn seasons. The Chinese Government has launched a major drive to step up silk production over the last two decades. In the process they not only overtook levels of production reached by Japan but also went far ahead. Among the measures, the Chinese Government apparently adopted for increasing production of cocoons were also schemes for conversion of multivoltine sericulture areas in subtropical South China into bivoltine sericulture areas. Reports on the success achieved by China on conversion of multivoltine areas into bivoltine areas are not very clear. A FAO Mission visited China recently and made a study on sericultural practices in that country. The official report of the mission indicates that polyvoltine races are still in use in Southern China and mainly in the Zhungiang areas. The FAO mission has observed that polyvoltine strains continue to persist in these areas. The mission of course was not convinced that such strains should continue to be encouraged. They were informed that the adaptation of these races to local conditions and the resistance to diseases were the main factors prompting continuance of polyvoltine strains. It is also indicated in the mission report that polyvoltine multi crops were more labour intensive. Therefore the need to absorb manpower in the densely populated South China required emphases on polyvoltine races. The mission has also indicated that a change over to bivoltine would presuppose a large scale readaptation in all processes including silkworm seed production, mulberry planting, leaf harvesting, silkworm rearing and the absence of efforts in this direction "explains the persistence of polyvoltine".

Dr. S. Krishnaswamy, former Director of the Principal Mulberry Research Station in India known as the C.S.R.T.I., was also a member of the mission. In a separate report released by him, he has observed that "there was a major effort in South China to replace the traditional multivoltine races with more productive bivoltine races". He refers to claims that "upto 30% of cocoons production in the traditionally multivoltine area of South China had been replaced with bivoltine hybrids". He proceeds to point out that this was possible because of the "advantage of the more favourable cold seasons in South China".

According to Dr. Krishnaswamy, China took to the idea of bivoltine "much later" than Indians and almost 30% of the cocoon production in South China had already switched over to bivoltine. He comments that this was made possible "because of the political dispensation prevailing in China and the determined effort with which production strategies and introduction of new technologies are implemented at the field

level". The story of the bivoltine silkworm experience in South China is by no means very clear.

TAIWAN - EXPERIENCE OF A NEWLY-DEVELOPED COUNTRY IN BIVOLTINE

Information available on the Taiwanese experience is rather limited but significant. Teremichi Osako has recently concluded his "Comparative study of sericulture in the temperate countries as compared to sericulture in the tropical countries". His book contains significant observations. Taiwan, though a small country, unfolds into both temperate and tropical zones. Taiwan silk industry developed remarkably after independence. The development was not so much in the temperate region of Taiwan where sericulture was previously concentrated but in the tropical regions. As on date 12 out of 19 such sericultural areas in Taiwan are south of the Tropic of Cancer.

Apparently, two new bivoltine races, "Taiwan n° 5 and 6" were introduced into the tropical south. Though Osako concedes that productivity levels in the tropical south are not as high as those in the temperate north, yet the manner in which sericulture has split over into the tropical south shows that this newly industrialized country has achieved as much in sericulture as it has in the case of rapid industrialisation and for which she is held out as a model.

THAILAND

Thailand is among the tropical countries which have made an effort at rearing of bivoltine races. The Japan JICA (different from the IACEA) extended active assistance. Sericulture in Thailand was in a particularly backward state in 1969. The Government launched the International Cooperative Agency, Sericulture Development Cooperation Project of Japan in Thailand. Introduction of bivoltine was among the programmes sought to be implemented. However, the introduction of bivoltine races was not proceeded by any exercise at adaptation of races. An adaptation of technique was advocated for bivoltine hybrids. The Japan International Cooperation Agency noted that production of F1 generation "requires many facilities, much labour and fairly complicated techniques. Therefore it is recommendable to use the second generation F2 hybrid. This, the Agency felt, is slightly weak when compared with F1 but never weaker than indigenous polyvoltines".

By 1973, the Project Leader Dr. S. Omura published his book "Silkworm rearing technics in the Tropics". He points out, "we may say that although there are many techniques which we wish to introduce, few can be used here as they are. Because the natural environment in Japan in the temperate zone is fairly different from that in Thailand in the Tropic zone. Japanese technology cannot be of any help without proper adaptation".

The same Dr. S. Omura was destined to become Chairman of the International Agricultural Cooperative Experts Association which took up the responsibility of providing the technical input from Japan for a bivoltine-oriented programme in India. After his conclusion of a study tour of Karnataka and in the context of pointing out the difficulties in achieving bivoltine, he has cautioned that Thailand had failed in this efforts. However, the Thai experience can be of limited significance because sericulture in Thailand was in a rather primitive state if one should judge from the fact that farmers themselves were producing silkworm eggs.

INDIA

The traditional mulberry growing states in India are Karnataka and West Bengal. The Mysore Race and the Nistari are the aboriginal races in these two states. The quality of pure Mysore Race is rather poor particularly in terms of silk yields or renditta. In the early part of this century in the old Mysore State, the Government having learnt of the improvement in the races in China and Japan made efforts to upgrade the quality of races available and introduced the Chinese bivoltine called Ci-ni-chi as father race for production of hybrid seed. The cross breed held its way for decades.

In the meantime in Japan and China, thanks to continuous and rapid developments in the field of genetics, newer and more vigorous and productive races were being evolved and propagated.

It was in the Behrampore Research Station that Dr. Krishnaswamy was able to use improved Japanese strains for breeding bivoltine strains suitable to Indian conditions. Dr. Krishnaswamy later moved to the Central Sericultural Research Station, Mysore. CSRTI had carried out extensive results with the bivoltine K.A. breed and it was obvious that a number of rearers were able to obtain yields to the extent of 60 to 65 kgs per 100 dfls. Thereafter, CSRTI evolved and released other races including NB-7, NB-18. The new bivoltine races were used to cross with the Mysore pure race and this practically resulted in a silk revolution in Karnataka State. Sericulturists in all districts except Mysore District switched over to the use of eggs produced from bivoltine seed as male parent. In the meantime the CSRTI continued its thrust towards a total switch over to bivoltine. At this stage, the Government of Karnataka made an effort at achieving a change from multi-bivoltine to pure bivoltine.

At this stage it must be noted that the story of bivoltine in India is practically the story of bivoltine in Karnataka. Indeed Karnataka's efforts at introducing bivoltine did not start with the Karnataka Sericulture Project. The Fifth Five Year Plan aimed at increasing bivoltine silk production by 600 tonnes and provided for a variety of programmes to achieve this target.

Half way through the Fifth Five Year Plan on 11-9-1978, a Review of the Bivoltine Programme was undertaken by the State Government and an official role on the technical capacity of producing 1700 tonnes of bivoltine silk prepared at that time is available. After noting that the Fifth Plan target was of 500 tonnes, it was felt that bivoltine production during 1977-78 would be of the order of 100 tonnes. It was forecast "this will easily go up to 200 tonnes during 1978-79". The note went on to express the hope "once this base has been reached and the improved method of bivoltine rearing is propagated, bivoltine hybrid cocoons will increase according to schedule".

Certain working papers were also prepared as a prelude to finalisation of Karnataka Sericulture Project by the Ducksoolee Pre-Appraisal Mission.

These papers were four in number and dealt separately with moriculture, silkworm rearing, silk reeling and finally silk marketing. The second paper, "silkworm rearing in Karnataka" considered the implications of the State's shift in emphasis from multi-voltine to bivoltine. The Mission stressed the need to complete the switch over from Mysore Hybrid to the Bivoltine Hybrid "as quickly as possible". The papers did sound a note of caution in achieving the switch over and particularly the need for introducing "a hardy (bivoltine) race with abundant egg producing capacities". The paper also stressed the need for a variety of other measures if bivoltine was to succeed.

The Karnataka Sericulture Project which aims at producing 1000 tonnes of bivoltine silk has now been under implementation for three years. By the end of 1982-83, the World Bank Mission came to a finding that bivoltine had not progressed to the extent anticipated. The Aide-Memoire prepared by the Epworth Review Mission in March 1983 noted "a conspicuous aspect of the project is its failure, to date, to have any impact on increasing bivoltine silk production". They summed up their impression that this was due, in varying degree, to insufficient extension service, lack of sufficient number of robust bivoltine silkworm races and inadequate price incentive.

It may however be noted that notable success has been achieved in Anekal Taluka and with a large number of rearers in the northern part of the State as also in Kolar District.

All these three factors namely, poor quality of races, poor extension work and lack of quality seed have contributed in varying degree to the present impasse under which bivoltine silk production is substantially behind target.

EXTENSION

The sericulturists in the State are not fully conversant with the techniques of bivoltine rearing. Working paper n° 2 of the Pre-Appraisal Mission of the World Bank stresses that "silkworm rearers must be educated on the extremely wide difference in nature between bivoltine hybrid and the Mysore hybrid". The paper underlines that the strains were subjected to a process of selectivity over long years for increasing the renditta and for this reason their resistance to diseases had grown weaker. It emphasised the importance of CRCs so that the mortality rate in the early life of the silkworm is reduced. It also emphasised the need for "separate living quarters provided with adequate ventilation, suitable mulberry storage facilities and with adequate hand and foot stabilising equipments".

A number of remedial steps have been initiated. As many as 500 sericultural villages in the state have been identified for intensive extension effort and encouraging results have already been recorded. A census is also under way to enumerate all rearers who have exclusive rearing houses and all sericulturists who have been enumerated will be a further target of intensive extension effort. All bivoltine rearers will also be helped to maintain detailed progress records to enable identification of faulty rearing practices and ensure prompt corrective steps. Staff concerned with bivoltine programmes are being put through intensive training programmes in the new Training Institutions established with World Bank assistance.

RACES

On the all-important subject of races the problem is neither unexpected nor new. Way back in 1979-80, the Pre-Appraisal Mission emphasised the importance of improving the present varieties and the need to "actively collect pure original races from countries like Japan, South Korea, China".

The paper proceeded to emphasise the importance of Central Sericultural Research and Training Institute providing sufficient facilities to train breeders. After a detailed study, the paper concluded "in Karnataka any new races introduced must be hardy and possess abundant scope for reproduction". The papers also cautioned that breeding results cannot be expected within a short period of time and stressed the need of increasing the number of breeders to increase the opportunities for successful results. As on date Karnataka is "making do" with four races released much before

the launching of the Karnataka Sericulture Project. The CSRTI has however indicated that two new races are ready for extensive trials.

QUALITY EGG LAYINGS

Bivoltine production has suffered considerably for reason of the fact that the quality of egg layings was not satisfactory. The quality of egg layings themselves is determined by the quality of seed cocoon made available to P1 Grainages by the P2 and P3 Farms. A recent study indicates that not only was the productivity of P2 and P3 Farms in the state at a very low level, but also that steps had not been taken to ensure the quality of the seeds. Both in China and Japan, the procedure for preparing grand-parent and parent seed cocoons is carefully regulated. Basic seed obtained from research institutions are reared with utmost care so that high grade disease-free seed cocoons are produced, since the quality of seed cocoons has a direct relation with the quality of egg-layings.

Special mulberry fields are maintained for the purpose of obtaining high quality and infection-free leaf for rearing productive seeds. In some of the farms in China the harvested leaf are preserved in refrigerated rooms at a temperature between 62° to 70°F and such leaf is fed through day and night, so that the larvae get fresh leaves. In all such farms hygienic requirements are strictly enforced so that the worms grow quickly and free of disease. At every step in the course of the rearing the weak worms are systematically picked up and rejected. Action is also taken to examine the worms microscopically to ensure that the batch is free from diseases. A considerable portion of the grand parent eggs and parent eggs are rejected. Action is also taken to assess cocoon quality. If the cocoon harvest does not conform to the required standards, the whole batches are rejected. In China only about 50 per cent of these batches are selected and further more from each selected batch only 20% of the quality batches are selected for egg preparation as far as grand-parents are concerned. As far as the rearing of the parent egg is concerned, 30% of the batches are rejected and cocoons in the selected batches are rejected to the extent of 15%.

The Seed Organization in Karnataka receives P4 bivoltine layings from the Central Sericultural Research & Training Institute. P3 Farms are located at six places. The seed cocoons from P3 Farms are distributed to 16 P2 Farms. Unlike the practices in vogue in China and Japan, the production of these farms is limited and there was little scope for selection of worms and cocoons to be utilized for seed purposes. As a result necessarily the quality of layings made by the P1 Grainages was poor.

The bivoltine programme in Karnataka State has suffered for want of quality layings both supplied by the P1 Grainages and particularly Grainages producing F1 layings and farmers confidence is therefore limited. The programme has also suffered from lack of equipment which is an integral part of the new bivoltine husbandry techniques. What is clear from the above is that the achievement on the bivoltine calls for a number of inputs. At least from the Karnataka experience it may be said that these inputs were not forthcoming in full. Notwithstanding past experience it is obvious that steps will have to continue in the direction of ensuring a better trial for bivoltine.

Karnataka is the only state in India that has gone in for production of bivoltine silk in a big way. Jammu and Kashmir is producing a limited quantity of 7.7 tonnes of silk per year, West Bengal, 10 tonnes of silk per year, Tamil Nadu and Andhra Pradesh are using the limited quantity of their production entirely for prepa-

ration of seed. In effect, success or failure of bivoltine in the country depends upon the progress achieved in the state. Both Andhra Pradesh and Tamil Nadu, the other two important mulberry-growing states in the country, have prepared ambitious programmes for bivoltine and have sought World Bank assistance.

CONCLUSION

Bivoltine silkworm rearing is limited to the temperate countries, whether it is in Thailand or in India, the effort has been to push sericulture technology to the level of technology obtained in Japan. Japan is reputedly one of the most advanced country in the world if not the most advanced country. In most other fields, there is an effort at obtaining collaborations from advanced countries like Japan for upgrading technologies. Even in those areas the success achieved is rather limited. But in sericulture the effort is being made not only to reach that level but also to reach that level in spite of inherent handicaps.

The first obvious handicap is that relating to climatic conditions. The bivoltine silkworm is by nature more at home in the temperate zones than in the tropics. No doubt efforts have been made to evolve bivoltine silkworms races which can withstand the heat of the tropics. While bivoltine silkworm rearing has undoubtedly succeeded in laboratory conditions as also in the rearing houses of progressive sericulturists, the same cannot be said of such rearing in a universal sense. More disease resistant sturdy races are badly required.

Another basic difference is in regard to the hygienic conditions obtained in tropical countries as compared to conditions in the temperate countries. In countries like India, silkworm rearing is done in residential houses and hutments. Very often silkworm rearing is done in juxtaposition with cattle rearing and joint family living with numerous children running around. Hardly 20% of the rearers have exclusive rearing houses for themselves. Though sanitary and hygienic conditions in the villages have improved, yet there is no doubt that such conditions have not reached the levels obtained in Japan.

It is also wellknown that synchronised rearing is a pre-requisite for success in bivoltine. However, there are certain basic differences in the value systems in Japan and a country like India which makes it difficult to introduce synchronised rearing. To cite an example, if per chance a farmer has ready availability of leaves at a particular juncture and all others in the village do not have leaves, the farmer can easily be persuaded to refrain from hakitate* in Japan. The story in a country like India with castes and other divisive forces dividing the village may not be quite similar.

Sri S.K. Charsley, a social anthropologist has pointed out certain social factors obstructing sericultural development in regions like Karnataka. He has recently authored a treatise purporting to be an analysis of the sociological response of sericulturists in Karnataka to efforts of the State Government to introduce changes in sericulture. He has pointed out that deep-seated sociological forces could prove insurmountable obstacles in achieving the objectives and that such sociological factors could even permeate the thinking and work of functionaries in the department who themselves are in function as agents of change.

What is the future for bivoltine in the tropics? It is obvious that in the years to come there cannot be anything like universal success. It is not as if whole multivoltine areas can be transformed into bivoltine areas. Not all areas in the tropics are suitable for rearing bivoltine nor can best results be obtained during

seasons.

The approach will have to be selective. Tropical areas more suitable to bivoltine will have to be identified with due regard to seasons and the thrust will have to be in the direction of achieving a change in respect of such areas and in other areas perhaps only during selected seasons.

A farmer to farmer approach may also be necessary. Farmers with exclusive rearing houses and resources for rearing bivoltine could be persuaded in the first instance. In other words any programme at bringing about a transformation will have to be highly selective. Similar strategies depending on local conditions will also have to be evolved.

To sum up therefore we seem to have the example of one tropical country where efforts to introduce bivoltine have failed, viz. Taiwan, where it has apparently succeeded. Information on bivoltine in South China is not conclusive. The Indian experience shows that bivoltine has succeeded in pockets and that physical inputs have not yet been made available to the extent necessary, particularly in terms of sturdy races quality egg layings and cold storages. It is also true that introduction of bivoltine in tropical areas is faced with a number of peculiar problems. Bivoltine races are more at home in the temperate regions for more reasons than one. But notwithstanding all these handicaps there is no doubt that the effort is well worth the time, energy and investment. In the Indian scene itself bivoltine has succeeded in one pocket namely the Anekal area where it has almost established. The Anekal experience seems to show that success does indeed follow intensive effort. In Anekal, the Government of Karnataka was prepared to make the effort required because the bivoltine cocoon produced in Anekal was required for seed purposes and when it comes to satisfy the demand for seed no stone is left unturned to make it a success. It is pertinent to note that success has been achieved in the other areas also; the conclusion is unescapable that bivoltine is bound to succeed provided the effort is made.

Success no doubt may not be easy to come by. Success even in adaptation of technologies for industrial department has very often proved elusive. In this particular case the adaptation of technology is beset with inherent complications. Notwithstanding all this, bivoltine is so outstandingly advantageous for tropical countries that programmes for extension of bivoltine areas with suitable strategies are a must.

* * *

* "hakitake" is the Japanese word for "brushing". (Editor's note)

RAPPORTS DES DELEGATIONS OFFICIELLES

REPORTS OF OFFICIAL DELEGATES

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ECONOMIC ISSUES IN SERICULTURE

A CASE STUDY OF KARNATAKA

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I. SAMPLE AND COVERAGE

1. The average mulberry area per family has not varied much between 1980-81 and 1983-84 (Table 1) (1.67 acres in 1980-81 ; 1.31 in 1983-84).

2. Proportion of sample households in traditional region was more than (80.10 per cent) in non-traditional region (19.90 per cent) in 1980-81, which continued to be so in 1983-84 with 71.88 per cent in the traditional region and 28.12 per cent in the non-traditional region (Table 1).

II. VARIATIONS IN INPUT COSTS OF PRODUCTION OF LEAF AND DEMAND FOR LABOUR

Total costs on this account have been calculated by adding up both imputed costs as well as paid-out costs on the following items :

1. Farm yard manure costs

- a) owned compost (imputed cost)
- b) purchased manure (paid-out cost)

2. Fertilizers

Paid-out costs

3. Irrigation and other inputs

(Imputed as well as paid-out costs)

4. Sub-total of 1+2+3 items

5. Labour costs-sexwise-mandays

Family labour (imputed costs)

Hired labour (paid-out costs)

6. Cost incurred on the use of bullocks for cultivation

a) own bullocks (imputed costs)

b) hired bullocks for plough, transportation, etc. (paid-out costs)

7. Gross cost = Grand total of all items in terms of :

a) imputed costs

b) paid-out costs

8. Gross cost with the imputed value of family labour (including own bullock days)

9. Gross cost with only paid-out value

10. Variations in the demand for labour

For farm level activity there has been an increase in demand for the hired labour between two points of time as shown by the co-efficient of variation results.

III. REARING

1. During the first two quarters, some regions did well in the field of bivoltine rearing (particularly Region I & III) but by and large it is not picking up as expected originally.

2. The average yields with regard to the improved variety (CB) layings show not only improvement but also stability in both the regions.

3. Regarding employment generation due to silkworm rearing activity, we can say that the demand for hired labour (mandays) is increasing at a marginal rate in the traditional area for the same period, we find a conspicuous reduction in the demand for hired labour for this activity in the non-traditional area. This indicates the slow adaptation of sericulturists in the non-traditional area to the fact that rearing activity demands a greater participation of family labour, since it requires careful personal attention. This is a welcome trend which helps the sericulture activity to grow and stabilise. It also implies for the family members who were otherwise unemployed to get absorbed as regular labourers engaged in this activity.

IV. RETURNS

1. With imputed values added to the total cost, sericulture activity creates an impression that it is not viable. But a careful look at the costs and returns structure does indicate that the activity provides greater employment opportunities for both family and hired labourers and also supplements considerably to the total income of the family. In this respect, traditional region shows greater stability than the non-traditional region.

2. The non-traditional region is undergoing a transition from traditonal crops to new crops like mulberry. In some of the villages the transition is taking place at a rapid rate. At the moment, in the new region, certain pockets of successful sericulture have emerged and in other parts the progress has been very slow due to several natural and other adverse factors. In spite of difficult conditions prevailing in the new area Karnataka Government's Sericulture Department has been attempting to act as a crucial catalyst to bring about the expected transformation in the non traditional region, particularly with the help of KSP programmes.

* * *

Regions	No. of Sericulturists		Area under mulberry			
	III	IV	III		IV	
			Rainfed	Irrigated	Rainfed	Irrigated
I	49	49	98.05	10.90	119.10	14.11
II	49	48	1.40	32.78	1.38	34.08
III	56	55	2.25	61.10	7.00	50.05
IV	38	31	-	39.15	-	31.57
V	16	16	-	22.65	-	21.40
TOTAL	208	199	101.70	166.58	127.48	151.21

Table 1. Number of sericulturists and area under mulberry in III and IV quarter survey (1983-84) by regions.

	AVERAGE YIELD PER 100 DFLS					
	III			IV		
	Local	Improved	Bivoltine	Local	Improved	Bivoltine
I	10.00	24.6	6.50	13.65	21.55	12.12
II	16.25	10.96	3.95	16.00	18.68	14.29
III	-	24.69	20.79	-	24.54	3.50
IV	-	19.67	-	-	30.49	-
V	-	32.94	-	-	27.55	7.33
TOTAL	10.68	22.62	24.00	13.98	24.03	11.27

Table 2. Average yield per 100 Dfls in III and IV quarter survey (1983-84)
by regions

Regions	Gross cost with Family labour (Rs)				Leaf yield per acre (kgs)				Net returns with family labour (imputed values) per 100 Dfls (Rs)		
	Rainfed		Irrigated		Rainfed		Irrigated		Local	CB	Div.
	Local	M5	Local	M5	Local	M5	Local	M5			
TRADITIONAL											
I	125	39	-	159	661	988	-	1132	150	337	725
II	-	-	397	490	-	-	1370	1700	41	-60	-
III	157	--	472	470	583	-	1201	2471	-	93	996
NON TRADITIONAL											
IV	-	364	352	672	-	533	1066	1743	-	194	312
V	-	-	-	602	-	-	-	977	-	-58	-

Table 3. Regionwise gross cost with family labour (imputed value) for both irrigated and rainfed mulberry garden, yield rates and net returns (Rs).

DONNEES ECONOMIQUES SERICICOLES
ETUDE DU CAS DU KARNATAKA

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I. DENOMBREMENT ET ETENDUE

1. La surface moyenne de mûriers cultivés par famille n'a pas beaucoup varié entre 1980-81 et 1983-84 (Tableau 1) (1,67 acres en 1980-81, 1,31 en 1983-84).

2. En 1980-81, la proportion de ménages dénombrés était plus élevée dans la région traditionnelle d'élevage (80,10 %) que dans la région non-traditionnelle (19,90 %) ; la même tendance se retrouve en 1983-84 avec 71,88 % en région traditionnelle d'élevage et 28,12 % en région non-traditionnelle (Tableau 1).

II. VARIATIONS DU COUT DE PRODUCTION DES FEUILLES ET DE LA DEMANDE DE MAIN D'OEUVRE

Le coût total est calculé en ajoutant les coûts imputés et les dépenses (coûts payés) sur les postes suivants :

1. Coûts d'engrais naturel

- a) compost provenant de la ferme (coût imputé)
- b) compost acheté (dépense)

2. Engrais

Dépenses effectuées

3. Irrigation et autres frais

(Dépenses effectuées et coûts imputés)

4. Sous-total des postes 1+2+3

5. Coûts de main d'oeuvre

main d'oeuvre familiale (coûts imputés)
main d'oeuvre employée (dépenses effectuées)

6. Coûts occasionnés par l'utilisation de boeufs pour la culture

- a) boeufs appartenant au fermier (coûts imputés)
- b) boeufs loués pour les labours, le transport, etc. (dépenses effectuées)

7. Prix de Revient = Total de tous ces postes en :

- a) coûts imputés
- b) dépenses effectuées

8. Prix de Revient avec la valeur imputée de la main d'oeuvre familiale (y compris les jours d'utilisation des boeufs appartenant aux fermiers)

9. Prix de Revient brut (dépenses effectuées uniquement)

10. Variations de la demande en main d'oeuvre

Au niveau de l'activité des fermes, une augmentation de la demande en main d'oeuvre est apparue pendant la période étudiée comme le montrent les coefficients de variation.

III ELEVAGE

1. Au cours des deux premiers trimestres, certaines régions ont eu de bons résultats pour l'élevage des races bivoltines (en particulier, les régions I et III) mais dans l'ensemble, les résultats obtenus ne sont pas aussi bons qu'on le prévoyait au départ.

2. On enregistre pour les variétés améliorées (CB) une augmentation et une stabilité de la productivité moyenne dans les deux régions.

3. En ce qui concerne la création d'emplois due à l'activité séricicole, nous pouvons dire que la main d'oeuvre rétribuée (journaliers) augmente de manière faible dans la région traditionnellement séricicole, et pour la même période la demande en main d'oeuvre décroît considérablement dans la région non-traditionnellement séricicole. Ceci montre la lente adaptation des sériciculteurs de cette région au fait que l'élevage des vers à soie demande un effort accru de la part de la main d'oeuvre familiale car il nécessite beaucoup de soin et d'attention. C'est une tendance heureuse qui aide la sériciculture à croître et à se stabiliser. Cela implique aussi que les membres de la famille - qui seraient sans cela sans emploi - soient intégrés comme travailleurs à temps complet dans ce secteur.

IV. RENTABILITE

1. Lorsqu'on ajoute les coûts imputés au total des dépenses, on crée l'impression que la sériciculture n'est pas une entreprise viable. Mais si l'on regarde de plus près, on s'aperçoit que cette activité apporte de plus grandes possibilités d'emploi à la famille et à la main d'oeuvre extérieure, ainsi que d'importants suppléments au revenu global de la famille. A cet égard, la région traditionnelle est bien plus stable que la région non-traditionnelle.

2. La région non-traditionnelle est en pleine transition entre les cultures traditionnelles et les cultures nouvelles comme le mûrier. Dans certains villages, la transition s'effectue rapidement. A présent, la sériciculture s'est implantée dans certains endroits avec succès, tandis que dans d'autres endroits les progrès sont très lents en raison de facteurs défavorables, naturels ou non. Malgré les conditions difficiles existant dans la nouvelle région séricicole, le Ministère de la Sériciculture du Gouvernement du Karnataka s'efforce de jouer le rôle de catalyseur pour mettre en oeuvre la transformation dans la région non-traditionnelle, en particulier grâce aux programmes KSP.

* * *

Régions	Nbre de sériculteurs		Surface de culture du mûrier			
	III	IV	III		IV	
			non-irrigué	irrigué	non-irrigué	irrigué
I	49	49	98.05	10.90	119.10	14.11
II	49	48	1.40	32.78	1.38	34.08
III	56	55	2.25	61.10	7.00	50.05
IV	38	31	-	39.15	-	31.57
V	16	16	-	22.65	-	21.40
TOTAL	208	199	101.70	166.58	127.48	151.21

Tableau 1. Nombre de sériculteurs et surface de culture du mûrier aux IIIe et IVe trimestres de l'enquête (1983-84) suivant les régions.

PRODUCTIVITE MOYENNE POUR 100 PONTES SAINES						
Régions	III			IV		
	locale	améliorée	bivoltine	locale	améliorée	bivoltine
I	10.00	24.6	6.50	13.65	21.55	12.12
II	16.25	10.96	3.95	16.00	18.68	14.29
III	-	24.69	20.79	-	24.54	3.50
IV	-	19.67	-	-	30.49	-
V	-	32.94	-	-	27.55	7.33
TOTAL	10.68	22.62	24.00	13.98	24.03	11.27

Tableau 2. Productivité moyenne pour 100 pontes saines aux IIIe et IVe trimestres de l'enquête (1983-84) suivant les régions.

Régions	Prix de revient brut, main d'oeuvre familiale incluse (Rs)				Rendement en feuilles par acre (kgs)				Bénéfice net pour 100 pontes, main d'oeuvre familiale incluse (Rs)			
	non-irrigué		irrigué		non-irrigué		irrigué		locale	CB	bivolt.	
	locale	M5	locale	M5	locale	M5	locale	M5				
TRADITIONNELLES												
I	125	39	-	159	661	988	-	1132	150	337	725	
II	-	-	397	490	-	-	1370	1700	41	-50	-	
III	157	-	472	470	583	-	1201	2471	-	93	996	
NON-TRADITIONNELLES												
IV	-	364	352	672	-	533	1066	1743	-	194	312	
V	-	-	-	602	-	-	-	977	-	-58	-	

Tableau 3. Prix de revient brut incluant le coût de la main d'oeuvre familiale (valeur imputée) en moriculture irriguée et non-irriguée, productivité et bénéfices nets (Rs), suivant les régions.

LA PRODUCTION SERICICOLE EN ITALIE

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En 1983, la production séricicole italienne a légèrement diminué par rapport à l'année précédente : environ 80 000 kgs de cocons ont été produits, à partir de 3 500 boîtes de graines, par 320 éleveurs.

Le prix de vente des cocons était de 10 000 Lires italiennes par kg, prix qui comprend les subventions de la C.E.E. et des administrations régionales italiennes.

Pour l'année en cours, les élevages présentent quelques difficultés dues au mauvais temps qui en a retardé le démarrage de dix à quinze jours.

Environ 3 500 boîtes de graines polyhybrides importées du Japon ont été mises en incubation ; on prévoit également de répéter quelques élevages à l'automne, avec de la graine produite en Italie et traitée à l'acide.

Le prix de vente des cocons sera le même qu'en 1983 ou légèrement plus élevé.

Des initiatives ont été prises et des efforts sont faits pour augmenter la production séricicole, ou en tout cas en arrêter le déclin. Ceci est favorisé par le bouturage du mûrier au lieu du greffage, ce qui accroît sa multiplication avec une économie considérable des coûts et du temps de travail.

Il est également envisagé de reprendre la production de graines afin de répondre à la demande intérieure mais aussi, pour la plus grande partie, pour l'exportation, en particulier vers les pays méditerranéens qui s'adressaient jadis à la production italienne.

SERICULTURE IN ITALY

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The sericultural production in Italy slightly decreased in 1983 as compared to the previous year: about 80 000 kgs of cocoons were produced by 320 sericulturists from 3 500 seed boxes.

The cocoon sale price amounted to 10 000 Italian Lires, including grants from the European Economic Community and regional governments.

This year, the rearings are facing some problems such as delays of 10-15 days due to the bad weather.

Almost 3 500 boxes of polyhybrid eggs imported from Japan have been incubated for hatching. A few more rearings are expected to be carried out in autumn, using acid-treated eggs produced in Italy.

For the current year, the cocoon sale price will be the same as in 1983 or slightly higher.

Initiatives have been taken and efforts are being made in order to increase the sericultural production or at least to stop its decline. This is enhanced by the new method of mulberry propagation by cutting instead of grafting. This method leads to considerable savings in costs as well as in labour.

Furthermore, it is under consideration to boost up the egg production in order to meet the domestic demand but also to export, especially to the mediterranean countries which formerly used to be customers of Italy.

* * *

STATEMENT

by

Dr. M.C. AGARWAL

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Mr. Chairman, Excellencies, Dr. H. Bouvier, Ladies and Gentlemen,

It is a great pleasure to me to extend on behalf of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and my own behalf our best wishes for the success of the fourteenth International Sericultural Congress. We appreciate the invitation to participate in the Congress. The theme topic of this Congress, i.e., "Sericulture in tropical countries" has great relevance to the work of ESCAP in the Asia and Pacific region where several governments as well as non-governmental organizations have taken important steps individually and collectively for the development of production, processing and marketing of silk.

As a regional commission of the United Nations, ESCAP in collaboration with other United Nations agencies and interested organizations has the responsibility to serve as a centre for economic and social development in the region. In reviewing their role in the strategy for the third United Nations development decade, the regional commissions attach great importance to the eradication of poverty and hunger. The multi-sectoral development programme of technical assistance implemented by the ESCAP secretariat is based on the needs and aspirations of 43 affiliated countries and territories. Over the years, ESCAP has developed an exemplary tradition of co-operation between the developed and developing countries. Equally important has been the Commission's commitment to the achievement of economic and social development goals of the member and associate member governments.

Since economic and social development is a multi-dimensional and long-term process, ESCAP's operations have been diversified, in close consultation with member governments, so as to better respond to their needs. Thus, its assistance programmes and projects embrace many fields that add up to development. These cover the physical infrastructure related sectors such as shipping, transport, communications and water and energy resources together with agriculture, international trade, industry, human settlements, statistics and development planning, as well as activities focusing on important social problems and issues, among them excessive population growth, women's disadvantages and widespread youth unemployment. The role is of particular signi-

significance to member countries in the absence of any other region-wide assembly of governments, in the Asia and Pacific region, to provide assistance and facilitate their co-operation in the general economic and social development fields.

Mr. Chairman, for information of the International Sericultural Congress, I will now touch upon ESCAP's work in the development of silk in Asia and the Pacific region. To permit a co-ordinated and comprehensive approach, sericulture and silk are included in the work programme of three Divisions, i.e., Agriculture; Industry; Human Settlements and Technology; and International Trade. Each division on the recommendation of its respective legislative body and the Commission plans and implements activities related to its respective area of competence. The ministerial meeting on co-operation in Trade for Asia and the Pacific decided in 1978 that feasibility studies establishing regional co-operative arrangements for selected raw materials and commodities, including silk be undertaken by the secretariat. The secretariat after conducting a feasibility study on regional co-operation in silk and in consultation with the major silk producing countries has helped in the establishment of the inter-governmental Regional Consultative Group on Silk in 1982 comprising representatives of China, India, Indonesia, Malaysia, the Philippines and Thailand. As defined in the constitution adopted by the Group Silk, producing countries include countries engaged in any of the operations required for production of silk, i.e., cultivation of the host plant of silkworms and cocoons, reeling, weaving and processing of silk fabric.

The objective of the Group is "generally to promote the production, processing and marketing of silk" through co-operation between members in order to improve the quality of the products of the silk industry. The regional co-operative programme finalized by the Group emphasizes the production, processing, marketing, research and development, collection of statistics, and exchange and dissemination of information. To improve quality and yield of raw silk per cocoon, areas selected for co-operative action are : (i) development of appropriate technology in sericulture to suit the need of individual countries, (ii) development of post-cocoon technology and (iii) training of man-power for development of appropriate technology for sericulture as well as the post cocoon stages of production. In the area of marketing, efforts are being made for generic promotion of silk through a global campaign for promoting sale. With a view to increasing the consumption of silk in local markets, action has been taken to improve the characteristics and quality of products, e.g., wrinkle proofing and to promote the use of national traditional silk products. On the basis of experience already gained in individual countries, the Group would evolve uniform standards and procedures for collection and compilation of data within the ESCAP region for the purpose of production and market planning by the countries concerned.

Ladies and gentlemen, a number of promotional activities have been completed and some are in the pipeline for the development of sericulture in Asia and the Pacific region. A large area of the developing countries in the region falls within the tropical zone. Therefore, most of ESCAP's efforts are in line with the theme of this conference, i.e., "Sericulture in tropical countries". Some of ESCAP's activities in this field are a Regional Study of the Integrated Silk Processing Industry (1979) to examine the technical and economic aspects of the industry, Study on Feasibility of Regional co-operative Arrangements in Silk (1981), Seminar on the Integrated Silk Processing Industry hosted by the Government of China (1982), outlook for and framework of a Regional Co-operative Programme for Silk in the ESCAP Region (1982) and Training in Sericulture towards improving socio-economic conditions of women (1982) organized jointly with the Asian Institute for Rural Development, at Bangalore, and an Expert Group meeting on Research and Development of Silk (1982). At the recommendation of the Regional Consultative Group on Silk made at its second session held at ESCAP headquarters in December 1983, preparations to organize an

Asian Silk Fair in August 1984 at Hong Kong have been completed. The Secretariat has published "Asian women in tropical sericulture". It contains the latest available information on improved techniques in tropical sericulture and other important aspects of the silk industry, stressing its potential for improving the incomes and general living conditions of rural women.

A format has been circulated by the secretariat to member countries for cataloguing and exchange of genetic materials relating to mulberry varieties and silkworm races. A request has also been sent to the Governments to prepare a technical paper on the progress, programme and problems of silkworm breeding to appraise the need for the development of a regional silkworm breeding programme. Also, in order to consider the possibility of organizing a tour in China to study drying technology, information on cocoon drying is being collected from member countries. Although sericulture has yet to receive much attention in the national development plans of most of the region's tropical developing countries, the fine raw silk produced in the temperate climates of China, Japan and the Republic of Korea has been known around the world since the last century. Until recently, Asia's tropical zone was generally thought to be unsuitable for producing the kind of high-grade silk acceptable in the international market place. Between 1970 and 1982, as a result of the research and technology developed by the scientists in the Asian countries, especially in India, tropical sericulture has emerged as usually more profitable than that of the temperate zone and the Asian Silk industry has been gaining ground. Production of silk (raw and waste) increased at the compound rate of 1.8 per cent per year during the period 1973-1982 in the ESCAP region. It was 56 thousand metric tons in 1982 and the preliminary estimates show that it increased in 1983 to 62 metric tons or by 10.7 per cent. ESCAP region contributed 88 per cent to world production of silk in 1973 and about 87 per cent in 1983. Asia contributed 79 per cent to world export of silk during 1982 while it accounted for 57 per cent of world import. These statistics reveal the importance of the region as the major producer and trader of silk in the world.

The Regional Silk Group will welcome collaboration with the International Sericultural Commission in planning and implementing specific development projects which could benefit the sericulture and silk trade at the global as well as the regional level. Sericulture has the potential to generate supplementary income in rural Asia and the Pacific. The International Sericultural Congress may consider such areas where co-operative projects could be organized by the International Sericultural Commission and the Regional Consultative Group on Silk which functions under the aegis of ESCAP. In our opinion Mr. Chairman, the potential areas could be the development of appropriate technology in tropical sericulture through improvement in location specific mulberry varieties and silkworm races including effective pest and disease control of mulberry plant and silkworms, cocoon drying technology and training in sericulture. The International Sericultural Commission is invited to participate in the implementation of the regional co-operative activities identified by the Group. In this connection, I would request that the Technology and Research Committee of the Congress may discuss our proposal for I.S.C. and ESCAP collaboration.

On behalf of ESCAP, I offer my heartiest appreciation and thanks to the Government of India, especially the Central Silk Board and the people and Government of Karnataka for being excellent hosts.

We wish the fourteenth International Sericultural Congress every success in its deliberations to promote development of tropical sericulture.

DECLARATION

de

Dr. M.C. AGARWAL

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Madame le Président, Excellences, Dr. H. Bouvier, Mesdames et Messieurs,

Au nom de la Commission Economique et Sociale des Nations Unies pour l'Asie et le Pacifique (ESCAP) et en mon nom propre, j'ai le très grand plaisir de vous exprimer mes meilleurs voeux pour le succès du 14ème Congrès Séricicole International. Nous apprécions l'invitation qui nous a été faite de participer à ce Congrès. Le thème de ce Congrès, "Sericulture dans les pays tropicaux" coïncide parfaitement avec les activités de l'ESCAP en Asie et dans le Pacifique où plusieurs gouvernements et organisations non-gouvernementales ont pris d'importantes mesures, individuellement et collectivement, pour développer la production, la fabrication et la commercialisation de la soie.

En tant que Commission régionale des Nations Unies, l'ESCAP, en collaboration avec d'autres agences des Nations Unies et des organisations intéressées, joue le rôle de centre de développement économique et social en Asie et dans le Pacifique. Les Commissions régionales attachent une grande importance à l'éradication de la pauvreté et de la faim. Le programme de développement multi-sectoriel de l'assistance technique mis en place par le Secrétariat de l'ESCAP est fondé sur les besoins et aspirations de 43 territoires et pays affiliés. Au cours des années, l'ESCAP a développé un type exemplaire de coopération entre les pays industrialisés et les pays en voie de développement. Aussi importante a été la participation de la Commission dans la réalisation des objectifs économiques et sociaux des gouvernements membres et des gouvernements associés.

Le développement social et économique étant un processus multi-dimensionnel et à long terme, les opérations de l'ESCAP, qui est en rapport très étroit avec les gouvernements membres, ont été diversifiées afin de mieux répondre aux besoins. Ainsi, ses projets et programmes d'assistance englobent-ils de nombreux domaines qui s'ajoutent au développement. Ils couvrent les secteurs touchant à l'infrastructure tels que l'expédition, le transport, les communications, les ressources en eau et en énergie ainsi que l'agriculture, le commerce international, l'industrie, l'implantation des hommes, les statistiques, l'organisation du développement et également,

les activités relatives à des problèmes sociaux importants parmi lesquels la croissance démographique excessive, la condition de la femme et le chômage des jeunes. En l'absence de toute autre assemblée de gouvernements dans cette région de l'Asie et du Pacifique, le rôle de la Commission est particulièrement important pour les pays membres car elle fournit l'assistance et facilite la coopération entre pays en matière de développement économique et social.

Madame le Président, à l'intention du Congrès Séricicole International, je vais maintenant vous présenter le rôle de l'ESCAP en Asie et dans le Pacifique pour ce qui concerne le développement de la soie. Pour permettre une approche coordonnée et globale, les problèmes relatifs à la sériciculture et à la soie sont inclus dans les programmes de travail des trois secteurs suivants : Agriculture; Industrie; implantation des hommes et technologie; Commerce International. Suivant les directives de son propre corps législatif et de la Commission, chaque secteur met à exécution des projets relevant de son domaine propre de compétence. La réunion ministérielle qui se tint en 1978 sur la coopération commerciale en Asie et dans le Pacifique, décida que les études de faisabilité aboutissant à des mesures de coopération régionale pour des matières premières sélectionnées et des marchandises parmi lesquelles la soie, devraient être effectuées par le Secrétariat. Suite à une étude de faisabilité sur la coopération régionale relative à la soie et après consultation des principaux pays producteurs de soie, le Secrétariat a contribué à la mise en place en 1982 du groupe consultatif régional intergouvernemental sur la soie, comprenant des représentants de la Chine, de l'Inde, de l'Indonésie, de la Malaisie, des Philippines et de la Thaïlande. Conformément à la constitution adoptée par le groupe, les pays producteurs de soie comprennent les pays engagés dans l'une des opérations nécessaires à la production de soie, c'est à dire, culture de la plante nourricière des vers à soie et des cocons, filature, tissage et fabrication de tissus de soie.

L'objectif du Groupe est "de promouvoir la production, la fabrication et la commercialisation de la soie" par la coopération entre les membres afin d'améliorer la qualité des produits de l'industrie de la soie. Le programme de coopération régionale élaboré par le Groupe met l'accent sur la production, la fabrication, la commercialisation, la recherche et le développement, le recueil de statistiques, l'échange et la diffusion d'informations. Pour améliorer la qualité et le rendement de la soie grège par cocon, les domaines sélectionnés pour la coopération sont les suivants : (i) développement d'une technologie appropriée à la sériciculture et adaptée aux besoins des pays, (ii) développement de la technologie post-cocon et (iii) formation de la main-d'oeuvre pour le développement d'une technologie appropriée à la sériciculture et aux stades post-cocon de la production. Dans le domaine de la commercialisation, des efforts sont faits pour la promotion générique de la soie au moyen d'une campagne globale de promotion des ventes. Dans le but d'accroître la consommation de soie sur les marchés locaux, des mesures ont été prises pour améliorer les caractéristiques et la qualité des produits, par exemple, l'infroissabilité et pour promouvoir l'utilisation des produits de soie nationaux traditionnels. Sur la base de l'expérience déjà acquise dans chacun des pays pris séparément, le Groupe pourrait développer des normes et des procédures de recueil et de compilation de données au sein de la région de l'ESCAP pour que les pays concernés puissent organiser la production et le marché.

Mesdames et messieurs, un certain nombre d'opérations de promotion ont été réalisées et d'autres sont en cours de réalisation pour le développement de la sériciculture en Asie et dans le Pacifique. Une grande partie des pays en voie de développement se trouve en zone tropicale. Aussi les efforts de l'ESCAP s'accroissent-ils au thème de ce Congrès "Sériciculture dans les pays tropicaux". Les activités de l'ESCAP dans ce domaine sont les suivantes : une étude régionale de l'Industrie Intégrée de la Soie (1979) pour examiner les aspects économiques et techniques de cette indus-

trie; une étude de faisabilité des mesures de coopération régionale dans le domaine de la soie (1981); un séminaire sur l'Industrie Intégrée de la Soie à l'invitation du gouvernement chinois (1982); perspective et structure d'un programme de coopération régionale sur la soie dans la zone de l'ESCAP (1982) et formation en sériciculture en vue de l'amélioration des conditions socio-économiques des femmes (1982) organisée conjointement par l'Institut Asiatique pour le Développement Rural à Bangalore; une réunion d'experts sur la Recherche et le Développement de la soie (1982). Sur les recommandations faites par le Groupe Consultatif Régional sur la Soie au cours de sa deuxième session en décembre 1983 au siège de l'ESCAP, les préparatifs concernant l'organisation d'une Foire Asiatique de la Soie en août 1984 à Hong-Kong ont été achevés. Le Secrétariat a publié "la Femme Asiatique dans la sériciculture tropicale". Cet ouvrage contient les plus récentes données disponibles sur les techniques améliorées de la sériciculture tropicale et sur d'autres important aspects de l'industrie de la soie et met l'accent sur la possibilité d'améliorer le revenu et les conditions générales de vie des femmes en zone rurale.

Le Secrétariat a diffusé dans les pays membres une circulaire afin de répertorier la documentation sur les variétés de mûriers et les races de vers à soie (génétique) en vue d'échanges. Il a été également demandé aux gouvernements de préparer un rapport technique sur les progrès, les programmes et problèmes de la sélection des vers à soie afin d'évaluer le besoin d'un programme régional de sélection de ver à soie. Afin d'étudier la possibilité d'organiser un voyage d'étude en Chine sur la technique du séchage, nous recueillons dans nos pays membres des informations sur le séchage des cocons. Bien que la sériciculture doit être considérée avec encore plus d'attention dans les programmes nationaux de développement de la plupart des pays en voie de développement des zones tropicales, les soies grèges de qualité produites dans les zones tempérées de la Chine, du Japon et de la Corée sont connues dans le monde entier depuis le siècle dernier. Encore récemment, on considérait généralement que la zone tropicale de l'Asie ne convenait pas à la production d'une qualité de soie suffisante pour le marché international. Entre 1970 et 1982, grâce aux recherches et à la technologie développée par les scientifiques des pays asiatiques, notamment l'Inde, la sériciculture tropicale s'est avérée plus rentable que celle des zones tempérées et l'industrie asiatique de la soie a gagné du terrain. La production de soie (grège et déchets) a augmenté au taux composé de 1,8 % par an pendant la période 1973-1982 dans la région de l'ESCAP. La production s'est élevée à 56 000 tonnes en 1982 et les premières estimations indiquent qu'elle est passée à 62 000 tonnes en 1983 soit une augmentation de 10,7 %. La région de l'ESCAP a produit 88 % de la production mondiale en 1973 et environ 87 % en 1983. Les exportations de l'Asie représentaient 79 % de l'exportation mondiale de soie en 1982 alors que ses importations ne représentaient que 57 % des importations mondiales. Ces statistiques révèlent l'importance de cette région qui se place au premier rang mondial de la production et du commerce de la soie.

Le Groupe Régional de la Soie sera très heureux de collaborer avec la Commission Séricicole Internationale dans l'élaboration et la mise en oeuvre de projets de développement spécifiques qui pourraient profiter à la sériciculture et au commerce de la soie à un niveau général et régional. La sériciculture est source de revenus supplémentaires pour les zones rurales de l'Asie et du Pacifique. Le Congrès Séricicole International pourrait envisager que des projets de coopération puissent être organisés par la C.S.I. et le Groupe Consultatif Régional sur la Soie qui dépend de l'ESCAP. Selon nous, cette coopération pourrait porter sur le développement d'une technique appropriée à la sériciculture tropicale par un meilleur choix d'implantation de variétés spécifiques de mûriers et de vers à soie, le contrôle efficace des parasites et des maladies du mûrier et du ver à soie, la technique du séchage des cocons et la formation séricicole. La C.S.I. est invitée à participer à la réalisation d'opérations de coopération régionale définies par le Groupe. Aussi serait-il souhaitable que le Comité Technologie et Recherche du Congrès puisse discuter de notre proposition de collaboration entre la C.S.I. et L'ESCAP.

Au nom de l'ESCAP, je voudrais remercier le Gouvernement Indien et tout particulièrement le Central Silk Board et le Gouvernement de Karnataka pour l'accueil qui nous a été réservé.

Nous souhaitons que ce 14ème Congrès Séricicole International soit un succès et permette le développement de la sériciculture tropicale.

BRIEF OUTLINE OF SILK PRODUCTION

Central Silk Board

United Mansions
39 Mahatma Gandhi road
BANGALORE 560 001
India.

Silk textiles still comprise an insignificant portion of the total textile consumption in India. In 1981, against a total textile consumption of about 8,400 million metres, only 114 million metres were silk textiles which form a little more than one per cent of total consumption of textiles in the country.

The consumption of silk in India has been far above the demand for silk. The consumption in 1981 was estimated to be 114 million metres as against a production of 100 million metres. Deducting about 12 million metres which were exported, about 88 million metres were available for home consumption. It is expected that production by 1989-90 will raise to about 220 million metres against an estimated domestic demand of 224 million metres. Allowing for the export etc., about 190 to 200 million metres will be available for domestic consumption by 1989-90.

The production at the end of 1973-74 in India was 2,894 m. tons of silk. At the end of 1977-78, i.e. at the end of the V Five Year Plan, it was 3,711 m. tons giving thereby a compound rate of growth of 6.4 per cent between the IV Five Year Plan and the V Five Year Plan. The production at the end of 1982-83 was 5,700 m. tons. The production at the end of VI Five Year Plan is likely to be 6,754 m. tons giving a compound rate of growth of 7% over the V Plan. The production at the end of the VII plan i.e., by 1989-90 is expected to be 10,770 m. tons giving a compound rate of growth of 11% over the VI Plan.

Out of the above, the production of non-mulberry silk is expected to be 820 m. tons by the end of 1989-90 as against 489 m. tons in 1982-83.

The Central Silk Board is a statutory body entrusted with the task of developing the Silk Industry in the country. India is a federal country in which there is a division of powers and responsibilities between the States and the Central Silk Board. The development of sericulture and the silk is largely looked after by the State Governments. The Central silk Board advises the Government of India on resource allocation and technical feasibility of the schemes of the State Governments. The Central

Silk Board also helps the State Governments to formulate projects and implement them. The general functions of the Central Silk Board are contained in the Silkman's Companion which has been distributed to the delegates.

The lacunae in the sericultural system of India are :

- 1) inadequate supply of disease free silkworm seed ;
- 2) low literacy level of the farmers and the consequent delay in the results to be expected out of extension ;
- 3) decentralised and rural nature of the reeling sector leading to non-standardisation of silk yarn ;
- 4) decentralised industry of weaving sector leading to non-standardisation of woven cloth.

Attempts are being made in the VII Five Year Plan starting from 1985-86 to solve these problems within the framework of the overall policy laid down by the Government of India.

* * *

NAME OF THE STATE	MULBERRY			NON-MULBERRY					
	Area under mulberry (in ha.)	Prod. of Dfls. (lakh No.)	Prod. of cocoons (lakh kg.)	Tasar		Eri		Muga	
				Prod. of Dfls. (lakh No.)	Prod. of Cocoons (lakh kahan)	Prod. of Dfls. (lakh No.)	Prod. of Cocoons (lakh kg.)	Prod. of Dfls. (lakh No.)	Prod. of Cocoons (lakh No.)
Assam	600	4.26	1.20	0.68	-	20.74	1.95	132.33	1394
Andhra Pradesh	33,603	88.30	120.00	3.25	0.09	-	-	-	-
Tamil Nadu	22,245	110.00	80.00	-	-	-	-	-	-
Karnataka	1,21,500	1,651.22	376.51	-	-	-	-	-	-
Orissa	180	0.11	0.02	10.06	0.44	1.08	0.07	-	-
Manipur	400	0.90	0.80	1.34	0.02	0.20	-	-	-
Jammu & Kashmir	632	40.61	9.26	-	-	-	-	-	-
Madhya Pradesh	322	3.08	0.43	5.65	1.87	-	-	-	-
Uttar Pradesh	2,480	10.26	1.75	1.23	0.03	-	-	-	-
West Bengal	11,206	600.00	76.00	0.90	0.13	0.35	0.11	-	-
Himachal Pradesh	95	2.11	0.51	0.20	-	-	-	-	-
Tripura	407	0.19	0.07	-	-	0.21	0.02	-	-
Meghalaya	Neg.	Neg.	Neg.	-	-	-	-	-	-
Bihar	200	4.47	0.99	59.71	1.71	3.82	0.18	-	-
Arunachal Pradesh	Neg.	Neg.	Neg.	-	-	-	-	-	-
Maharashtra	150	0.63	0.06	0.20	-	-	-	-	-
Mizoram	Neg.	Neg.	Neg.	-	-	-	-	-	-
TOTAL	1,94,020	2,516.04	667.60	83.22	4.29	26.40	2.33	132.33	1394

Statement showing the statewise area under mulberry cultivation, production of Dfls., production of cocoons under mulberry and non-mulberry sectors during the year 1982-83.

PARTICULARS	End of IV Plan (1973-74)	End of V Plan (1977-78)		End of transitional period (1979-80)			Actuals at the end of 1982-83	
		Position	Growth rate %age		Position	Growth rate %age		
			SGR	CGR		SGR		CGR
I. Area under mulberry cultivation (lakh hectares)	1.10	1.31	3.8	-	1.55	9.2	-	1.94
II. Production of raw silk (mt. tons)								
1) Overall raw silk production	2894	3711	7.1	6.4	4805	14.7	13.8	5700
2) Mulberry raw silk	2421	3186	7.9	7.1	4193	15.8	14.8	5211
3) Non-mulberry raw silk	473	525	2.7	2.7	612	8.3	7.0	489
a) Tropical tasar	257	434	17.2	14.0	384	5.8	-	276
b) Oak tasar	-	-	-	-	-	-	-	3
c) Eri	141	56	15.1	-	183	113.4	80.7	173
d) Muga	75	35	13.3	-	45	14.3	13.4	37

SGR : simple growth rate.
CGR : compound growth rate.

PARTICULARS	VI Plan			Projections for VII Plan		
	Likely achievement at the end			(1985-90)		
	of VI Plan (1984-85)					
	Position	Growth rate %age		*Position	Growth rate %age	
SGR		CGR	SGR		CGR	
I. Area under mulberry cultivation (lakh hectares)	2.00	5.8	-	3.00	10.0	-
II. Production of raw silk (mt. tons)						
1) Overall raw silk production	6754	8.1	7.0	10770	11.9	11.0
2) Mulberry raw silk	6200	9.6	8.1	9950	12.1	9.9
3) Non-mulberry raw silk	554	1.9	-	820	9.6	8.1
a) Tropical tasar	306	4.1	-	450	9.4	8.0
b) Oak tasar	7	-	-	20	37.1	23.4
c) Eri	191	1.0	0.9	250	6.2	5.5
d) Muga	50	2.2	2.1	100	20.0	14.9

* The growth rate is calculated with 1979-80 as the base year.

SGR : simple growth rate

CGR : compound growth rate

Rate of growth during earlier Plan periods and the growth rate envisaged (tentative) for VII Plan.

BREF APERCU DE LA PRODUCTION DE SOIE

Central Silk Board
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India

Les textiles soyeux représentent encore à présent une partie minime de la consommation totale de textiles en Inde. En 1981, sur une consommation totale d'environ 8 400 millions de mètres de textiles, 114 millions de mètres seulement étaient des textiles de soie, ce qui représente un peu plus de 1 % de la consommation totale en textiles du pays.

La consommation de soie en Inde est bien plus élevée que la production de soie. En 1981, la consommation a été estimée à 114 millions de mètres et la production, à 100 millions de mètres. Si l'on enlève les 12 millions de mètres qui ont été exportés, 88 millions de mètres environ ont été mis sur le marché intérieur. On prévoit que la production atteindra vers 1989-90 environ 220 millions de mètres, pour une demande intérieure de 224 millions de mètres. En tenant compte des exportations, etc, 190 à 200 millions de mètres environ seront disponibles sur le marché intérieur en 1989-90.

A la fin de 1973-74, la production de soie en Inde était de 2 894 millions de tonnes. A la fin de 1977-78, c'est-à-dire à la fin du Ve Plan quinquennal, elle était de 3 711 millions de tonnes, ce qui donne un taux de croissance de 6,4 % entre le IVe et le Ve Plan quinquennal. La production était de 5 700 millions de tonnes à la fin de 1982-83. Elle sera vraisemblablement de 6 754 millions de tonnes à la fin du VIe Plan quinquennal, ce qui donne un taux de croissance de 7 % par rapport au Ve Plan. A la fin du VIIe Plan, c'est-à-dire en 1989-90, la production devrait être de 10 770 millions de tonnes, réalisant ainsi un taux de croissance de 11 % par rapport au VIe Plan.

Prise en compte dans ces chiffres, la production de soie non-mûrier devrait atteindre 820 millions de tonnes à la fin de 1989-90, contre 489 millions de tonnes en 1982-83.

Le Central Silk Board est un organisme gouvernemental auquel a été confiée la tâche de développer l'industrie de la soie dans le pays. L'Inde est un Etat fédéral au sein duquel le pouvoir et les responsabilités sont répartis entre les Etats et le Central Silk Board. Le développement de la sériciculture et de la soie est largement pris en charge par les Gouvernements des Etats. Le Central Silk Board joue le rôle de conseiller auprès du Gouvernement indien sur la répartition des moyens et la faisabilité sur le plan technique des projets des Gouvernements des Etats. Le Central Silk Board aide également les Gouvernements des Etats à formuler leurs projets et à les mettre à exécution. Les fonctions générales du Central Silk Board sont décrites dans la brochure "The Silkman's Companion" qui a été distribuée aux délégués.

Les faiblesses du système séricicole indien sont les suivantes :

- 1) l'approvisionnement inadéquat en graines de ver à soie saines,
- 2) le faible niveau d'alphabétisation des paysans avec comme conséquence la lenteur de la vulgarisation,
- 3) la nature décentralisée et rurale du secteur de la filature qui conduit à la production non-standard de fil de soie,
- 4) la nature décentralisée de l'industrie du tissage qui conduit à la production de tissés non standard.

Des efforts sont faits dans le cadre du VIIe Plan quinquennal débutant en 1985-86 pour résoudre ces problèmes selon la ligne de la politique globale fixée par le Gouvernement indien.

* * *

ETATS	MURIER			NON-MURIER					
	Culture de mûriers (ha)	Production d'oeufs (lakh No.)	Prod. de cocons (lakh kg.)	Tasar		Eri		Muga	
				Production d'oeufs (lakh No.)	Prod. de cocons (lakh kahan)	Production d'oeufs (lakh No.)	Prod. de cocons (lakh kg.)	Production d'oeufs (lakh No.)	Prod. de cocons (lakh No.)
Assam	600	4.26	1.20	0.68	-	20.74	1.95	132.33	1394
Andhra Pradesh	33,603	88.30	120.00	3.25	0.09	-	-	-	-
Tamil Nadu	22,245	110.00	80.00	-	-	-	-	-	-
Karnataka	1,21,500	1,651.22	376.51	-	-	-	-	-	-
Orissa	180	0.11	0.02	10.06	0.44	1.08	0.07	-	-
Manipur	400	0.90	0.80	1.34	0.02	0.20	-	-	-
Jammu & Kashmir	632	40.61	9.26	-	-	-	-	-	-
Madhya Pradesh	322	3.08	0.43	5.65	1.87	-	-	-	-
Uttar Pradesh	2,480	10.26	1.75	1.23	0.03	-	-	-	-
West Bengal	11,206	600.00	76.00	0.90	0.13	0.35	0.11	-	-
Himachal Pradesh	95	2.11	0.51	0.20	-	-	-	-	-
Tripura	407	0.19	0.07	-	-	0.21	0.02	-	-
Meghalaya	Neg.	Neg.	Neg.	-	-	-	-	-	-
Bihar	200	4.47	0.99	59.71	1.71	3.82	0.18	-	-
Arunachal Pradesh	Neg.	Neg.	Neg.	-	-	-	-	-	-
Maharashtra	150	0.63	0.06	0.20	-	-	-	-	-
Mizoram	Neg.	Neg.	Neg.	-	-	-	-	-	-
TOTAL	1,94,020	2,516.04	667.60	83.22	4.29	26.40	2.33	132.33	1394

Culture du mûrier, production d'oeufs et production de cocons dans les secteurs mûrier et non-mûrier dans les différents Etats de l'Inde en 1982-83.

	Fin du IV Plan (1973-74)	Fin du V Plan (1977-78)				Fin de la période de transition (1979-80)			Fin de 1982-83
		Position	% de croissance		Position	% de croissance			
			SGR	CGR		SGR	CGR		
I. Surface de culture du mûrier (lakh ha)	1.10	1.31	3.8	-	1.55	9.2	-	1.94	
II. Production de soie grège (tonnes)									
1) Production totale de soie grège	2894	3711	7.1	6.4	4805	14.7	13.8	5700	
2) Soie grège mûrier	2421	3186	7.9	7.1	4193	15.8	14.8	5211	
3) Soie grège non-mûrier	473	525	2.7	2.7	612	8.3	7.0	489	
a) Tussah tropical	257	434	17.2	14.0	384	5.8	-	276	
b) Tussah du chêne	-	-	-	-	-	-	-	3	
c) Eri	141	56	15.1	-	183	113.4	80.7	173	
d) Muga	75	35	13.3	-	45	14.3	13.4	37	

SGR : taux de croissance brut

CGR : taux de croissance composé

	VI Plan			Prévisions du VII Plan		
	Résultats prévus pour la fin			(1985-90)		
	du VI Plan (1984-85)					
Position	% de croissance		*Position	% de croissance		
	SGR	CGR		SGR	CGR	
I. Surface de culture du mûrier (lakh ha)	2.00	5.8	-	3.00	10.0	-
II. Production de soie grège (tonnes)						
1) Production totale de soie grège	6754	8.1	7.0	10770	11.9	11.0
2) Soie grège mûrier	6200	9.6	8.1	9950	12.1	9.9
3) Soie grège non-mûrier	554	1.9	-	820	9.6	8.1
a) Tussah tropical	306	4.1	-	450	9.4	8.0
b) Tussah du chêne	7	-	-	20	37.1	23.4
c) Eri	191	1.0	0.9	250	6.2	5.5
d) Muga	50	2.2	2.1	100	20.0	14.9

* Le taux de croissance est calculé en prenant 1979-80 comme année de référence

SGR : taux de croissance brut

CGR : taux de croissance composé

Taux de croissance au cours des Plans précédents et estimation du taux de croissance pour le VIIe Plan.

RECENT JAPANESE SERICULTURE INDUSTRY AND VIEWS ON THE TECHNICAL COOPERATION IN THE FUTURE

I. CIRCUMSTANCES RELATING TO THE JAPANESE SERICULTURE INDUSTRY

1. Supply and demand situation of the raw silk and silk

Surroundings of the Japanese sericulture industry are facing to quite severe situation. In other words, domestic demand of the raw silk and silk decreased to 13,200 tons in 1983, or a decrease of about 40% during the past five years from 1978 to 1983 because of standstill of the domestic general economy, change of mode of living, decrease of population of adult women, etc.

The above slow demand of the raw silk and silk has brought raw silk stock to the Japan Raw Silk and Sugar Price Stabilization Agency (hereafter, referred to "Agency") amounting to 10,600 tons as of end of April, 1984, meaning as large as 10 months amount of the Japanese raw silk production level. As a result, raw silk price has been hovering around lower than the standard raw silk price level which has been fixed by the Japanese Government.

In addition, such increasing of the stock for the Agency resulted that the Agency's loan reached above 860 million dollars as of end of April, 1984, so that the amount of interests to be paid reached to 73 million dollars. Such has made a financial difficulty to the Agency, or the Raw Silk Price Stabilization System supporting the Japanese sericulture system basically is in a critical situation.

In order to cope with quite severe situation, the Japanese Government as well as all of the sericulture industry people have agreed to have countermeasure as follows unanimously.

1) Promotion of the development of new usage of raw silk as well as a large campaign to promote the raw silk and silk.

2) Enforcement of reducing cocoon production in 1984 as large as 25% under the Government's guidance.

3) Disposal of raw silk reeling capacity as large as 30% including the large enterprises.

4) Controlling of import of raw silk and silk goods on two-nations agreements.

5) Raw silk support price by the Government has been maintained for 3 years after reducing by 700 yen/kg in 1981, while various prices have been increasing. Even though the countermeasures improving the domestic supply and demand situation as well as promotion of various countermeasures were arranged, quite severe situation will last long.

Table 1. Raw silk supply and demand

Year	Production	Imports	Domestic demand	Ending stock	Agency's stock	Of which imported
1978	16.0	5.0	21.2	4.5	3.0	3.0
1979	16.0	3.6	18.0	6.1	5.0	4.3
1980	16.2	3.0	15.8	9.5	8.6	6.6
1981	14.8	0.9	15.0	10.2	9.5	6.2
1982	13.0	2.3	15.9	9.6	8.6	5.2
1983	12.5	2.4	13.2	11.2	10.5	5.2

(1,000 ton)

2. Cocoon production situation

Recent sericulture in Japan is explained as follows.

The number of sericulture farm households in Japan decreased to 125,000 in 1983 with annual rate of decrease of 7.3% during the past five years, particularly for small size farm households, because the people engaged in sericulture have become older and the mulberry field has been partly shifted to other crops due to hovering lower raw silk price level for a long time.

Mulberry hectarage decreased to 109,000 in 1983 with annual rate of 3.3% during the past five years, because number of sericulture farm households decreased, the people engaged in sericulture have become older, the planned cocoon production was adopted, and the field was partly shifted to other crops.

Cocoon production decreased to 61,000 ton in 1983 with annual rate of 4.7% during the past five years, because number of sericulture farm households as well as silkworm eggs used decreased.

Managing scale for a sericulture farm household increased during the past five years until 1983, i.e. an increase of 23% or 0.85 ha for the mulberry field and an increase of 15% or 477 kg for cocoon production, because rationalization of the managing scale advanced while number of sericulture households with mainly medium and small scale decreased.

Cocoon production per ha was at standstill, i.e. 559 kg in 1983, because of the more extensive management of mulberry fields due to getting older of the people engaged in sericulture as well as having more side business.

The Japanese sericulture industry as mentioned in above has taken root in farming or mountain villages as well as upland field crop area as one of important industry even under severe situation. Also, it contributes to the farm economy as well as communities as one of important complex crops in farm management. In this respect, it is thought important to make its stabilized development even more rationalization will be required in the future.

Table 2. General situation of sericulture

TOTAL IN JAPAN						
Year	No. of sericulture households		Mulberry hectareage		Cocoon production	
	No. 1,000	Index	ha 1,000	Index	ton 1,000	Index
1978	187	100	130	100	78	100
1979	176	94	125	96	81	104
1980	166	89	121	93	73	94
1981	150	80	117	90	65	83
1982	139	74	113	87	63	80
1983	128	68	109	84	61	78

Year	PER HA		PER SERICULTURE HOUSEHOLD			
	Cocoon production		Mulberry hectareage		Cocoon production	
	Kg	Index	ha	Index	Kg	Index
1978	599	100	0.69	100	415	100
1979	649	108	0.71	103	461	111
1980	603	101	0.73	106	441	106
1981	553	92	0.78	113	432	104
1982	560	93	0.81	117	456	110
1983	559	93	0.85	123	477	115

II. DIRECTION OF THE TECHNICAL COOPERATION IN SERICULTURE

The world consumption of raw silk and silk goods has been at standstill or in a decreasing trend, as reflected by a decline in Japan, the largest consuming country. As a result, overall silk situation in the world stands on the remarkable overproduction keynote.

Supply and demand situation of the raw silk and silk in Japan shows a continuous imbalance due to a substantial decline in demand, as discussed in above. The government is taking countermeasures as follows :

- 1) Promotion of the domestic demand.
- 2) Domestic cocoon production in 1984 is curtailed by as large as 25% of the standard production level.
- 3) Raw silk support price by the government has been maintained for three years after reducing by 700 yen/kg in 1981, while various prices have been increasing.
- 4) Domestic raw silk production capacity will be disposed as large as about 30% in order to recover a balance of supply and demand situation together with the above measures.
- 5) Controlling of imports of raw silk and silk goods from major silk exporting countries like China has been based on the two-nations agreements.

On the other hand, recovery of balance in the supply and demand situation of the raw silk and silk in Japan will take time, because cocoon production area is located in mountain villages etc. and manufactures of raw silk and silk textiles are composed of the medium and small enterprises.

In addition, the Agency's raw silk stock has been piled up enormously. Disposal of the stock is considered as urgent problem. However, there is no hope to solve it soon for recovery. In this connection, surplus condition is seemed to be continued in the future worldwide.

Even under such worldwide condition, we are informed that there are a few countries who try to encourage development of cocoon production in order to export the raw silk and silk goods to Japan. We think that such countries have to recognize Japanese silk situation which has never been experienced before.

Japanese technical cooperation in sericulture will be extended to such countries who will develop the cocoon, raw silk and silk goods for the purpose of their domestic consumption, if Japan is asked so by such country.

In this respect, such country has to understand the Japanese policy which will correspond to such country's application after full discussion between two countries concerned.

NOUVELLE INDUSTRIE SERICICOLE JAPONAISE ET PERSPECTIVES DE LA COOPERATION TECHNIQUE

I. PROBLEMES RELATIFS A L'INDUSTRIE SERICICOLE JAPONAISE

1. Situation de l'offre et de la demande de soie grège et de soie

Le secteur de l'industrie séricicole japonaise connaît actuellement de grandes difficultés. En d'autres termes, la demande nationale de soie grège et de soie est passée à 13.200 tonnes en 1983 soit une diminution au cours des cinq dernières années (1978-1983) d'environ 40 %. Cela est dû à la stagnation de l'économie générale du pays, au changement du mode de vie, à la baisse de la population adulte de sexe féminin etc.

En raison de cette faible demande, l'Agence Japonaise de Stabilisation des Prix de la Soie Grège et du Sucre a vu ses stocks de soie grège et de soie atteindre 10.600 tonnes à la fin d'avril 1984, ce qui équivaut à dix mois de production japonaise de soie grège. Aussi, le prix de la soie grège s'est-il situé en deçà du prix standard de la soie grège qui est fixé par le gouvernement japonais.

De plus, en raison de l'augmentation du stock, l'emprunt de l'Agence a atteint 860 millions de dollars à la fin d'avril 1984, de telle sorte que les intérêts se sont élevés à 73 millions de dollars. Telles sont les causes des difficultés financières de l'Agence, autrement dit, le système de stabilisation du prix de la soie grège qui soutient le système de la sériciculture japonaise se trouve dans une situation critique.

Pour faire face à cette situation difficile, le gouvernement japonais ainsi que les industriels de la sériciculture ont unanimement approuvé les mesures suivantes :

1) Promotion du développement de nouvelles utilisations de la soie grège et campagne de promotion de la soie grège et de la soie.

2) Réduction de 25 % de la production de cocon en 1984, sous la direction du gouvernement.

3) Diminution de 30 % de la capacité de filature de soie grège, grandes entreprises incluses.

4) Contrôle des importations de soie grège et d'articles de soie, au moyen d'accords bilatéraux.

5) Le soutien du prix de la soie grège par le gouvernement a été maintenu pour une période de trois ans, après une diminution de 700 yen/kg en 1981, alors que

d'autres prix ont augmenté. En dépit de ces mesures qui améliorent la situation de l'offre et de la demande et de diverses autres mesures, cette situation critique risque de se prolonger.

Tableau 1. Offre et demande de soie grège

Année	Production	Impor- tations	Demande domestique	Stock final	Stock de l'Agence	Part des importations
1978	16.0	5.0	21.2	4.5	3.0	3.0
1979	16.0	3.6	18.0	6.1	5.0	4.3
1980	16.2	3.0	15.8	9.5	8.6	6.6
1981	14.8	0.9	15.0	10.2	9.5	6.2
1982	13.0	2.3	15.9	9.6	8.5	5.2
1983	12.5	2.4	13.2	11.2	10.5	5.2

(1 000 tonnes)

2. Situation de la production de cocons

La nouvelle situation de la sériciculture au Japon s'explique de la façon suivante.

Le nombre d'exploitants séricicoles est passé à 125 000 en 1983, soit une baisse annuelle de 7,3 % au cours des cinq dernières années. Ce taux concerne en particulier les exploitations séricicoles de petite taille en raison du vieillissement des exploitants et du remplacement partiel des champs de mûriers par d'autres cultures car le prix de la soie grège est depuis longtemps assez bas.

La surface plantée de mûriers a diminué ; elle était de 109 000 hectares en 1983 ce qui représente une baisse annuelle de 3,3 % au cours des cinq dernières années. Ceci résulte de la diminution du nombre d'exploitants séricicoles, du vieillissement des exploitations, de l'adoption d'une production de cocon planifiée et du remplacement partiel des champs de mûriers par d'autres cultures.

La production de cocon est passée à 61 000 tonnes en 1983 soit une diminution annuelle de 4,7 % au cours des cinq dernières années. La baisse de la population des exploitants séricicoles et le moindre nombre d'oeufs de ver à soie utilisés en sont la cause.

La taille de l'exploitation séricicole a augmenté au cours des cinq dernières années jusqu'en 1983 avec une augmentation de 23 % du champ de mûrier, soit 0,84 hectare, et une augmentation de 15 % de la production de cocon, soit 477 kg. Dans le même temps, le nombre de fermes séricicoles de petite et de moyenne importance a diminué.

La production de cocon a l'hectare plafonne à 559 kg en 1983 en raison de l'exploitation extensive des champs de mûriers par une population vieillissante d'exploitants séricicoles qui ont en outre des activités annexes.

L'industrie séricicole japonaise s'est implantée dans les exploitations agricoles, les villages de montagne ainsi que dans les zones de culture en altitude et constitue une branche d'activité importante même en période de crise. Aussi est-il important de stabiliser son développement et encore plus de rationalisation sera nécessaire dans l'avenir.

Tableau 2. Situation générale de la sériciculture

TOTAL AU JAPON						
Année	Nbre d'exploitations séricicoles		Superficie en mûriers		Production de cocons	
	Nbre (x1000)	Index	ha (x1000)	Index	tonne (x1000)	Index
1978	187	100	130	100	78	100
1979	176	94	125	96	81	104
1980	166	89	121	93	73	94
1981	150	80	117	90	65	83
1982	139	74	113	87	63	80
1983	128	68	109	84	61	78

Année	PAR HA		PAR EXPLOITATION SERICICOLE			
	Production de cocons		Superficie en mûriers		Production de cocons	
	Kg	Index	ha	Index	Kg	Index
1978	599	100	0.69	100	415	100
1979	649	108	0.71	103	461	111
1980	603	101	0.73	106	441	106
1981	553	92	0.78	113	432	104
1982	560	93	0.81	117	456	110
1983	559	93	0.85	123	477	115

II. DIRECTION DE LA COOPERATION TECHNIQUE DANS LE DOMAINE DE LA SERICICULTURE

La Consommation mondiale de soie grège et d'articles de soie plafonne et même diminue comme le montre le déclin au Japon qui est le plus grand pays consommateur de soie. De ce fait, la situation générale de la soie dans le monde est à la surproduction.

Il y a un déséquilibre constant entre l'offre et la demande de soie grège et de soie à cause de la baisse importante de la demande. Le gouvernement a pris les mesures suivantes :

- 1) Promotion de la demande domestique.
- 2) La production nationale de cocons a été réduite de 25 % par rapport au niveau standard de production.
- 3) Le soutien par le gouvernement du prix de la soie grège a été maintenu pendant trois ans après que ce prix ait diminué de 700 yen/kg en 1981, tandis que divers prix ont augmenté.
- 4) La capacité nationale de production de soie grège sera réduite de 30 % environ afin de rééquilibrer l'offre et la demande.

5) Le contrôle des importations de soie grège et d'articles de soie provenant de pays exportateurs de soie comme la Chine est basé sur des accords bilatéraux.

Cependant le rééquilibrage de l'offre et de la demande de soie grège et de soie prendra du temps car la production de cocon est localisée dans les villages de montagne etc. et les entreprises qui fabriquent la soie grège et les textiles de soie sont des Petites ou Moyennes Entreprises.

De plus, le stock de soie grège de l'Agence s'est considérablement accru et l'on considère que l'écoulement de ce stock est un problème urgent. Cependant, il ne semble pas possible de le résoudre dans l'immédiat. De ce fait, cette situation de surplus risque de se prolonger dans le futur à l'échelle mondiale.

En dépit de cette situation, quelques pays essayent d'encourager le développement de la production de cocons en vue de l'exportation de soie grège et d'articles de soie au Japon. Nous pensons que ces pays doivent prendre conscience de la situation de la soie au Japon.

Ces pays qui développent la production de cocons, de soie grège et d'articles de soie pour leur consommation intérieure bénéficieront, s'ils le demandent, de la coopération technique du Japon dans le domaine de la Sériciculture.

A cet égard, ces pays doivent comprendre la politique du Japon qui s'appliquera aux pays demandeurs de coopération après discussion entre les deux pays concernés.

RAPPORT DE MONSIEUR HSIAN-TSER CHU

REPORT OF MR. HSIAN-TSER CHU

* * *

CURRENT STATUS OF SERICULTURAL INDUSTRY IN TAIWAN

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I. INTRODUCTION

Sericulture is a relatively old undertaking of farmers in Taiwan.

The climate conditions in Taiwan are favorable to the planting of mulberry trees and to the raising of silkworms. In the past, however, sericulture was not only a side-line but it relied mostly on wild mulberries also. This, coupled with the backwardness in sericultural techniques, had resulted in a poor quality and low yield of cocoons. On the other hand, the silk-reeling facilities were so obsolete that the output of silk was so low while the cost therefore so high.

In order to cope with this situation, efforts have been made under JCRR/CAPD* initiated and supported projects to boost silk production in Taiwan. The notable ones during the past decade include :

- a) helping the Taiwan Sericultural Improvement Station (TSIS) carry out programs for the varietal and cultural improvement of both silkworms and mulberry trees.
- b) introducing the modern technology of sericulture from abroad.
- c) demonstrating the improved techniques of both sericulture and moriculture to local farmers.

All these activities have proved very helpful to the implementation of sericultural production plans.

* JCRR : Joint Commission on Rural Reconstruction (reorganized as CAPD on March 15, 1979)

CAPD : Council for Agricultural Planning and Development.

II. ESTABLISHMENT OF SPECIALIZED SERICULTURE PRODUCTION AREA (SSPA)

In view of the remarkable results as mentioned above and in line with the Accelerating Agricultural and Rural Development Program (ARDP), an intensive establishment of SSPAs has been going on in Miaoli, Nantou, Tainan, Pingtung, Taitung and Hualien areas (see the attached map) since 1973. The purpose is :

- a) to grow mulberry trees and raise silkworms on a contract basis.
- b) to develop mulberry plantations in low-yielding plains and slopelands.
- c) to operate silkworm-feeding practices in a cooperative and specialized way.
- d) to renovate silkworm-rearing facilities and introduce labor-saving practices.
- e) to assist sericultural farmers and industrialists in concluding a contract for production and purchase of cocoons, the latter to be contingent on the quality of products and the price of silk.
- f) to conduct training for silkworm raisers and promote cooperation with agricultural vocational schools.
- g) to strengthen infrastructure, such as cooperative young silkworm rearing houses, disinfecting equipment, and drainage and irrigation facilities, so as to improve the physical conditions for sericultural production.
- h) to provide loans for sericultural production.
- i) to assist contractors in purchasing cocoons from SSPAs and in setting up modern filatures for the production of better silk.

III. CHISHANG INTEGRATED SILK PRODUCTION ZONE

To promote an integrated management of sericultural production and marketing, the Government has been positively helping both farmers and contract dealers set up cooperative farms and modern filatures (silk reeling factories). It is through this endeavor that the Chishang Integrated Silk Production Zone has been set up. And a cooperative farm, a sericultural demonstration center and an automatic filature are to be established there.

a) Retired Servicemen's Cooperative Sericulture Farm

About 70 retired servicemen and their families with a total of 50 ha mulberry plantations are participating in this organization. Though individual family farms continue to cooperate as basic units, the farmers are grouped to engage in various farming activities on a cooperative basis. The purpose is to change the conventional structure of sericultural production by (1) enlarging the scale of farm operation through the group approach, (2) alleviating the labor shortage and individual input burden, and (3) providing for commercial-scale handling and marketing of products.

b) Sericultural Farming Demonstration and Training Center

As silkworm feeding accounts for 70 to 80 per cent of the total labor requirements for silk production, its mechanization is urgently desired. To that end, JCRR had assisted the VACRS in setting up a demonstration and training center at Chishang

and installing a set of automatic "spiral-rotating" silkworm-rearing devices. The function of the center is :

- (1) to demonstrate the techniques of cooperatively feeding young silkworms.
- (2) to train silkworm raisers in the use of labor-saving machinery for raising grown-silkworms.
- (3) to introduce improved moricultural methods and better water management for mulberry cultivation.

c) Special Training Program for Combination of Sericultural and Educational Developments

In order to speed up the training of extension workers, a special plan for combination of sericultural and educational developments has been carried on since 1974 with JCRR/CAPD support. It provides for the students of the Ta-hu Agricultural Vocational School (TAVS) to pursue studies at the school but go back to their homes in the five SSPAs during the sericultural farming seasons - from March to June and from mid-August to mid-November - to work together with farmers by way of demonstrating standard farming techniques and gaining practical experience. For the time being, 14 students are working at the Taitung Silk Reeling Factory and 10 students at the Cooperative Sericulture Farm.

d) Taitung Silk Reeling Factory

The Shin-Shin Silk Industrial Corporation, a designated contractor in this area, has built an automatic filature capable of yearly producing about 78,000 kilograms of raw silk in the Chishang Integrated Silk Production Zone. The filature started operation in May 1975.

IV. PROSPECTS AND CONCLUSION

From the agricultural point of view, Taiwan is an ideal area climatically favorable for the development of Sericulture. In southern and eastern parts of the island, silkworms can be raised six to eight crops a year, an advantage that can never be attained in Japan or Korea. In addition, the potential for raising silkworms in the gentle slope land of Taiwan is also promising. In view of the decline of silk production in developed countries, there is plenty of room for us to promote sericulture. However, our silk processing industry is still at the primitive stage. For instance, the silk reeling capacity is too small to catch up with the sericultural output. A considerable amount of quality cocoons, almost 80%, is exported as raw material to Japan. It is therefore urgently necessary to build a down-stream industry and to upgrade the scale of primary reeling levels to finished products. Like a newly hatched silkworm, our silk industry is just taking off the ground. There is a bright future but still a long way to go.

A brief account of Sericulture in Taiwan

Year	Mulberry Hectarage (Ha)	No. of Sericultural Families	No. of seed eggs distri- buted (case)	Total produc- tion of green cocoons (kg)	Unit yield of cocoons (kg/case)	First grade (%)	Price of cocoon (NT\$/kg)	Exported dry cocoons (Ton)	Imported raw silk (Ton)	Remarks
1940			5,250	39,695	7.56					The highest record be- fore restoration of Taiwan.
1956			27,531	210,713	7.65					The highest record be- fore the establishment of specialized sericul- tural production areas (SSPA).
1973	681	1,724	8,836	123,841	14.02	79	71.0			The year of the establish- ment of SSPA
1974	1,629	2,126	15,524	264,304	17.01	83	102.0			
1975	1,062	4,896	24,762	478,487	19.45	82	105.0	289		
1976	1,256	2,863	27,516	550,024	19.99	86	120.9	414	2.1	
1977	1,212	4,622	29,017	586,204	20.20	87	126.7	317	52.1	Aggregate output affec- ted by extreme drought in the spring season.
1978	1,677	3,749	38,824	937,775	24.00	87	130.3	649	126.8	
1979	2,513	2,962	51,240	1,346,438	26.00	87	135.0	768	300.7	
1980	2,737	3,109	68,239	1,824,498	26.73	87	141.0	1,166	247.9	
1981	2,394	2,796	59,204	1,638,917	27.65	87	141.0	953	262.5	
1982	1,677	2,113	44,272	1,248,759	28.21	87	146.0	1,208	318.1	
1983	1,246	1,344	33,395	960,598	29.00	90	148.0	999	305.5	
1984	863	1,251	16,724	825,338	28.00	92	147.0	338	207.2	

Distribution of Specialized Production Areas in Taiwan.

Répartition des Zones Spécialisées de Production Séricicole à Taiwan.

MIAOLI

Hsi-hu,
Tung-hsiao

NANTOU

Min-chien

HUALIEN

Kwang-fu

Jui-sui

TAINAN

Hsia-ying

Shan-shang

Hsin-hua

Kao-shu

Nei-pu

Wan-luan

TAITUNG

Chih-shang

Kuang-shan

Lu-yeh

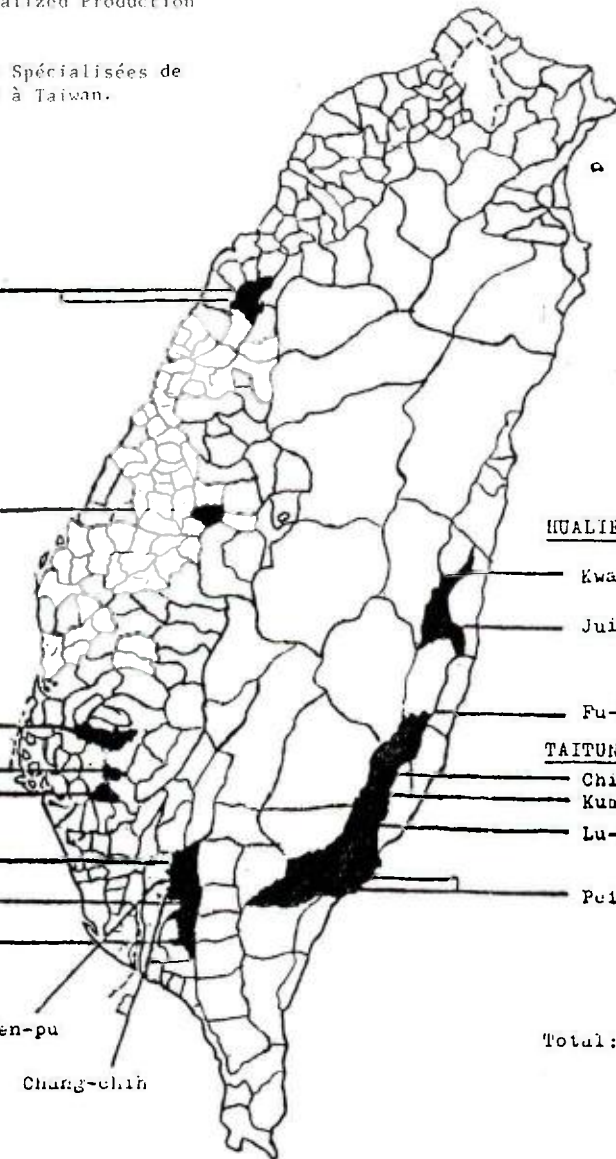
Pui-nan

PINGTUNG

Yen-pu

Chang-chih

Total: 2,453.9



SITUATION ACTUELLE DE L'INDUSTRIE SERICICOLE A TAIWAN

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I. INTRODUCTION

La sériciculture est une activité relativement ancienne chez les paysans de Taiwan.

Le climat de Taiwan favorise la plantation de mûriers et l'élevage de vers à soie. Autrefois, la sériciculture n'était pas uniquement une activité secondaire mais elle reposait principalement sur des mûriers sauvages. Ceci ajouté à des techniques archaïques de sériciculture donnait de petites récoltes de cocons de qualité médiocre. D'autre part, les filatures de soie étaient si périmées que la production de soie était très faible et donc les coûts très élevés.

Afin de remédier à cette situation, la JCRR/CAPD* a pris l'initiative de financer des projets destinés à relancer la production de soie à Taiwan. Les projets les plus remarquables mis en oeuvre au cours de la décennie furent les suivants :

a) aide apportée à la Station d'Amélioration Séricicole de Taiwan (TSIS) pour qu'elle mette en oeuvre des programmes destinés à améliorer les variétés et la culture des mûriers et des vers à soie.

b) introduction des technologies modernes de sériciculture venant de l'étranger.

c) démonstration des techniques améliorées de sériciculture et de moriculture aux paysans locaux.

* JCRR : Commission Jointe sur la Reconstruction Rurale (réorganisée en CAPD le 15 mars 1979).

CAPD : Conseil pour le Planning et le Développement Agricole.

Ces activités se sont avérées très utiles pour l'exécution des projets de production séricicole.

II. ETABLISSEMENT DE ZONES SPECIALISEES DANS LA PRODUCTION SERICICOLE (SSPA)

Etant donné les résultats remarquables mentionnés ci-dessus, et dans le cadre du programme de développement rural et agricole accéléré (ARDP), des SSPAs ont été implantées d'une manière intensive dans les régions de Miaoli, Nantou, Tainan, Pingtung, Taitung et Hualien (voir carte ci-après) depuis 1973. Les objectifs sont les suivants :

- a) faire pousser des mûriers et élever des vers à soie sur la base d'un contrat.
- b) développer les plantations de mûrier dans les plaines à faible rendement et sur des terrains en pente.
- c) pratiquer les élevages de vers à soie d'une manière spécialisée et au sein de coopératives.
- d) renover les locaux d'élevage et introduire des méthodes permettant une économie de main d'oeuvre.
- e) aider les sériciculteurs et les industriels à conclure un contrat portant sur la production et l'achat des cocons, ce dernier étant conditionné par la qualité de la production et le prix de la soie.
- f) former les éleveurs de vers à soie et promouvoir la coopération avec les écoles à vocation agricole.
- g) renforcer l'infrastructure comme les nourriceries coopératives, le matériel de désinfection, l'équipement pour le drainage et l'irrigation afin d'améliorer les conditions matérielles de la production séricicole.
- h) accorder des prêts à la production séricicole.
- i) aider les contractants à acheter les cocons dans les SSPAs et à construire des filatures modernes afin de produire une soie de meilleure qualité.

III. ZONE DE PRODUCTION INTEGREE DE CHISHANG

Pour promouvoir une organisation intégrée de la production séricicole et de la commercialisation, le gouvernement a considérablement aidé à la fois les fermiers et les entrepreneurs du contrat à installer des coopératives et des filatures modernes (usines de filatures de soie). C'est grâce à cet effort que la zone de production de soie intégrée de Chishang a pu être implantée. Une coopérative, un centre de démonstration séricicole et une filature automatique doivent y être installés.

a) Ferme séricicole coopérative de militaires à la retraite

Environ 70 militaires à la retraite et leurs familles participent à cette organisation sur une plantation de mûriers d'une superficie totale de 50 hectares. Bien que la ferme familiale reste la cellule de base, les paysans se regroupent au sein de la coopérative pour diverses activités agricoles. Le but est de changer la structure traditionnelle de la production séricicole en (1) élargissant le champ d'activité de la ferme grâce au regroupement, (2) en allégeant les charges dues à un manque

de main d'oeuvre et aux investissements individuels et (3) en assurant la promotion et la commercialisation des produits.

b) Centre de formation et de démonstration séricicole

L'alimentation des vers à soie représente 70 à 80 % du travail nécessaire à la production de la soie, aussi est-il urgent de la mécaniser. Dans ce but, le JCRR a aidé le VACRS à installer un Centre de démonstration et de formation à Chishang et un système automatique "rotatif-spirale" pour l'élevage des vers à soie. Les fonctions du Centre sont :

(1) de montrer les techniques permettant de nourrir les jeunes vers à soie au sein d'une coopérative.

(2) de former les éleveurs de vers à soie à l'utilisation de machines destinées à élever les vers à soie adultes avec une main d'oeuvre moindre.

(3) d'introduire de meilleures méthodes de moriculture et d'irrigation.

c) Programme spécial de formation combinant un enseignement traditionnel et un enseignement séricicole

Afin d'accélérer la formation des ouvriers, un programme spécial comprenant un enseignement traditionnel et un enseignement séricicole a été mis sur pied en 1974 avec l'aide du JCRR/CAPD. Il permet aux étudiants de l'Ecole à Vocation Agricole de Ta-hu (TAVS) de poursuivre leurs études à l'école mais aussi de rentrer chez eux dans les SSPAs pendant la saison séricicole c'est à dire de mars à juin et de mi-août à mi-novembre, de travailler avec les sériciculteurs en leur montrant les techniques standard de sériciculture et d'acquérir de l'expérience pratique. En ce moment, 14 étudiants travaillent à la filature de soie de Taitung et 10 autres à la coopérative séricicole.

d) Filature de soie de Taitung

La société industrielle de soie de Shin-Shin, un entrepreneur désigné dans ce domaine, a construit dans la zone de production intégrée de Chishang une filature automatique d'une capacité annuelle de production d'environ 78.000 kg de soie grège. La filature a démarré en mai 1975.

IV. PERSPECTIVES ET CONCLUSION

Du point de vue agricole, Taiwan est un endroit idéal pour le développement de la sériciculture en raison des conditions climatiques. Dans les régions sud et est de l'île, on peut obtenir de 6 à 8 récoltes de cocons par an, ce qui n'est pas le cas ni au Japon ni en Corée. De plus, les régions vallonnées de Taiwan conviennent très bien à l'élevage de vers à soie. Le déclin de la production séricicole dans les pays industrialisés nous laisse le champ libre pour promouvoir la sériciculture. Cependant, notre industrie de la soie est encore d'un niveau très bas. Par exemple, la capacité de filature de soie n'est pas assez élevée pour absorber la production séricicole. Presque 80 % des cocons de bonne qualité sont exportés au Japon sous forme de soie grège. Aussi est-il urgent de mettre en place une industrie en aval et d'élever le niveau de filature jusqu'aux produits finis. Notre industrie de la soie est à ses débuts, elle a un avenir brillant mais beaucoup de chemin reste encore à parcourir.

Sericiculture à Taiwan

Année	Superficie en mûriers (Ha)	Nbre de familles séricicoles	Nbre de graines distribuées (boîte)	Production totale de cocons verts (kg)	Unité de récolte de cocons (kg/boîte)	Première catégorie (%)	Prix du cocon (NT\$/kg)	Cocons secs exportés (tonne)	Soie grège importée (tonne)	Observations
1940			5 250	39 695	7,56					Le plus fort résultat avant la restauration de Taiwan.
1956			27 531	210 713	7,65					Le plus fort résultat avant la mise en place de zones de production séricicoles spécialisées (SSPA).
1973	681	1 724	8 836	123 841	14,02	79	71,0			Année de la mise en place des SSPA.
1974	1 629	2 126	15 524	264 304	17,01	83	102,0			
1975	1 062	4 896	24 762	478 487	19,45	82	105,0	289		
1976	1 256	2 863	27 516	550 024	19,99	86	120,9	414	2,1	
1977	1 212	4 622	29 017	586 204	20,20	87	126,7	317	52,1	Production globale affectée par une importante sécheresse au printemps.
1978	1 677	3 749	38 824	937 775	24,00	87	130,3	649	126,8	
1979	2 513	2 962	51 240	1 346 438	26,00	87	135,0	768	300,7	
1980	2 737	3 109	68 239	1 824 498	26,73	87	141,0	1 166	247,9	
1981	2 394	2 796	59 204	1 638 917	27,65	87	141,0	953	262,5	
1982	1 677	2 113	44 272	1 248 759	28,21	87	146,0	1 208	318,1	
1983	1 246	1 344	33 395	960 598	29,00	90	148,0	999	305,5	
1984	863	1 251	16 724	825 338	28,00	92	147,0	338	207,2	

Directeur Gérant : H. BOUVIER

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