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THAILAND SERICULTURE/SETTLEMENTS PROJECT

Joint Mid-Term Evaluation

January 24 - February 21, 1979

Public Welfare Department

USAID Evaluation Team

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Sincerely,

Donald R. Mitchell, Team Leader

Dr. Neungpanich Sinchaisri

Dr. Thomas Morgan

SUMMARY

The Sericulture/Settlements Project Loan Agreement between the RTG and USAID was signed September 8, 1976 for \$2.6 million to be equally divided between Public Welfare Department (PWD) and Bank for Agriculture and Agricultural Cooperatives (BAAC). PWD is the implementing agency for the extension aspects of recruiting, training and counseling silk producers. BAAC provides the credit through local branch banks to project participants. Technical information, training, hybrid silkworm eggs and cocoon marketing services are provided by the Sericulture Division of the Department of Agriculture.

Settlers in ten Northeastern Land Settlements are the target audience. According to a 1977 baseline study, these settlers had seven family members with a combined average income of ₱9,245 (\$462). The goal of the Project is to increase the family income of participants by fifty percent in five years. To do this 1,500 families are to produce silk cocoons according to approved practices.

Project technology includes the planting of four rai of mulberry, building a silkworm rearing house according to specifications and rearing hybrid silkworms following approved husbandry practices. By September 30, 1978, a total of 588 families were either producing silk or in the early stages of training or establishing mulberry plots.

Major technical problems are the production of mulberry leaves by the farmers and the supply of quality hybrid silkworm hatching eggs produced by the Sericulture Division. Both areas are seen as critical constraints to silk cocoon production. Mulberry cultural practices of using mulch, compost, manure, chemical fertilizer and weeding are within the means of the villagers. Lack of water or flooding are problems over which the farmer has less control. However, location and soil type combined with good cultural practices can ameliorate these conditions

Production of hybrid silkworms is a temperate zone technology where the parent stock produce eggs only two times a year. To hatch silkworms for six or more cycles required in this Project, involves storage and breaking the dormant cycle as needed. The technology and facilities are available, but require more testing and adjustment in procedures to attain a hatchability rate of domestically produced eggs comparable to those imported from Japan.

The silkworm rearing skills of the farmers appears to be good with many members obtaining cocoon yields only slightly less than in Japan. The old silk worm rearing houses facilitate the rearing of worms relatively free of pests and disease. The PWD extension workers appear to be doing an effective job of assisting farmers with mulberry production and worm rearing

Farmers are receiving a good income from silk cocoon production. The average farmer produced 106 kilograms of fresh cocoons in 5 cycles between May and December 1978, making a gross income of ¥5,485, with an estimated ¥475 net income. Cocoon price has recently increased by ¥38 per kilogram for high quality cocoons and should substantially increase the incomes of members and encourage additional farmers to join

The Project is behind schedule in disbursement of funds, number of members anticipated and production targets. This reflects more over-optimism at the planning stage than lack of solid progress. A good base has been developed and combined with recent increases in silk prices, the Project should gain momentum over the next three years and should be able to meet planned targets by 1981

CONCLUSIONS AND RECOMMENDATIONS

1. The Project, while not achieving the targets originally planned, is meeting the basic objectives of increasing income of poor people in the 10 land settlements areas. The average income in the 10 settlements in 1977 was ¥10,592 and the medium income ¥10,650 with a low of ¥6,315 and a high of ¥21,551 per family.

2. Technical knowledge of mulberry production is available but most farmers do not follow the recommended practices of pruning, applying compost, manure, mulching and chemical fertilizer. Those farmers who follow the recommended practices are achieving good leaf production. We would like to see more innovativeness in planting mulberry to achieve higher production. An adequate food supply is the key to higher cocoon weight and better quality silk. A contest is suggested to stimulate increased use of approved practices.

3. Technical knowledge of silkworm rearing appears to be good, with most people following directions. Many report large losses of worms during the rainy season. Many producers report yields of 20 kg. or more of cocoon per box and are striving for 24 kg. yields achieved in Japan. Producers obtaining high yields appear to do so consistently, indicating they are following good practices. Conversely, low producers are also consistently producing less than the average.

4. We are concerned about the cost of the silkworm rearing houses, usually ¥15,000. Construction materials varied, but all were very sturdy with cement block foundations, wooden, block or brick walls and corrugated or asbestos roofing. Some people built the house themselves, others hired a contractor. The villagers did not think of them as being too expensive, but were proud of this new status symbol. We believe a less expensive house could be built utilizing local material that would still provide the sanitary and comfort conditions required by the silkworms. We would encourage some innovativeness in this area. Perhaps a contest in the schools of architecture would produce some interesting design possibilities.

5. Credit is being extended to farmers in all settlements as fast as members for the Sericulture Project can be recruited and trained. By September 30, 1978 a total of ¥6,934,780 credit was extended out of ¥13,315,000 approved for 588 families in the 10 settlements, with a total loan usually being ¥20,000 to ¥25,000 for the rearing house, equipment and starting mulberry plots.

6. It is too early in the project to determine the repayment rate, but it is expected to be good since the cocoons are marketed through the Korat Center. The repayment is deducted at the land settlement at the rate of 40% of the total value of the cocoon marketed. As long as the Korat Center pays a good price this system will assure a high repayment rate, but if farmers can earn more selling privately, collection could become a problem.

7. The BAAC provides guidelines but apparently gives the local bank manager some discretion in collateral or number of guarantors needed for loan approval. This is good and we would encourage the bank to be innovative and not overly strict in applying collateral or group guarantee rules to the very poor who have demonstrated industriousness or willingness to produce silk.

8. The extension workers appear to be well trained and enthusiastic. The ratio of one extension worker to 20 families seems rather high and probably could not be maintained in a greatly expanded program. The project does provide a training opportunity for these relatively inexperienced officers; with more experience they could advise more farmers. We believe more women could be employed as extension workers on this Project.

9. The supervisors are knowledgeable and seems to generally be doing an effective job of managing the project within the settlements. Most women supervisors seemed to be effective in their work.

10. While this has been described as a women oriented project it is by no means exclusively the domain of women. It is a family business with all members of the family involved, particularly at busy times. Women and teenage girls were most often responsible for the gathering of leaves and feeding worms, but men did these jobs as well.

11. Trainees are equally divided between men and women. The reason most often given for men attending training is that they could get away for the month long training session. Women, particularly those with small children, could not be away from home for so long a period. If training could be conducted in the land settlements more women would probably be able to attend.

12. Cooperatives have not been a significant component of the project to date. Since the promotion of cooperatives would require a large investment of personnel and financial resources and would divert attention from the more central objective of increasing production and incomes, it is recommended that the cooperative element of the Project be deemphasized for the time being.

13. This Project has the potential for replicability on a broader scale. It has been shown that the technology can be transferred successfully. Scattered incidences of spread-effect have been observed already in the vicinity surrounding project sites. RTG, however, must soon undertake planning for the replication phase in order to be prepared by the termination date of this Project

14. The Project Coordinating Committee appears to have been an effective mechanism for discussing and resolving problems among the implementing agencies.

EVALUATION OF THE THAILAND/USAID SERICULTURE/SETTLEMENTS PROJECT

Introduction

The Sericulture/Settlements Project was approved in AID/Washington on June 29, 1976 and the Loan Agreement with the Royal Thai Government was signed on September 8, 1976. The loan agreement provided a loan of \$2.6 million with the standard 40 year repayment plan for the RTG. Of the loan funds, \$1.3 million was to be provided to the BAAC with BAAC providing a matching fund, to be loaned to the project beneficiaries. The remaining \$1.3 million was to be utilized by PWD to develop facilities at the land settlements, farmer training and to improve roads in the settlement areas. Grant funds in the amount 100 thousand dollars were to be provided for third country training, baseline studies conducted by Kasetsart University and the evaluations.

The Evaluation Team was composed of Dr. Neungpanich Sinchaisri, Insect Toxicologist at Kasetsart University, Dr. Thomas Morgan, Social Science Analyst, Northern Illinois University and Donald R. Mitchell, Agricultural Advisor, Asia Bureau, AID/Washington who served as Team Leader. Dr. Neungpanich was contracted for five weeks during the December - February period to provide much of the technical review of the Project. Morgan and Mitchell arrived January 23, 1979 to join in the evaluation. Field visits were made to nine of the ten settlements and discussions held with appropriate project manager offices in both USAID and the RTG. A joint review of the evaluation by USAID and RTG officials was held on February 13, 1979 to discuss the evaluation and its recommendation.

This paper is organized to cover the items listed in the scope of work as well as an analysis of the project logical framework to determine the status of the project at the time of this evaluation. We have taken some editorial license in restructuring the scope of work to avoid repetition and, we hope, to make the report more readable.

Goals and Purposes

The stated goal of the Project is to "increase the annual net cash farm income of 1,500 families in 10 North-eastern settlements by an average of 50% in 5 years." It

was assumed that: the RTG would continue to stress improvements in rural living standards as a national priority; population increases among the poor would not be greater than family income increases; and the project benefits would be spread among the 1,500 farm families.

The project purpose as stated is to "establish modern sericulture technology among 1,500 farm families in 10 settlements in Northeastern Thailand". In achieving this purpose, it was assumed that: the target families would be willing to accept the risks involved in adopting modern sericulture technology; there would be a reasonable demand for silk warp yarn; adequate staff would be available to manage the project and; inputs would be available as needed at reasonable prices

Comment: The original project purpose and methodology remain essentially valid. Indicators such as stable or rising demand for silk, especially within Thailand, and a substantial price for cocoons suggest that participants in the silk rearing project stand to increase their annual incomes by a considerable margin. From the first cycle in May 1978 to the fifth cycle in December 1978 the average price received by silk producers for raw cocoons has risen from $\text{฿}42.40$ to $\text{฿}67.80$ per kg. It is too early to determine whether an average increase in income of fifty percent as called for in the Project Paper will be achieved contingencies such as weather, disease or production input shortages may reduce incomes below the amount called for. Nevertheless, the goal of a fifty percent increase remains feasible.

The methodology employed by this Project in establishing a viable sericulture industry among the poorest population in the Northeast has been shown to be valid in practice. A highly technical system such as the one proposed in the project design can be effectively transmitted to a population familiar only with traditional and relatively less productive methods provided that necessary supports in the form of credit training, extension and supervision are readily available.

The assumptions which underlie this Project were in general accurate. They erred principally in being over-optimistic in terms of the speed with which a project of this nature can be implemented. A principal exception is the reliance in the project design on the use of cooperatives as a vehicle for managing cocoon production and marketing.

Cooperatives in Thailand have yet to show themselves able to stand on their own and continue to require a great deal of governmental direction. Given this fact it seems preferable for the time being to deal with producers individually or in informal groups until such time as cooperatives gain the maturity needed to handle the complex components of hybrid silkworm rearing. It is possible that as individual producers gain experience in all the ramifications of the process they may begin to exert pressure on the government for a more active role on the management side of this industry

Current Technology

Rearing of silkworms has been done in Thailand for hundreds of years and is still done in the villages of the Northeast probably much the same as several generations ago. The native silkworm reproduces throughout the year and a few cocoons are kept from each batch to provide the eggs for the next cycle. A few mulberries planted near the house provides the worm food supply. The silk fiber is irregular and only about one third the length of that produced by the hybrid worms. The resulting yarn is not suitable for the warp, but when used as the weft, it produces a nubby texture so characteristic of Thai silk.

Introduction of the hybrid silkworms has brought a new technology to the Northeast that is similar to modern broiler production in contrast to raising a few chickens around the year. Technology for the production of hybrid worms has come from Japan and is largely a temperate zone technology being trans-planted and adapted to the Tropics. The hybrid silkworm produces a high quality filament which is triple the length of the native filament and which can be used for warp as well as weft.

Being a temperate zone creature, the Japanese silkworm reproduces only twice a year. The eggs can be held in cold storage up to 6 months. With a change in temperature and when treated with a weak solution of hydrochloric acid, the hybrid eggs can be induced to hatch at most any time of the year. Once the worms are hatched they must be well cared for as they are voracious eaters of mulberry and are more susceptible to disease and insect pests than the native worms.

The technology introduced in this Project includes the following practices:

Hybrid eggs are produced at Korat, Mukdahan, Khon Kaen, Udorn and Ubol and are provided to the members of this Project through the land settlements. In the event that a sufficient supply of eggs is not available locally, they can be imported from Japan

Young worm rearing house: At each of the settlements, a young worm rearing house has been constructed where the eggs are hatched and the young worms fed through the first three stages or about 10 days. During these early stages the worms must be fed only the most tender leaves

Old worm rearing house: Each of the participants in this Project constructs or has built an old worm rearing house, usually about 4 m. x 6 m. and has the capacity to rear two boxes of worms at a time or produce 40 to 50 kilos of fresh cocoon at a time. The building must have a cement floor and foundation and be constructed of materials that are tight to keep out all insects and permit fumigation between cycles. Windows must be tightly screened and must be adjustable to provide adequate ventilation for worm comfort.

Equipment: The rearing beds are about 90 cm. x 2.5 m. and are made of a wooden frame covered with half-inch chicken wire. Paper is usually placed over the frame during the rearing period and can be changed frequently as a sanitary measure. The beds are placed in an adjustable rack and can be stacked 10 high. As the worms begin to spin their cocoons, they must have something to which to attach themselves. The most commonly used equipment for this purpose is the half-inch wire mesh crimped into a corrugation much like metal roofing. However, a more desirable frame copied from one used in Japan is made of cardboard consisting of cells about 1 x 1½ x 1 inch deep. Other miscellaneous equipment would include baskets and sacks for gathering the mulberry and transporting the cocoons as well as cleaning materials.

Mulberry Plot: Each participating member is expected to plant 4 rai of mulberry, which under most circumstances should be enough to feed the two boxes of worms to the cocoon stage. The mulberry cuttings are planted in rows about 3 meters apart. Application of compost, manure and mulching as well as some chemical fertilizer is essential for good leaf production. The plot must also be pruned and kept free of weeds.

At each of the land settlements, 100 rai of mulberry is planted and used to feed the newly hatched worms in the young worm rearing house. This mulberry is pruned somewhat differently to induce maximum growth of tender leaves. This plot is under the supervision of the project supervisor and the extension workers. Most of the labor is hired from the surrounding settlers and paid for by the Land Settlement.

To learn the technology the potential participants first attend three to four days of training in the planting and cultivation of mulberry at a land settlement. They return home to establish their mulberry plots. At a later date the farmers return to the center for a month long training period to take the silkworms through a complete cycle.

The BAAC loan to the farmer is approved at the time of the first training and the funds are provided for the planting of mulberry. After the second training cycle is completed and the mulberry plot well established, the bank provides the funds for the construction of the old worm rearing house and equipment. The farmer can construct the house himself or hire it built, but it must meet certain specifications and be approved by the project supervisors.

The technical report of Dr. Neungpanich Sinchaisri is included with this evaluation as Appendix A

Improved Technology

The level of technology used in this Project appears to be adequate and is apparently understood by most of the participants. While most do not understand the reasons why certain practices must be followed, they are, for the most part, following the recommended practices.

Old worm rearing house: One area that was of particular concern to the evaluation team was the cost of the old worm rearing house. In nearly all cases the houses were said to cost about B15,000 though some said even this was not enough. An additional B10,000 is usually required for the planting of mulberry and equipment, for a total loan of B25,000. To us, this seemed a rather high debt for a poor farmer. Yet we did not encounter anyone who felt the rearing house was too expensive. It seemed to be accepted as the cost of silk production. In most cases the

rearing house was better than the house the people were living in. Perhaps the people consider this "Mercedes Benz" by their house to be a status symbol.

At any rate we were concerned about the cost of the rearing house and believe some innovation in this area could produce a house that would be less expensive to construct without compromising the health and sanitation requirements of the silkworms. Perhaps a contest could be sponsored in the Schools of Architecture for the best design(s) that can be constructed of local materials for the least cost and still meet the basic requirements. For example the use of a thatched roof rather than metal or asbestos would be cooler for the worms and even if it has to be replaced every year or two, may be less expensive. Would a dome or round building with a center opening and with appropriate openings around the perimeter provide the desired ventilation and cover more floor space for less cost than a conventional square building? We believe innovation in this area is desirable and may bring surprising results

Mulberry: There appears to be considerable latitude for research and testing various cultural methods for mulberry. The research stations now have some 30 varieties of mulberry. Some varieties show limited resistance to root rot and other diseases. Others tend to be better under drought conditions. The rather standard cultural practice is to plant the cuttings 75 cm. apart in rows 3 m. wide. Different spacings were being tested at Mukdahan and it appears that double rows planted close together with wider spacing between the rows may result in higher leaf production

We would also encourage the testing of perhaps wider row spacings with leguminous crops grown in between the mulberry rows. Perhaps low growing clover or beans could be grown. Contour strips with fairly wide strips for the tillage of upland crops may be another possibility and may provide the added benefit of growing the mulberry on different soils that may result in higher leaf production during different seasons of the year. There are many practices that could be tested.

To encourage the farmers to use better practices or try new ideas, we would suggest that a contest might be held for the member obtaining the highest leaf yield from a rai of land. A prize could be given in the settlement and a grand prize for the highest yield in all 10 settlements. A prize might also be offered for the most innovative

cultural practices that result in high leaf yield. Distinction would need to be made between irrigated and nonirrigated mulberry.

The prizes for old worm rearing houses and mulberry production could be provided by the RTG or USAID. We believe this contest need not cost much, but the interest it would stimulate would be of great value.

Irrigation: We noted that at several of the Settlements sprinkler irrigation was being used on the central mulberry plots. While this no doubt increases leaf production, it would be a rather expensive practice for farmers. Irrigation will almost surely have to be practiced to achieve maximum leaf production from a given area of land. Furrow irrigation was not observed in any of the Settlements and where water is available would be one of the least expensive forms of irrigation.

It would seem that in an area where water is scarce, and irrigation appears feasible, consideration should be given to drip irrigation. Mulberry is a permanent crop that would lend itself very well to this practice and the energy requirement would be less than for sprinklers. Photovoltaic cells, though currently expensive, are being tested for irrigation and show considerable promise. Mass production will almost surely bring unit cost down to acceptable levels. This project might very well serve as a research site to test sun-power for irrigation purposes and could be a part of the Energy Project being developed by USAID and the RTG.

Cocoon Pricing

The price the farmer receives for fresh cocoons is set by a committee composed of representatives of the Sericulture Division, the Ministry of Industry and the Weavers Association. The base price is set at $\text{¥}1,000$ per kilogram of warp filament. A formula has been developed to determine the price of raw cocoons in terms of the price of the reeled filament.

It is estimated that sixty-five percent of the reeled filament is accounted for by the cost of the raw material, the remaining thirty-five percent represents the cost incurred in reeling. Therefore, the base cost of the raw material (cocoons) is estimated at $\text{¥}650$ $\text{¥}1,000 \times .65 = \text{¥}650$.

Tests at the Korat Sericulture Center indicate that approximately seventy-three percent of the filament in a cocoon can be recovered during reeling. This gives a reelability factor of .73

$$B650 \times .73 = B474.5$$

The proportion of filament to the weight of the dried cocoon varies, and this variation is used to grade the raw cocoons. Grades vary from 15 to 24 percent of dried cocoon weight. This factor is then used to determine the price per kilogram of cocoons received by the farmer. For example, cocoons graded at 15% would yield a price to the farmer of B71.3 per kilogram of cocoons.

$$B474.5 \times 15 = B71.3$$

These figures are illustrative only. Prices cited by farmers during the evaluation were lower than that in the example above. This is accounted for by a recent increase in the base price of warp silk from B750 to B1,000 per kilogram. (See Appendix K for a more complete explanation by the Director of the Sericulture Division)

Farmer Income

The Sericulture Project is attractive to the farmer in that it employs a portion of the family that normally is not able to earn money outside the village, i.e. the women and girls. The income earned from silk is generally additive to that from the more traditional crops. According to the data collected by Kasetsart University, the median income of farmers participating in this Project in 1977 was B10,950 or about 300 Baht higher than the median for all settlers in the ten settlements. This tends to confirm our field observations that Project Participants were relatively more affluent than the average settler. The average income in 1977 was B10,592 per family in the ten settlements.

While it is too early in the Project to determine profitability from actual experience we have attempted to estimate production costs. In doing so we relied on Dr. Chamnien Boonma of Kasetsart University, who provided the leadership for collecting and analyzing the data in the baseline studies. Utilizing the actual amount of fresh cocoons marketed through the Korat Center, as shown in Appendix E, we find that an average of 215 farmers produced

silkworms during the five cycles between May and December 1978 with an average of 106 kilograms of cocoons marketed. The gross value of the cocoons marketed average B5,485 per farm.

The average cash and noncash costs for the five cycles without including depreciation is B5,010.55 resulting in a net income of B474.75. However, if depreciation is included a net loss of B1,059.89 is incurred. The break even price for this period was B61.63/kg. The average price increased substantially during the 5 cycles going from B42.40 to B67.80/kg. for the last cycle project members realized a profit margin of B6.17 per kilogram. The average price for the coming year will probably average near B100/kg.

The above gross sales do not include the cull cocoons that are usually kept by the family, spun into thread and woven into cloth. One woman reported weaving and selling 6 skirts for B300 each over the past year. Families using better management practices are making more than these average figures would indicate and seem pleased with the new enterprise. We find it very encouraging that the increased price of silk is being shared with the farmer.

Organizational Aspects

The Sericulture Project is a joint venture of three Thai Government agencies and USAID. Since the implementation of the Project is entirely in the hands of the Thai Government with USAID providing only a financial contribution, it is proper to examine the respective roles of these components separately. Afterwards, the nature of the relationship between the Thai Government and USAID will be examined.

The Public Welfare Department, Ministry of Interior, through the Land Settlements Division, is directly responsible for implementation of the project in the field. On each of the land settlements, a sericulture project supervisor with two or three extension agents are responsible for recruiting members and monitoring their progress in establishing mulberry plots, constructing the rearing houses, securing silkworm eggs, supervising the rearing in the young worm rearing house, providing on farm follow-up during the rearing cycle and collecting the fresh cocoons for shipment to Korat. There are currently 10 supervisors and 32 extension workers in the ten settlements.

Technical responsibility for the project rests with the Sericulture Division of the Department of Agriculture, Ministry of Agriculture and Cooperatives. The Sericulture Division has ongoing research programs in mulberry production and many aspects of the silkworm reproduction and rearing. The Korat Sericulture Center is the primary research center, with 12 smaller centers scattered throughout the Northeast. Four of these sub-centers are producing the hybrid silkworms while the remainder work with the traditional silkworms and provide mulberry cuttings for nearby farmers. Training PWD extension workers is carried out primarily at Korat and the farmers receive training at either Korat, Surin, Mukdahan, Khon Kaen or Udorn.

Credit for the sericulture farmers is provided by the BAAC through local branch offices. The Bangkok Office provides the funds and the guidelines for giving credit, but does permit some local discretion in the use of collateral or group guarantees. This process is more fully described in the credit section.

Coordination at the Bangkok level is managed through a project advisory committee that meets on a nearly regular monthly schedule. The committee is composed of representatives of the implementing agencies plus DTEC, NESDB, MOI and KU. Notes on the committee meetings are on file at USAID and report on discussions and steps taken to correct various implementation problems.

Comment: All of the RTG implementing agencies appear to be doing an effective job in performing their responsibilities. The Project Advisory Committee, while sometimes a cumbersome method of achieving coordination, has worked well to bring people together to discuss problems before they get out of hand. This innovation should receive continued encouragement.

At the field level we were impressed by the interest and enthusiasm of the PWD extension workers and their supervisors. They appeared to relate well to the silk producers and seemed knowledgeable of the technical aspects of mulberry production and silkworm rearing. While they have not reached the targets originally planned, they are making solid progress in establishing this new technology in the settlements. We did not delve into the training of the extension workers, but it may be of value to include more training on identifying and motivating poor farmers to adopt the income increasing technology promoted in this Project.

The technical capability of the Sericulture Division appears to be very good and has received the assistance of several Japanese advisors of the past 10-15 years. The Thai staff appear to be well informed and knowledgeable of the problems in producing mulberry. Some 30 varieties of mulberry are available and they are being tested for resistance to diseases and their suitability for various soil conditions. Silkworm rearing technology seems to be well understood and judging from the yields farmers are obtaining after following the accepted practices, it appears sound. Not so well understood is the silkworm egg production--a very critical problem in this Project. We believe the staff has the ability to solve this problem and will in time develop the techniques necessary to have a steady supply of hatching eggs available as the silk producers need them. Hatchability of the domestically produced hybrids is not as good as those eggs imported from Japan.

The BAAC has branch banks in all of the land settlement areas and has the staff to assist with the credit needs. The branch managers appear cooperative and sympathetic to the villagers needs.

USAID has a dual role in this Project. First, it is a major contributor of the funds required by the Project. Second, it serves as a facilitator of communication among the participating RTG agencies.

With USAID support a program of monthly meetings of all concerned agencies was established. The progress of the Sericulture Project owes a great deal to this innovation. After reading through meeting records compiled over the past two years and after attending two meetings with representatives of the participating agencies we were impressed with the frank and substantive nature of the discussion.

Although USAID will have to continue to monitor the progress of this Project, it has reason to feel confident that a viable management mechanism has been created which will be able to continue on its own when USAID ceases its direct involvement in the Project.

The multiagency character of this Project is one that invites a host of managerial and other problems. It is to the credit of all the Thai agencies participating that such problems have been kept to a minimum. A number of areas of the operation of the Project, however, could be improved by making certain modifications in project organization. These areas are training, credit, and extension.

Training: Up to the present time the training of farmers in mulberry cultivation and silkworm rearing has been done in Korat Sericulture Research and Training Center, Surin and Mukdahan. This training pattern has a number of benefits principally in the presence of experienced instructors and good facilities. There are, however, several serious drawbacks to this training pattern.

First, it requires those receiving training to be absent from their homes for periods of time on two occasions - one period lasting a month. When training coincided with other agricultural requirements of farmers, they have withdrawn from training or have sent an alternate and less qualified member of the family for training. In one incident, the aged mother of one participant was sent for training. The woman's daughter admitted that her mother had not been able to comprehend the course of the training.

Second, conducting the training at centers limits the number of people exposed to technical requirements of this novel form of silkworm rearing primarily to those who have already displayed a degree of commitment to the Project. It might be better for the long term success of the Project if many more people, even those who have no immediate intention of joining the Project, could be exposed to training in modern sericulture. By broadening the base population of those familiar with the requirements, potential members could make a better informed decision on whether to participate. Additionally, with more members of a given sericulture family trained the family could respond to contingencies more readily. Several instances emerged in the interviews conducted for this evaluation where the person with prime responsibility for rearing the silkworms married and left the farm leaving a less qualified person in charge, precipitating a subsequent decline in production.

Serious consideration should be given to the possibility of conducting most, if not all, of the sericulture training at the individual land settlements. This could be done on a rotating basis with the sericulture extension staff of each land settlement supplemented by technical experts sent out from Korat, Surin or Mukdahan and perhaps including the Sericulture Division in Bangkok.

Conducting this training at the land settlements is feasible because now most of the infrastructure required for the project operation is in place. Local training would

permit adaptation of the curriculum to the specific characteristics encountered in each locality. Furthermore, more people from a given family could attend the training giving greater depth to the pool of sericulturists.

Local training would permit more women to participate and would broaden the base of understanding of the Sericulture Project among non-participants in the land settlements. This latter benefit is important with regard to the spread effect of the Project. The more people there are who understand the potential of hybrid silkworm rearing, the less novel and experimental will this occupation appear. The costs of transferring at least part of the training to the land settlements would not add considerably to the overall training costs.

Credit: The provision of credit through the BAAC has been generally satisfactory. However, the lack of extension of credit has contributed to the inability of the Sericulture Project to reach its planned membership targets on time. In some areas which have experienced difficulties with insurgency potential project members have been unable to obtain credit, even though they intend to remain on their farms. Ban Kruat, initially one of the land settlements with the most promise of a successful Sericulture Project, has been particularly hard hit by this credit shortage.^{1/} While it is not proper to demand that the BAAC incur undue losses in providing loans in these areas, it is nevertheless a reasonable expectation that the bank adopt a less conservative posture in this regard. The BAAC itself has realized this need and has proposed that the government provide some guarantees to the bank for loans made in areas potentially subject to major calamities of a natural or man-made kind. Serious consideration should be given to this proposal.

^{1/} Ban Kruat Land Settlement Headquarters was attacked in April 1978 by insurgents and Khmer Rouge soldiers. 30 people were killed in the incident including a PWD extension worker. Most of the buildings were burned. As a result many of the participants in the project have fled to safer territory.

A number of farmers have been deterred from joining the Project because they feared the large debt burden required in getting their mulberry plantations into production and the old silkworm rearing houses constructed. The result has been a somewhat greater representation among sericulture project members of the relatively more well-to-do land settlers who are more sophisticated and imaginative. The KU study reported that the highest average income families were located in the Chieng Phin Settlement with an average of 21,551 Baht, or about \$154 per capita. The average income for all settlements amounted to \$75.65 per capita (฿10,592 per family) with a low of \$45 at Lam Dom Noi (฿6,315 per family). The spread is not great and even the highest income settlers are well below the \$400 per capita income level accepted by international development institutions as the poor population. While this is at variance with project directives to concentrate on the poorest element of the population, from the standpoint of preserving project momentum and insuring the viability of hybrid sericulture in the long run, it is recommended that emphasis continue to be placed on motivation and interest rather than income.

Extension: The Sericulture Project at present has a generally highly competent group of agricultural extension workers and supervisors at the ten settlements. Especially encouraging were the women extension workers who, though few in number, have worked effectively

Though the Evaluation Team found the quality of extension work being done to be good, certain shortcomings were apparent. First, it did not appear that techniques to maximize mulberry yields were being effectively communicated. Soil quality and pruning techniques need more attention.

Second, maintenance of rearing house, while generally good, could be significantly improved. Some farmers let their facilities deteriorate and lapsed into poor sanitation practices. It was mentioned that some farmers feel that they know more than do the extension agents and hence ignore instructions. This suggests that more effort could be directed to gaining farmer confidence and friendship. Merely admonishing the farmer to improve as was seen several times may only reinforce the farmer's resistance to suggestions. Farmers did not usually seek out the extension worker for assistance. Therefore, the burden for information transmission rests on the extension worker almost exclusively.

Third, based on general impressions gained from extension workers, it appeared that the better silk producers received greater attention than did the less productive farmers. In ordinary extension work this orientation is perhaps appropriate. However, extension agents in this Project have a dual responsibility: helping clients who need their services and also of creating clients who are aware of their need for these services. The latter responsibility is the most difficult and demands persistence by the extension worker in the face of repeated failures.

There is a problem in some settlements, however, with a relative shortage of extension workers. This situation has arisen because of the emphasis on the less sophisticated farmers in the Sericulture Project. This type of project member requires very close supervision, perhaps even daily, to prevent deviation from the rigorous technical requirements for successful sericulture. An accelerated acquisition of extension workers in excess of the targets proposed in the Project Paper would allow this close contact to be maintained. Since it is important to the long term success of the Sericulture Project that failures be minimized, a greater emphasis on acquiring such extension workers is warranted.

The quality of the officials in the Sericulture Project is high. However, the program could benefit from greater depth of personnel. This would insure the continuity of initiatives given the inevitability of promotions, transfers and other attrition from the program. It is imperative that a sufficient pool of qualified personnel be maintained within the PWD so that interchangeability of personnel is facilitated. If approval for such acquisitions cannot be obtained from the Civil Service Commission, it may be possible to use permanent-hire personnel with appropriate qualifications - especially as extension agents in the field. This latter path may indeed provide greater administrative flexibility for the PWD, if the Sericulture Project expands beyond the boundaries of the land settlements. Such hired personnel might then more easily transfer to one of the other concerned government agencies such as the Department of Agricultural Extension or the Sericulture Division of the Department of Agriculture.

Despite a slow start in terms of membership and production, there is reason to believe that progress will accelerate as the project matures. As the membership in the Sericulture Project reaches its natural limits within

each settlement, maintaining the momentum of the project will require its expansion into the surrounding non-settlement area. The Department of Agricultural Extension has extension agents who are familiar with traditional silk rearing practices. However, they do not as yet have many agents who are trained in the highly technical area of hybrid sericulture. If they are to be able to carry on in a timely fashion in areas outside the land settlements planning and preparations for this expansion must begin soon.

The use of extension aides or sericulture leaders could be used in both the settlement and non-settlement areas. Selection of a person for this role would be from this local area who has excelled in mulberry production or silkworm rearing and has the ability to communicate these skills to neighbors. Local assistants to the extension workers have been effectively used in many countries and is a very good way of extending coverage by one professional extension worker. Furthermore, it provides a form of recognition to the successful silk producers. Payment for such services might be through the regular RTG budget or it might be paid by the recipient as a percentage of the first cycle, i.e. a consulting fee.

Egg Production

The production of hybrid silkworm eggs for this Project appears adequate at current demand levels. The main center at Korat and the four subcenters have been able to satisfy farmer needs. With the exception of the Korat Center, however, there is a lack of depth of personnel at each of the four subcenters. While not yet a serious problem contingencies such as personnel rotation or illness could pose a threat to the continued high quality of the eggs required in the future. If an inadequate supply of hybrid eggs is produced locally, high quality eggs can be imported from Japan to keep production on schedule.

The Korat Center is competently managed and has a highly qualified staff. In the past, however, it has relied heavily on the technical expertise of a team of Japanese sericulturists. The Japanese Team will be leaving next year, thus placing the entire burden of technical supervision on the personnel of the Sericulture Division stationed at Korat. While this staff will be able to take over technical supervision at Korat, their capacity to provide adequate technical assistance to the four subcenters will be strained. Some method of filling this need must be found to provide

advice as required. It might also be beneficial to rotate on a short term basis some of the middle level staff between the subcenters and the Korat Center to keep their skills honed.

The production of high quality hybrid silkworm eggs is seen as one of the primary constraints in this Project. Without a reliable supply of eggs the farmers will not be able to maintain production at a profitable level. Many people reported low or variable hatchability of eggs produced in Thailand in contrast to those imported from Japan. Sericulture Division personnel readily admit this is a problem and they are trying to find a solution. Climatic factors especially temperature and humidity and cold storage may be physical factors affecting hatchability. There may also be genetic factors involved in the selection of parent stock strains.

Who Should Supply Hatching Eggs?

The supply of high quality silkworm hatching eggs to meet the demand of the silk cocoon producers is a very critical point in the production process just as good seed is essential for any other crops. Without exception, the RTG officials felt the production of hatching eggs should be in the private sector with the Sericulture Research stations maintaining and providing the foundation seed stock. This may very well be the best approach, but we also see problems. We would therefore like to raise some questions and suggest some alternatives. The decision on what will be done rests with the RTG and conscious policy decisions should be made to encourage development in the desired direction.

Private Sector: Competition in the production of hatching eggs would be very good and would in time weed out the producers of poor quality eggs. Who would these entrepreneurs be? The most technically qualified people to undertake this work are the sericulture researchers. Would there be a conflict of interest if government employees producing the private stock at the research facility are also working for a company producing hatching eggs for cocoon producers? Could the research worker advise a private hatchery operator for a consulting fee or should he do this as an official part of his job? These and many more questions need to be answered.

The private hatchery operator would require some equipment probably imported from Japan. Would he receive

duty free imports as a means of encouraging this enterprise? How many private hatcheries would be required or permitted? Would they be required to purchase parent stock from the Sericulture Stations or could they develop their own breeding stock? What sanitation requirements and quality controls are needed?

The alternatives to private hatcheries would appear to be a government owned and operated hatchery or a government corporation.

Government owned businesses can be inefficient and may not produce the desired end-product on schedule. Nevertheless, the sericulture stations are currently producing hatching eggs sufficient for present demand. How much more can they produce with current facilities? The Korat Center is apparently constrained from expansion in land area. Would it be desirable to establish a hatchery in a climatic zone that would be conducive to the production of mulberry as well as silkworm eggs? This may be in the Northeast or elsewhere since the eggs can be shipped. Is there a maximum size for a hatchery? One facility could conceivably produce the egg requirements in Thailand for some time to come. The major constraint on size as we see it would be on mulberry leaf production. The rearing facilities could be designed to control disease.

A quasi Government Corporation may be an alternative that would permit government employees to work and share in the profits. The research work could be financed in part from the revenue gained from the sale of eggs, therefore reducing the financial burden on the RTG, and shifting it to the sector making the profit.

Young Worm Rearing As a Specialty

A further step in the silkworm rearing procedure that could be done on a large scale may be the production of the worms to the fourth stage or about 10 days of age. Currently worms are raised to the third stage in the young worm rearing houses located at each of the land settlements where the farmers come and stay (unless they live nearby) to feed and care for the young worms. The worms are then transported to the old worm rearing houses located at each home where the worms are fed for about 3 weeks before they spin their cocoons.

In each of the settlements the young worm rearing houses are only used for about 10 days plus time needed for cleaning and fumigating then are idle until the next cycle of worms begins. There is no overlapping of cycles since the farmers are fully occupied in feeding and caring for the worms in their later stages of development.

The mulberry must also be pruned to promote maximum growth of the young tender leaves required in the early stages of the silkworm's growth. At later stages the worms eat the larger leaves which require a different form of pruning.

It therefore appears that a private individual could on a fairly large scale produce the worms for 10 days of age for sale to the farmer that finishes the cycle to the cocoon. At the early stage the worms have a small food requirement. Investment in irrigation may be justified or may be required for high leaf production. Overhead costs could be reduced by more continuous use of facilities. Furthermore, it may be that the farmers would prefer to pay for the started worms so they do not have to stay at the center. They would also be able to buy the number of worms they can feed and would not be affected so much by the varying hatchability rates - this would be the concern of the young worm grower who would learn to adjust the number of eggs needed to meet demand.

This system is analogous to the laying hen industry in the U.S. Formerly the poultry man bought day-old chicks, raised them to maturity, kept them through a laying year and then sold them. The industry is now split with some individuals raising the pullets to laying age at which time they are sold to the egg producer. Both individuals find they make the most efficient use of their facilities and talent. A similar division of labor could be effective in the silkworm rearing business.

Unlike the hatching egg production that could be concentrated in one or two locations, the young worm rearing would need to be located near the cocoon producers to reduce transportation problems. Mulberry leaf production would also need to be close to consumers. Size of the young worm rearing facility would depend upon the tender leaf production capacity of an area.

The Role of Women

The Sericulture Project has been considered women-oriented project since traditional silk production has generally been done by village women and girls. While there are many women involved in this Project, it is not inherently the domain of either men or women, but rather a project that requires the participation of all members of the family. In Thai villages there is not a strong sex differentiation in the kinds of jobs that are done. At busy times of the year everyone pitches in to do the necessary work.

This is also true with sericulture. In general terms the men do the heavy work related to the planting and cultivation of the mulberry and perhaps the construction of the silkworm rearing house. While it is usually the women and girls that gather the mulberry leaves and feed the worms, men and boys also participate. In some cases we found men in complete charge of the silkworms, though it was usually the mother of the family or an older daughter that was responsible. One daughter said she would not let her father in the silkworm rearing house because he smoked and it would be harmful to the silkworms.

At the time the worms began to spin their cocoons, all of the family participates in putting the worms in the cocoon spinning frames to produce a uniform top quality silk. This activity usually involves all available hands throughout the night. To neglect this important aspect of silkworm rearing would be to reduce the economic return.

During the past year, month-long training in silkworm rearing was provided for 210 potential project participants. They were nearly equally divided between men and women (103 men and 107 women). When asked why more women did not attend the training we were told that it was difficult for the women to get away from the family for a month, particularly if they had small children. In general it seemed that the person attending the training was the family member with the most interest in the Sericulture Project and who could get away for the required training period. This may suggest that more women might attend training programs if the training was held in the Land Settlement where they could attend during the day and return home at night. It would require some restructuring of the training and may require additional facilities at the settlement headquarters, though it is believed this would be minimal.

While we would encourage the RTG to hire more women as extension workers and at higher levels in the administration of this Project, we do not feel that the RTG is deliberately discriminating against women in recruitment. It does seem that with the large number of women on the production side of the Project, more women extension workers would be very beneficial. It should be emphasized that we were impressed by the capability of some of the women supervisors as well as the Assistant Project Coordinator from PWD.

Women Professional Staff: Among the professional staff of PWD, a vast majority are men, but some of the more able women are moving up in the administrative ranks. One of two RTG project coordinators is a woman; of ten project supervisors in the Land Settlements, three are women; but of the 32 PWD sericulture extension workers only two are women.

When we asked RTG officials why more women were not being hired as extension workers, we were told hiring was done on a competitive basis without regard to sex; that men usually did better in the civil service examination. It would appear there may be an unintentional bias that may have developed over the years in the selection of civil service workers. Another factor is that many women do not want to work in land settlements because of their remoteness. One of the women extension workers at Ban Kruat was originally from that village and has family there. She speaks the Khmer dialect and communicates easily with villagers in that area. Incidentally, she and the other extension worker were married the day before our arrival.

While civil service regulations may require assignments solely on the basis of competence, it is recommended that wherever possible people with roots in the local area be assigned as extension workers. This recommendation might be met by hiring on a part time basis of competent members of each settlement. Such people might be designated as extension aids and work along with the regular civil service extension agents of the PWD. These workers could be given intensive training for this job, with subsequent on-the-job-training from sericulture extension agents and supervisors at the settlements. In this way the extension capacity of the Sericulture Project would be enhanced without adding a permanent burden to the budgetary resources of the PWD.

Approximately 32 percent of the 1977 graduates of agricultural colleges in Thailand, were women. 2/ The potential base of women extension workers is large enough to permit the hiring of more women. 3/ While 30 percent of the supervisors in the Project are women, only five percent of the extension workers are women. If both groups combined for a total of 42 officers, only 12 percent are women

In the Sericulture Division of the Ministry of Agriculture, approximately 37 percent of the professional level staff are women out of a total professional staff of 140

At USAID the Assistant Project Officer is women.

Project Expenditures

Expenditures for the Project have not been made according to the original plan, but again this reflects an optimistic view of what might be done. PWD, during the first two years of the Project has provided 93 percent of the funds that it was expected to expend. Disbursement of the USAID loan funds, however, has only been at 66 percent of the planned figure. When both the loan funds and the PWD budget are combined the expenditure rate during the first two years of the Project is 77 percent of the planned target (See Appendix F)

The Sericulture Division of the Ministry of Agriculture has over the first two years of the Project spent 60 percent of the RTG budget planned for it. No USAID loan or grant funds have been administered by the Sericulture Division (See Appendix G).

2/ Out of the 1977 Class of Graduates from all Agricultural Colleges in Thailand 969 (662 men and 307 women) received bachelor degrees. At the master degree level 101 graduated (48 men and 53 women)

3/ Ministry of Education Planning Division, Department of Vocational Education reports that the 1543 graduates of Vocational Agricultural Schools 15% (226) are female.

The BAAC has not used any of their own funds to provide loans to the sericulture farmers. A total of \$6,524,560 has been loaned to farmers--all of it from the USAID loan. Of the \$13,933,000 planned to be loaned through FY 1978, only 49 percent of the funds have been utilized. Of the total planned (both USAID and BAAC funds) to be loaned to farmers by the second year of the Project only 23 percent have been spent (Appendix H). While the Project Paper and the Loan Agreement state that USAID and the BAAC will provide equal amounts of loan funds, it was not stipulated that equal amounts must be used each year. The BAAC is proceeding to utilize the loan fund first, then will utilize their own funds at least to the amount stipulated in the Loan Agreement. If the Project is successful, the BAAC will most likely continue to make loans for sericulture.

The Evaluation Team does not have strong feelings about the use of USAID loan funds first before using their own funds, but we do wish to make note of the fact. It was not generally known at USAID that this approach was being used. Most were under the impression that equal shares of funds were being used. However, since this is a loan to the RTG, this does not appear to be an improper action. By raising this issue we hope to avoid a possible misunderstanding at a later stage in the Project.

Of the \$100,000 grant component of the Project 42,800 dollars has been obligated through FY 1978. These obligations do not reflect the cost of the current evaluation.

The Evaluation Team did not do a detailed study of the project finances, but has relied on Mission records for major expenditure totals. Detailed analysis is more properly the role of the auditors.

The Mission and RTG have revised the budget estimate for the balance of the Project as shown in Appendix K). The estimate appears reasonable, but assumes an accelerated increase in the number of sericulture farmers. With the increasing price of silk, interest in the Project will likely be stimulated. A sound base has been developed upon which the Project can grow and develop. The extension workers are gaining experience and with it confidence to recruit and train members.

Prospects of Achieving the Project Purpose

Experience has shown that there is a wide variation in the degree to which farmers will adhere to the technical requirements of the new sericulture program. Despite this wide variation, the greater portion of the farmers are tending to follow the specified procedures. Some farmers have even altered their life styles as a result of these requirements. One farmer, for instance, stopped smoking and using fragrant hair oil in order to protect the silkworms he was raising from the fumes.

Although all of the members of the Sericulture Project are poor by any objective standard, interviews and observation indicated that it was the slightly better off of this group who most scrupulously followed recommended practices.

Another source of variation in rearing practices is that the person who actually raises the silkworms in a family is sometimes not the one who received the training. In one instance the daughter of a farmer was trained and initially raised the silkworms. She later married and left home. Her father, who then took over rearing chores, was not technically prepared nor psychologically committed to the task. His production was consistently low, and he lost his entire crop of worms to disease on several occasions.

The Evaluation Team attempted to determine whether previous experience by the farmer in raising traditional varieties of silkworm would enhance or hinder the achievement of project targets. It was tentatively concluded that while previous experience in raising silkworms contributed to interesting people in the Project, lack of previous experience resulted in greater adherence to the requirements of the new technology.

Several remedies seem appropriate regarding the maintenance of technical standards at the farm level. First, the person who is legally responsible for the loan should be one of the family members who is trained in sericulture. As mentioned elsewhere, holding training at the land settlements rather than at Surin, Mukdahan or Khon Kaen could help to accomplish this objective by adding depth of expertise to the sericulture family.

Second, priority in the recruitment of members to the Project should be given to the marginally better off farmer

whenever possible. This will augment the chances of approximating production and income targets of the Project. The closer Project income is to reaching these goals the stronger its foundation will be for moving into the replication phase at the end of the project period.

Third, the farmers with poor performance records or those with obviously substandard practices should be monitored and encouraged much more closely than has been the case to date. This would seem to require a greater investment in extension workers by the PWD. At the same time superior performance should be regarded by the land settlement, perhaps by making more land for mulberry cultivation available to successful farmers who wish to expand their operations. This practice was observed at one settlement, and while its effects could not be determined, it merits further consideration.

A limiting factor in the production of silk is the availability of mulberry. This problem was cited by virtually every farmer interviewed by the Evaluation Team. The sericulture staff at the various settlements noted that the shortage was generalizable to the other members as well.

This suggests that a significant increase in overall production of cocoons can be achieved if the production of mulberry can be raised. One possibility, and one which was mentioned several times by farmers, was to increase the number of rai devoted to mulberry plantations. An alternative which seemed to receive very little attention by either farmers or sericulture staff was increasing the level of production from existing plantations.

There was little experimentation with cultivation techniques at the settlement level to determine which practices produced better results. Cultivation practices, however, differed among settlements. Some built up beds at both the central mulberry fields and at the farm level, while others did not. There was not any indication that sericulture staff used the central mulberry fields for demonstration purposes on a regular basis.

Aside from cultivation practices there seemed to be little attention to increasing production through increasing soil fertility. The principal fertilizer used was prepared chemical fertilizer which, according to reports from sericulture staff, cost between B700 and B1,000 per year for a four rai plantation. The evaluation team was not able

to determine how much of this fertilizer was actually used by farmers. This question should be examined carefully to determine whether farmers may try to cut costs by reducing fertilization.

The use of animal manure, compost and green manure was in little evidence in the settlements visited. The exception was at the Ubonrat Land Settlement where animal manure was said to be easily obtained. The highest income earning occupation at this settlement was animal husbandry. At other settlements manure could be purchased from outside the settlement for about \$100 per quarter ton truck load. Some farmers also noted that burnt rice husks could be obtained from rice mill at a nominal cost - perhaps only the cost of transportation (one price cited was \$60 for a large 10 wheel truck load). In all of the settlements visited abundant composting materials were prevalent in the form of rice stalks, grass and miscellaneous vegetable material. None of the farmers produced or used compost on a meaningful scale. The argument given for not doing so, and one that has considerable credibility, was that composting required too much labor and that adequate water was not available. Since the team visited the settlements in the dry season it was not possible to determine whether the amount of water at other times of the year was also inadequate. It is suggested that the feasibility of composting be determined for each of the settlements, and if shown to be possible on a sufficient scale, that it be strongly encouraged by sericulture extension personnel.

Project Objectives: In evaluating the extent to which the Project has achieved its objectives, it is important to make some clarifications on the significance of various statistics. With regard to determining membership in the Project two figures are relevant. The first figure is the number of persons who have been approved for loans by the BAAC. If this figure is used, farmer participation in the Project is grossly inflated by a factor of almost 2. For example, according to the latest BAAC compilation of December 31, 1978, 599 persons had been approved for loans, but the maximum number of silk producers in any rearing cycle in 1978 was 276.

The latter figure may under represent the present membership in the program because it reflects only farmers who produced cocoons. It does not, however, include individuals who have received loans for and are in the process of establishing mulberry plantations or OSWRH's, but who have not yet begun to produce cocoons.

Given a total of B7,353,780 dispersed by BAAC as of 31 December 1978 and an average total loan of B25,000 (a figure cited at several settlements we visited) this gives a total of approximately 294, slightly higher than the maximum number of silk producers recorded in 1978 of 276. The difference of 18 represents a baht total of B450,000. This remainder may be accounted for by loans for mulberry plantation, OSWRHs or equipment. The portion of this amount accounted for by each type of loan cannot be determined from the figures at hand. However, if one assumes for purposes of illustration that the entire amount went for loans to plant mulberry at B4,000 per farmer the total of farmers actually engaged in some phase of implementing a sericulture operation is increased by 122 for a maximum total of 414.

The exercise above is of course somewhat speculative with assumption made as to amounts borrowed. It serves principally to illustrate the difficulty of reconciling PWD, BAAC and USAID figures unless a better breakdown of figures is made available.

Data Evaluation: A major difficulty the Evaluation Team encountered was the inadequacy of the data available on the Project. There was no single compilation of data from the various agencies to which reference could be made. Frequently it was difficult to reconcile figures on numbers of members, amounts of loans actually dispersed and production of silk-worm cocoons.

Section I There needs to be a clear indication at each period of time of (1) the number of families actually producing cocoons, (2) the number of people actually in the process of establishing mulberry plantations but who have not yet begun to raise silkworms and (3) the number of people accepted by the Project but who have not yet begun to establish mulberry plantations. (4) the number of farmers who discontinue their participation. This information should be available for each settlement according to a common time frame. (This probably should not be rearing cycles because these vary in number and do not always occur simultaneously at all settlements). This information should be then also be aggregated for the entire project.

Section II Information on loans to farmers caused us some problems in determining the extent of BAAC lending. There should be a clear breakdown by settlement on

1) the total number of people who have received loans broken down as (a) the number of people who have received loans for establishing mulberry plantations but not for OSWRH, (b) the number of people who have received loans for both purposes

2) the number of new loans made in each period according to the same time frame employed in Section I

3) the total amount of loans, and the total amount of loans broken down as (a) amount of loans made for mulberry plantations, (b) amount of loans for OSWRH.

This information should be compiled according to the same time frame as that employed in Section I

A possible format for this information is included as Appendix J

Project Replicability: The conclusion of the evaluation team is that the Sericulture Project has the potential for replicability in other areas of the country and in areas outside of the land settlements. This judgement is based on four factors

First, the technology required for this project has proven to be transferable to the low income level population targeted by this Project. This assumes that credit, extension and infrastructure needs for this transfer are met.

Second, the domestic demand for hybrid silk remains high at about two hundred tons per year, while present domestic production is greatly below this. Domestic silk reelers have indicated that they will purchase as much as can be produced. The Japanese also have indicated readiness to buy all the fresh cocoons that can be produced. There is thus a large and ready market for those who choose to produce cocoons.

Third, sericulture has the potential for generating a significant amount of income for the farmer. The figures in Appendix E indicate marginal profitability for producers during five rearing cycles in 1978. If depreciation on farmer-owned facilities and equipment is counted, there is an average sixty baht loss per rearer over the five cycle period. These figures may be misleading. The non-cash costs to the farmer may be overestimated, especially by applying standard labor costs and the inclusion of production costs for cocoons not sold through the settlements (and thus not reflected in revenue figures). Also the farmers on

whom these figures are based and presently producing far below their potential capacity. Since most of them had been in the program for only one year they were still in the learning stage of cocoon production, and perhaps not yet sufficiently confident to expand their production.

Furthermore, the volume of cocoon production (and hence revenue) is dependent on the amount of mulberry leaves available. The mulberry tree takes about three years to reach maximum leaf production. Since the mulberry plantations of the farmers had been established for only slightly over one year, cocoon production and profitability should rise as the plantations mature.

The fact that farmers continue to join the program suggests that they understand that profitability requires a long-term commitment on their part. This conclusion is also supported by the loan repayment procedure adopted for this Project. Forty percent of each farmer's gross sales in each rearing cycle is deducted for repayment to the BAAC. This high figure was chosen by the farmers themselves, rather than being imposed by the BAAC. A lower deduction for loan repayment would enhance the profitability figures, but would lengthen the repayment period. Farmers interviewed were willing to accept the heavy debt, but wished to eliminate it as quickly as possible.

Fourth, there are indications that the technology promoted by this Project has even been adopted by some of the producers of the traditional variety of Thai silk. Though figures on this proliferation are not available, it is encouraging because shows that the benefits in terms of productivity of this technology are being perceived by a wider audience than merely land settlement members. As this Project matures over the next three years more traditional silk rearers are likely to become receptive to the new silk rearing practices.

Replication of this Project, apart from market conditions and income potential, ultimately depends on the farmers who are recruited into the Project. Some of the characteristics of successful sericulturists are discussed elsewhere in this paper. However, before replication is attempted a detailed analysis of the characteristics of both the successful and unsuccessful members of this Project should be undertaken. This will permit a more accurate targeting of the population for the replication phase.

The RTG provides a considerable subsidy to farmers in this Project. This subsidy includes the cost of providing extension and supervisory personnel at the land settlements, the sericulture facilities at the settlements (central mulberry fields and CYWRH) and the cost of operating the Korat Sericulture Center and the various subcenters. If such costs were computed in determining the profitability of hybrid sericulture the overall deficit would be great. The government cannot be expected to subsidize this enterprise indefinitely. However, it is perhaps more accurate to view these direct and indirect subsidies as long term investments rather than simply as costs. The turn around time on a social and economic development project such as this one perhaps should be seen in decades rather than merely in years.

Technical Sericulture Project Evaluation

This portion of the mid-term evaluation was conducted from November 17 to December 8, 1978 by Dr. Neungphanich Sinchaisri of Kasetsart University.

Introduction

The RTG-USAID Sericulture Project is an ambitious enterprise which combines two primary characteristics. The first is the introduction into a very poor element of the population of a sericulture system with a high technological component. The second is the development, largely because of the technical requirements, of an integrated management system for the Project.

Overall management is provided by a committee of representatives from the participating agencies which meets monthly to review progress, to coordinate operations, and to propose solutions to problems arising from project implementation. The Department of Public Welfare (PWD), the Sericulture Division of the Department of Agriculture and the Bank for Agriculture and Agricultural Cooperatives (BAAC) handle day-to-day matters in their respective areas of concern.

The sophisticated procedures promoted by this Project promise to expand domestic silk production significantly and also to greatly enhance the income levels of the 1,500 farm families who are targeted to participate in the Project. Indirect benefits that will result from the Project are an increase in the technical expertise of the agricultural sector and encouragement of self-help initiatives by farmers, principally in the form of viable producer cooperatives.

This portion of the mid-term evaluation was carried out between November 17 and December 8, 1978.

Technical Basis

Technical inputs to the Project were found somewhat insufficient. More attention should be paid to:

A. Mulberry

A sufficient supply of mulberry leaf qualitatively and quantitatively is the primary requisite for success in the rearing of silkworms. The overall finding in the settlements is that there is considerable need of improvement. The majority of settlers in the settlement cannot complete the

rearing schedules of 2 boxes/cycle and 6 cycles/year due to the shortage of mulberry leaves. The reasons for this shortage are:

1. Insufficient and incorrect mulberry cultivation practices.

2. Farm practice in new mulberry plantation is irregular causing an abnormal growth of young mulberry trees.

3. Early harvesting of too young mulberry trees (less than one year old) badly damaged primary growth and the health of the plants.

4. Pruning practices are still not performed correctly.

5. Compost, green manure are still used at too low a rate.

6. Settlers devote less time for mulberry management than other crops.

7. Settlers spend too much time picking the leaves for feeding the worms. Settlers who seem to have a serious concern about the nutritive value of leaves and the proper leaves for their worms are still few.

8. Root-rot disease occurs in settler's mulberry plantation at Lam Pac and Ubonrat settlements. Grafting "noi" with "pai" varieties should soon replace the diseased plants.

9. Pest and diseases, for instance, powdery mildew (fungus), thrips, stem borer and mealy bug attacking mulberry tree of the settler will lower the quality and quantity of the leaves.

10. Some settlers keep fruit trees re: mango, guava, and jackfruit in the mulberry plantation as dual-purpose crop because of **the** limited land utilization This is a poor practice.

11. Settlers do not pay strong attention to the management of mulberry plantation through modern technology.

B. Silkworm

Technical insufficiencies were noted with regard to:

1. Silkworm egg (silkworm seed)

a. Egg production technique

- i. inbred line (parent varieties for hybrid producing)
- ii. F₁ hybrids producing in four sub-centers.
- iii. hatchability percentage.
 - artificial hatching techniques
 - incubation technique
 - hibernating egg

2. Rearing techniques

- a. Young silkworm (at CYSRH)
 - i. bed cleaning with net
 - ii. enlargement of rearing area
 - iii. quick removal of the infected worms away from the healthy worms.
 - iv. proper treatment with burnt chaff before the worms sleep.
- b. Old silkworm (at settler's house)
 - i. practice of pre-rearing and post rearing seasons
 - ii. rearing house design
 - iii. rearing bed
 - iv. feeding
 - v. bed cleaning
 - vi. removal of infected worms before they die.
 - vii. proper stage to transfer ripe-worms into the mounting frame.
 - viii. management during the worm spin their cocoon.

3. Disinfection of rearing room and tools.

- a. At pre-rearing and post rearing.
- b. During rearing season.
 - i. for young silkworm
 - ii. for old silkworm
 - iii. in case of serious damage condition.

The items listed above will be briefly described here:

1. Silkworm Egg

In order to obtain a high quality egg supply produced in Thailand, care must be taken to the inbred line as a original source of hybridization. Even though the present hybrid exhibits moderately high production of eggs, an irregularity of F1 hybrid eggs from 4 sub-centers was often found. This is more important point than the egg yield in providing encouragement for cocoon producers. Inbreeding during moth mating, artificial hatching, and incubation of eggs may present difficulties which contribute to the production of the unqualified eggs

2. Rearing Technique

It seems to be noticeable that most of supervisors and extension workers understand the technology of silkworm rearing. But they still need rather more experience and practice in some critical points as mentioned in sub-items i - viii.

For the old silkworm, the capability between settlers who produce a high and low quality and yield of cocoon varies remarkably. There is not enough information to explain this phenomenon. Several aspects, excluding the self-attitude of an individual settler, were mentioned in items 2, i - viii. Some likely factors found in some settlements during the field trip were, for instance, the worms were fed all the time, too late to remove the infected worm away of the healthy worms without proper tools and the farmers kept the abnormal worm in the healthy colony. The most important thing farmers neglected was keeping the rearing room clean of dust, litter of mulberry leaves, silkworm feces and dead worms. Some farmers stored some other crop product in the rearing room during the off-season rearing which is also a very poor practice.

3. Disinfection of the Rearing Room and Tools

In fact, disinfection by formalin 3% or cerasan does not assure that the worm can be freed of diseases. Therefore, the correct procedure should be done without carelessness. Some confusion on the effectiveness of formalin solution and cerasan powder for disease control still remained in the settler's mind. They misuse, for instance, cerasan (fungicide) to control infection by virus diseases. It is a task for supervisor to let settlers understand well about how to protect the silkworm from those diseases. One more point should be considered. Settler should be careful of disease-prevention. The settlers often wear too old slippers or leave their feet dirty from mulberry fields. This will make meaningless the advice to change the slippers when going in the rearing room because the invisible spores of diseases will contaminate the inside of the room. Moreover the simple procedure of separating the infected worms by bare-hands will promote quick spreading of diseases.

Recommendations

Regarding the overall finding, I would like to ask for the consideration and correction on the following items.

A. Mulberry

1. Strong emphasis is needed for the preparation of favorable soil conditions before cultivating mulberry
2. Poor preparation of soil from the beginning may be corrected by application of compost or green manure at the middle of the row (follow the applied rate of Korat Center).
3. Farmers in all settlements should be encouraged to prepare large amounts of compost for application on their own mulberry fields.
4. Pruning techniques should receive particular attention on the settler's mulberry plantation.
5. Never forget to apply the plant food (compost, chemical fertilizer) to mulberry tree whenever low-cutting is finished.
6. If the settler's mulberry plantation is in good condition, feeding the worms by shooting method should be preferred to the leaf packing method. Using shoots helps to keep the leaves fresh with high nutritive value and make it easier to keep rearing beds clean.

7. More time should be devoted to the mulberry plantation, especially for weeding and control of pests and diseases found mechanical methods.

8. Mulberry trees affected by root-rot disease should be collected and burnt. Unusable leaves (yellow) or leaves infested by powdery mildews (fungus disease) should be also collected and burnt.

B. Silkworm

1. Silkworm egg supply from 4 sub-centers must concentrate on uniformity of egg number per sheet and note hatchability percentages for every cycle.

2. The better inbred line of parent varieties should be intensively improved. Man power is necessary. RTG, probably, has to subsidize a special fund to purchase the better variety from Japan, if the request through the present cooperation under JICA program is not improved in time.

3. Pebrine disease should be seriously checked before distribution of eggs to the settlements. An existing pebrine disease in local varieties has caused serious problems.

4. Hybrid silkworm egg should be produced domestically. Special emphasis should be placed on silkworm egg production unit. Persons with a high level of academic background are strongly needed for this unit. (M.S. or Ph.D. degree in the field of breeding or animal genetics)

C. Disinfection

1. To apply formalin solution for disinfection, only formalin 40% should be purchased from an authorized dealer and applied with enough rate

2. Quick removal of infected worms from the rearing bed should be done by chopsticks which are kept clean by dipping the tips in formalin solution (3%)

3. Chopsticks, nets for bed cleaning and baskets should be often cleaned and exposed to the sunlight.

4. Convince the settler to use separate baskets for bed cleaning and feeding purposes.

5. When the mulberry leaves are carried into rearing house, entrance should be only by the door of mulberry storage room.

D. Supervisors and Agricultural Extension Workers

1. Should visit the settlers frequently which will enable them to gain more experience in sericulture and also make them more familiar with the settlers.

2. Records of individual settlers should be established, because it is quite useful for finding the weak-points of their practice.

3. Rotation of seminars among the supervisors and agricultural extension workers of 10 settlements should be held at appropriate times and places with some invited technical staff from MOAC or other agencies. It may be more effective than refresher course at the same place (Korat Center). Costs for technical staff and others to participate in such seminars can be provided by PWD Head Office. Main topics of the rotating seminar may be given time to time, for example, mulberry and its management, practical techniques on young silkworm rearing, or how to control silkworm diseases. Other topics may be selected by those participants. Discussion among them will initiate creative ideas from their experience. I believe the atmosphere will be very different from the seminar at Korat Center.

4. To offer the license to the supervisors who can work successfully with the settlers at a ratio 1:50.

5. Duration of training in mulberry cultivation and management seems to be too short particularly for supervisors and agricultural extension workers. A more intensive course of practical training should be provided.

E. Others

1. It should be borne in mind that mulberry leaf quality and favorable conditions during the growth of silkworm will greatly reduce the problem of virus diseases (Nuclear and Cytoplasmic polyhedrosis viruses).

2. It is feasible to transport silkworm to settler's house at 4th stage because the space of CYSRH is accommodated for the young worm only (1st - 3rd instars). Besides, transportation, conventionally, should be done when the worms are sleeping (no feeding activity).

3. Settlement roads and wooden bridges in the settlement damaged by the last flooding should be soon repaired during the dry season. It directly affects the transportation of young silkworms to the settler's house both by causing excessive vibration and by lengthening transportation time.

4. Cocoon drying unit should be completed soon in order to decrease the overload work on the cocoon grading staff at Korat Center. This should allow the cocoon grading staffs to have more time to handle cocoon sampling, grading, reelability, and finally fixing the price of cocoon lot.

5. Mulberry and silkworm rearing training capacity should be expanded to cover a larger number of participants.

6. More knowledge on the basic science should be provided to technical training staffs.

Record of Cocoon Production in 1977 and 1978

During the past two years, the record of cocoon production of 10 settlements was obtained. The data from most of the settlements demonstrate high potentiality of the settler's capability. From Table 1, the record of average production from Prasat, Lam Dom Yai and Ubonrat Dam Resettlement seems to be progressing satisfactorily. Initial variation of the production reflects an irregularity of the settler's ability to accept modern technology and variable quality of silkworm eggs (productive variety and hatchability percentage). However, the record of only one cycle reared at Lam Dom Noi, Phon Phisai, Kham Soi and Kuchinarai settlements cannot explain definitively the irregularity of production. The influence of climatic conditions and living security at 6 settlements (Table 1, 2) also play a critical role in the yield loss. An introduction of imported eggs into the settlements was quite acceptable with regard to Prasat, Ban Kruat and Lam Dom Yai Settlements in 1977. The exception was Ubonrat Settlement (Table 2). However, it is too early to encourage the settlers to turn to imported eggs due to the egg cost as well the inadequacy of their existing facilities (mulberry leaf supply, and disinfection).

TABLE 1. Cocoon Production from Domestic Egg for the Average Target of 20 Kg/Sheet (from Original Plan)

Land Settlements	No. of Cycle	1977 Kg/box	% Reach the Target	No. of Cycle	1978 Kg/box	% Reach the Target
1. Prasat	4	14.5 (0-22.4) <u>1/</u>	73	2	16.5 (13.6-19.4) <u>3/</u>	83
2. Ban Kruat	3	7.3 (0-20.2) <u>1/</u>	36	2	1.5 (NA-3.0)*	8*
3. Lam Dom Yai	3	12.0 (0-18.6) <u>2/</u>	60	2	16.5 (15.9-17.1)	83
4. Lam Dom Noi	1	18.1	90	2	13.1 (8.39-17.1)	65**
5. Ubonrat Dam	3	14.3 (12.0-18.8)	71	3	14.6 (8.2 -18.1)	78
6. Chiang Phin	3	17.7 (14.8-20.5)	88	2	7.3 (3.8 -11.0)	37**
7. Phon Phisai	1	15.5	78	2	8.7 (7.2 -10.3)	43
8. Kham Soi	1	19.8	99	2	7.0 (2.4 -11.6)	35**
9. Kuchinarai	1	16.1	80	2	7.0 (4.0 -10.0)	35**
10. Lam Pao	-	-	-	2	3.1 (2.7 - 3.4)	15**

1/ = Egg from Korat (hibernating egg)

2/ = Egg from Ubol (" " ")

3/ = Hatchability 65% (egg from Khon Kaen)

NA = Farmers reel this cocoon at home

* = Problem of security

** = Problem of draught and flooding

TABLE 2. Cocoon Production from Domestic Egg for the Average Target of 30 Kg/Box (from Original Plan)

Land Settlements	No. of Cycle	1977 Kg/box*	% Reach the Target	No. of Cycle	1978 Kg/box*	% Reach the Target
1. Prasat	1	28.6	95	1	21.7	72
2. Ban Kruat	1	27.6	92	1	16.9	56***
3. Lam Dom Yai	1	30.3	100	1	24.2	81
4. Lam Dom Noi	-	-	-	1	16.8	56**
5. Ubonrat Dam	1	4.2	14	-	-	-
6. Chiang Phin	-	-	-	1	18.6	62**
7. Phon Phisai	-	-	-	1	26.1	87
8. Kham Soi	-	-	-	1	21.3	71**
9. Kuchinarai	-	-	-	1	16.3	54**
10. Lam Pao	-	-	-	1	18.5	62**

* Calculated from 1 cycle reared in Aug. - Sept.

** Effect of draught and flooding.

*** Effect of security.

Key Persons Influencing the Technical Component

The attached flow chart indicates the key persons who determine the success of the RTG-USAID Sericulture Project.

1. Settler

The farm family which participates in this Project must be willing to do the job, must be interested in this modern technology and be ready to do sericulture as a business. The person who deals with sericulture should be well trained. Some settlers' sons or daughters were trained but later left to take other jobs or to get married leaving the sericulture work to a parent who had no training. Therefore, the selection of settlers plays an important role in the Project.

2. Project Supervisor (PS)

The project supervisor is one of the most important elements of the Project since this person works closely with the settler. It is quite enough that a person with B.Sc. in an agricultural field is selected by PWD. His tasks involve mainly technical guidance. The job of the supervisor is to allocate and advise the agricultural extension workers on their work and to monitor the progress of project members in the settlement. The project supervisor also has to have good human-relation to join with all settlers, agricultural extension worker, superintendent and BAAC's branch manager under his scope of work. Furthermore, he should know all problems occurred and then, making an effort to find out the solution. The best way to accomplish these tasks is for the project supervisor to maintain a complete record of the work of individual settlers. I found during my trip on several settlements there are some project supervisors who operate in this fashion. It must be strongly emphasized that the modification by the supervisors of the original techniques learned from training centers without any experimental efforts of their own should be avoided. This is because the failure of settlers due to improper modification of technique will produce a bad-effect for the settlers and may even jeopardize the success of the Project.

3. Agricultural Extension Worker (AEW)

The AEW never works independently, but in close contact with the supervisor. AEW gives attention to promoting friendly relations with the settlers and must encourage them to work by giving good example. Actually AEW will encounter more technical

and non-technical problems than supervisor. To take those problems, therefore, to discuss with supervisor and superintendent of the settlement at once is preferable. Often visit to the settler house is really needed in order to provide more technical support, and in term of psychological sense, to give more incentive to the settlers. It may be necessary to arrange meeting among the settlers from time to time.

4. Superintendent of the Settlement (SOS)

This person also plays a role in this Project. The work of the superintendent involves overall administrative responsibility for the land settlement. The superintendent has two primary duties concerning this Project. First, the superintendent should let the project supervisor and AEWs concentrate fully on sericulture. Additional work may be provided for them whenever they are out of duty, for instance, acting superintendent, to participate changwat annual exhibition and so on. Secondly, the superintendent should facilitate the project supervisor and AEWs to become close to the settlers and should always collaborate with them to find out the solutions to the problems.

5. Technical Staff of MOAC

It should be borne in mind that the transference of the new technology depends greatly on this staff. It is essential that those attending training receive a sound foundation. A periodic evaluation of what has been done in previous sessions should bring about an improvement of training techniques. Questions from the attendants of every training session should be carefully recorded. Moreover, technical staffs of each part of the training program should develop more useful training material, mainly, pictures, charts, slides, films and specimens, to make the material more clear to the attendants. Staffs themselves are also required to have some occasional training to learn the better methods and more know how to achieve their effective training program.

6. Egg Producer from MOAC

The domestic silkworm eggs supply, till now, is produced only by the MOAC, Sericulture Division which has its main Sericulture Center at Korat and 4 sub-centers in the Khon Kaen, Udorn, Mukdahan, and Ubol. Silkworm eggs comprise one of the critical factors in this Project. Egg producer staffs should require qualified persons with enough training experience (at least 5 years). Additional technical know how in silkworm breeding and genetics should be provided occasionally for them. Lacking of good communication between the staffs rather, may

easily cause conflict and it will be very difficult to produce a qualified egg supply. It must be recognized that the loss of goodwill from the settlers (cocoon producer) comes mainly from two factors - low production and the irregular hatchability of egg.

7. Cocoon Grader (and Cocoon Price Set) (CG) and (CPS)

These two groups cannot work independently. At present, setting the price after grading the cocoon is administrated by the staffs of the reeling section of the Sericulture Research and Training Center, Korat, which has a fully equipped laboratory. To achieve fair grading and reasonable price of cocoon requires the right persons and adequate manpower. At present the available staff should concentrate on the method of quick and reliable grading method of sampling the cocoon and how to set a reasonable price. To share the time and manpower for cocoon drying service to the private reeler now is not the correct duty of this staff. Fair judgement of cocoon will be a positive value to both sides (cocoon producers and silk reelers). The establishment of a special committee to judge the fair price may be required for a better practice in the silk industrial system.

8. BAAC Branch Manager

It is generally accurate to assume the BAAC's branch managers are well-versed in banking system and in the purposes of this joint project. However, the over-reliance of some branch managers on regulations and the need for bank benefit are problems periodically encountered. Approval of loans for settlers participating in this Project can be facilitated by cooperation from the supervisors and superintendents of the settlements. Similarly, supervisors and superintendents can help managers of BAAC branches to feel confident in extending credit by providing adequate monitoring of sericulture activities in their settlements.

Actual Cocoon Production Against the Desired Goal

During the past two years, the critical factors which affected the cocoon production were the number of boxes reared/settler and average yield/box.

The data in Table 1, indicates the almost half of silkworm reared against the original plan in Project Paper in 1977 and average yield/box is still low with high variation among the cycles. The reason can be mainly ascribed to the lack of mulberry leaves. Settlers cannot reach their full capacity to rear silkworm by 2 boxes. Unfortunately, record of mulberry leaf production does not exist for the supplementary subject to facilitate the evaluation of the poor production of leaves. But it is, however, possible to roughly estimate the yield of mulberry leaves by the available data of cocoon production (Table 3). The recalculated data shows the yield of mulberry leaves in 1977 of six settlements was approximately 477.8 kg/rai/year. Which is less than half of the production originally designed in the Project Paper. It is proper to conclude that strong emphasis should be made on the mulberry leaf production. Factors involved in an improvement of mulberry plantation should be carefully researched and implemented soon such as:

- method of establishment of mulberry plantation
- pruning practice
- fertilizer application (compost and manures)

Considering the net income per cycle of the settler of the model settlement at Prasat (Table 2) in 1977 after participating in this Project is $\text{B}517.1/\text{family}$. It seems to be not much of an incentive to the settler in comparison with labor hire. In fact settlers can produce more cocoons if good mulberry plantation is available. The condition of their work makes it impossible to obtain good results.

APPENDIX BLAND SETTLEMENT SIZE, NORTHEAST THAILAND

<u>Name of Settlement</u>	<u>Province</u>	<u>* Established</u>	<u>Total Area (Rai)*</u>	<u>Area Allocated (Rai)*</u>	<u>Official Membership (Families)</u>	<u>Family Size (Person)**</u>	<u>Plot Size (Rai)**</u>	<u>Total Land Holding/ Family**</u>
Prasat	Surin	1958	245,000	50,125	1,955	6.7	25	35.2
Lam Dom Noi	Ubol	1969	55,504	21,015	1,401	6.5	15	28.0
Lam Dom Yai	Ubol	1971	18,125	7,500	500	6.6	15	32.4
Mukdahan	Nakorn Panom	1956	123,750	38,400	1,740	6.7	25	41.4
Kuchinarai	Kalasin	1963	30,000	12,650	506	7.4	25	31.1
Lam Pao	Sakon Nakorn	1965	118,000	26,130	1,742	7.5	15	27.9
Ubonrat Dam	Khon Kaen	1964	373,900	61,960	1,946	6.4	15	20.6
Chiang Phin	Udon	1955	105,000	47,195	2,304	7.3	25	39.7
Phon Phisai	Nong Kai	1955	165,625	56,371	2,348	7.4	25	39.4
Ban Kruat	Buriram	1959	211,562	81,950	3,255	6.6	25	38.1
<u>Average for all Settlements</u>						6.9	21	33.4

* Kasetsart University, Faculty of Economics and Business Administration, "Basic Baseline Data Summary Report on Five Land Settlements, 1976" Vol. I and VII.

** Third, "Summary Report on Ten Land Settlements Under USAID Sericulture Project, 1977".

APPENDIX - C

Average Land Use and Income Among Farmers on 10 Land

Settlements in Northeast Thailand

	1976 <u>a/</u>	1977 <u>b/</u>
Land Holding Size Total Rai	32.3	33.4
Paddy	(13.7) <u>c/</u>	(12.9)
Upland	(8.4)	(11.1)
Mulberry	(0.7)	(1.7)
Other	(9.5)	(7.7)
Percentage of Farmer who borrow Money	31.8	64.6
Weighted Average debt	฿4,455.58	฿6,760.43
Average Net Cash Income per Capita (6.9 per family) US dollars	฿9,245.66	฿10,591.84

a/ KU, Faculty of Economics & Business Admin.
"Basic Baseline Data Summary Report on Five
Land Settlements, 1976 "Vol. I and III",
Bangkok, Thailand.

b/ "Third, Summary Report on Ten Land Settlements
under USAID Sericulture Project. 1977"
Bangkok, Thailand 1979

c/ Data available for only five Settlements:
Ubonrat Dam; Kuchinarai; Mukdahan; Lam
Dom Noi; Lam Dom Yai

d/ Chiang Phin Settlers had an average debt of
฿14,908.33 in 1976; The average debt of
the other 9 settlements is ฿3,281.39.

APPENDIX D

Silk Worm Rearing and Cocoon Production in 1977 of USAID
Sericulture, Average for 10 Settlements.

Total Sericulture Farmers	378
Number who reared silk worm	157
Average number of cycles	2.42
Cocoon yield per farm (kg.)	49.6
Average value of cocoon per farm	฿2,325.60
Net return (Total Revenue - Cash Cost)	฿1,940.60
Net return (Total Revenue - Total Cost)	฿1,618.70

Source: KU, Faculty of Economics and Business
Administration, "Sericulture Report
on Ten Land Settlements under USAID
Sericulture Project, 1977",
Bangkok 1979

APPENDIX E

Summary of Cocoon Production for 5 Cycles during Second Year of Sericulture Project,
May - December, 1978

<u>Cycle</u>	<u>No. of Farmers</u>	<u>Kg. Cocoon</u>	<u>Value</u>	<u>Cost</u>	
				<u>Ia/</u>	<u>IIb/</u>
1	240	2,252.70	95,519.35	201,260.00	271,660
2.	276	5,059.60	241,808.73	264,480.00	355,680
3	237	6,760.10	341,142.35	278,990.00	349,590
4	205	5,862.10	303,990.98	199,984.00	252,944
5	119	2,947.00	199,798.54	134,560.00	180,960
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Total	1,077	22,881.50	1,181,531.95	1,079,274.00	1,409,834
Av./cycle	215.4	4,576.30	236,306.39	215,854.80	281,966.8
Av./farmer/cycle		21.24	1,097.06	1,002.11	1,309.04
Av. for 5 cycles		106.20 kg.	#5,485.30	5,010.55	6,545.19

a/ Cost I = Total cost without depreciation cost.

b/ Cost II = Total cost + depreciation cost.

Source: Kasetsart University, Faculty of Economic and Business Administration

PUBLIC WELFARE DEPARTMENT (PWD)

Financial Status

000 Baht

FY	RTG Contribution			AID Loan			Total			Accumulatiive		
	Planned	Actual	%	Planned	Actual	%	Planned	Actual	%	Planned	Actual	%
1977	7,121	7,016.97	98.5	10,092.	6,812.91	67.5	17,213	13,829.88	80.3			
1978	4,664.4	3,992.84	85.6	6,975.6	4,548.395	65.2	11,640	18,541.235	159.4	28,853	22,371.115	77.5
1979	6,168.0 (3,883.4)			6,060.0 (3,821.04)			12,228 (7,704.44)			36,557.44		
1980	7,078.8 (10,892.612)			667.2 (3,409.76)			7,746 (14,302.372)			50,859.812		
1981	7,564.8			6,224.4			13,789.2			64,649.012		
										62,892.00	Figure in PP	

- NOTE:**
1. Figures in parenthesis are the revised figures. On the RTG Contribution, it was below than plan because the Budget Bureau cut some items out.
 2. The revised figures for FY 1980 are still under reviewing by the BOB.

APPENDIX G

SERICULTURE/SETTLEMENT PROJECT

Sericulture Division, MOAC: Financial Status

000 Baht

FY	MOAC Contribution			Accumulative		
	Planned	Actual	%	Planned	Actual	%
1977	3,141	2,323.6	73.98			
1978	792	19.063	2.41	3,933	2,342.663	59.56
1979	36			3,969		
1980	25			3,994		
1981	35			4,029		
				4,657.2		
				Figure in PP		

APPENDIX H

SERICULTURE/SETTLEMENTS PROJECT
 BANK FOR AGRICULTURE & AGRICULTURAL COOPERATIVES (BAAC)

Financial Status

'000 Baht

FY	BAAC Contribution			AID Loan Thru BAAC			Total			Accumulative		
	Planned	Actual	%	Planned	Actual	%	Planned	Actual	%	Planned	Actual	%
1977	6,703	0	0	6,703	1,743.32	26.0	13,406	1,743.32	13.0			
1978	6,680.4	0	0	6,681.6	4,781.24	71.6	13,362	4,781.24	35.8	26,768.2	6,524.56	24.4
1979	4,346.4			4,346.4			8,692.8			35,461.0		
1980	4,345.2			4,346.4			8,691.6			44,152.6		
1981	4,770.2			3,922.6			8,692.8			52,845.4		
										55,320.6		
										Figure in PP		

APPENDIX I

SERICULTURE/SETTLEMENTS PROJECT

Summary Table On The Total Project Cost For 5 Yrs. Of The Project

000 Baht

FY	PWD			BAAC			MOAC			Total		
	PP	Planned	Actual	PP	Planned	Actual	PP	Planned	Actual	PP	Planned	Actual
1977	19,587.6	17,213	13,829.88	16,334.4	13,406	1,743.32	4,536.0	3,141	2,323.6	40,458.0	33,760.0	17,896.8
1978	11,566.8	11,640	8,541,235	12,918.0	13,362	4,781.24	25.2	792	19.063	24,510.0	25,794.0	13,341,538
1979	11,732.4	7,704.44		8,692.8	8,692.8		36.0	36		20,461.2	16,433.24	
1980	7,292.4	14,302.372		8,691.6	8,691.6		25.2	25		16,009.2	23,018.972	
1981	12,712.8	13,789.2		8,692.8	8,692.8		34.8	35		21,440.4	22,517.0	
Total	62,892.00	64,649.012	22,371.115	55,329.6	52,845.2	6,524.56	4,657.2	4,029	2,342.663	122,878.8	121,523.212	31,238.338

NOTE: PP refers to "Project Paper"

APPENDIX K

SILK PRICING

By

Mr. Chote Suvipakit
Director, Sericulture Division, MOAC

Translated by Thomas Morgan, USAID Consultant

The program to rear hybrid silkworms at land settlements began at the Phimai Land Settlement in 1971 under the auspices of the Sericulture Division. The Sericulture Division received a revolving fund from the Government for the purpose of purchasing cocoons from the farmers, reeling and finally marketing the warp filament.

At that time imported warp silk sold for approximately 1,000 - 1,200 Baht per kilo and showed tendencies to rise even higher as a result of increasing labor costs in the producing nations. The volume of domestically reeled silk at that time was small and domestic textile mills were not willing to purchase it. It was therefore necessary to sell the domestically reeled silk at a price much below that for the imported variety.

The Sericulture Division determined the price for the farmers silk cocoons using the "cocoon layer percentage" as a standard. The Sericulture Division set the price of fresh cocoons at fifty baht per kilogram for fresh cocoons having a seventeen percent (17%) shell weight. If a percentage of the cocoons were spoiled the price would be reduced according to the established standard. Experience showed that farmers who reared silkworms were generally satisfied with the price. Moreover, it was also found that private reelers who began operating about the same time employed the pricing system of the Sericulture Division in determining the price paid to their own rearing members.

Subsequently, around 1975, the domestic warp silk market became quite unstable. Following Thailand's approval to importers to order silk from the Peoples' Republic of China the price of domestic warp silk dropped considerably. Indications were that the market would fall further because of the competition among an increased number of importers, as well as because of increased stocks of warp silk within the country resulting from import orders of warp silk much in excess of domestic demand.

Reverberations from this market situation threatened to adversely affect the production of domestically produced silk. Specifically, when the textile mills were able to obtain cheap imported warp silk they turned to this rather than supporting the use of domestic warp silk, in turn causing the price to fall. As a result of this the domestic reelers of warp silk joined together to request assistance from the State. They claimed that without such help they could not stay in business. The Thai Silk Promotion Board, the Department of Industrial Promotion and the Ministry of Commerce, which had already considered raising the import tax on warp silk, stipulated that importers would have to purchase a specified amount of domestic warp silk before being able to place orders for foreign warp.

In order to determine the price of domestic warp silk consultations were held among the silkworm rearers, the importers, the Thai Silk Association and concerned government agencies, namely, the Ministry of Commerce, the Ministry of Agriculture and Cooperatives and the Ministry of Industry. The commercial silk producers and reelers agreed with the importers to set the price of domestic warp silk at seven hundred baht per kilogram (at that time the ratio of purchases of domestic warp silk to imported warp was set at 1:4). Warp silk then being imported from the Peoples' Republic of China sold for five hundred to six hundred baht per kilogram.

The price of seven hundred baht per kilogram set by the producers and importers was seen by the Sericulture Division to be acceptable to the farmers while permitting the reelers to make a satisfactory profit. The division, therefore, made no substantial change in the original price. The division simply specified that the value of the raw materials (cocoons) needed to produce one kilogram of warp silk was four hundred baht. It also established a more equitable method of pricing spotted cocoons.

Subsequent to the specification of the standards just discussed the private silk producers were able to operate successfully. However, because of the rising costs of various production factors the investment required of farmers and private companies in order to produce warp silk increased.

At the same time the price obtained for domestic warp filament remained at seven hundred baht per kilogram. This situation prompted the silk rearers to petition the Department of Industrial Promotion to review the price of domestic warp silk and to raise the price sufficiently to cover their increased costs.

A related problem also arose about the same time. Dried cocoons were being exported to Japan because a better price could be obtained there than could be gotten by reeling and selling warp silk domestically. Government officials were concerned that silk reeling plants might reduce their production due to a shortage of raw materials, a situation which would adversely affect the rearing of silkworms for the production of domestic warp silk. Accordingly, the government arranged numerous discussions among the silk producers, the importers, the Thai Silk Association and the government agencies involved. As a result of these discussions it was decided to revise the domestic versus import ratio to 1:20 (initially this ratio was set at 1:4 and later revised to 1:5). It was also decided to establish a two grade pricing system for silk filament with the Department of Industrial Promotion responsible for determining the grades. Grades 1 and 2 had prices of 1,000 Baht and 850 Baht per kilogram respectively

The Government felt that since the price of silk filament had already been increased the price for fresh cocoons purchased from farmers should also be raised to bring it into accord with the price of filament. The Sericulture Division considered this matter and decided that if the raw material content of one kilogram of silk filament was set at six hundred fifty baht the farmers would realize a sufficiently higher price for their fresh cocoons and the reeling plants would also continue to make a profit because the price of silk filament had been raised to one thousand baht per kilogram. The specified schedule of prices is as follows:

Silk Cocoon Prices as of December, 1978

<u>Percent of Shell Weight</u>	<u>Baht per Kilogram</u>
24	113.9
23	109.1
22	104.4
21	99.6
20	94.9
19	90.2
18	85.4
17	80.7
16	75.9
<u>15</u>	<u>71.2</u>

These new prices are those which the Sericulture Division has directed the Nakorn Ratchasima Sericulture Research and Training Center to pay farmers for cocoons in the Sericulture Projects with which the division is involved, for example, the Accelerated Silk Production Project in Self-Help Land Settlements. These prices are not compulsory for general private sector dealings. Therefore, if a reeling plant chose to arrange purchases at prices different from these, it would be free to do so

APPENDIX L

SERICULTURE/SETTLEMENTS PROJECT

Schedule for the Technical Sericulture Project Evaluation
November 17 - December 8, 1978

November 17: On duty Bangkok

November 18: Saturday - November 19: Sunday

November 20: On duty Bangkok, joint Monthly Sericulture Meeting

November 21: Meet Mr. Vichit Piyarom, PWD (a.m.)
Depart for Korat (p.m.)

November 22: On duty Korat

November 23: On duty Bangkok: Meet Ms. Valee, Sericulture Div.

November 24: On duty Bangkok: Meet Dr. Chamnien Boonma, KU

November 25: Saturday

November 26: Sunday

November 27: 0745 Lv. Don Muang Airport
0855 Ar. Khon Kaen Airport
0905 Lv. " " "
1000 Ar. Ubonrat Dam Resettlement
On Duty at the Settlement
1600 Lv. Ubonrat Dam Resettlement
1800 Ar. Udorn - Stay overnight at Charoen Hotel

November 28: 1730 Lv. Udorn
0800 Ar. Chiang Phin Land Settlement
1030 Lv. The Settlement for Mukdahan
1200 Lunch at Amphoe Pung Khone
1600 Ar. Mukdahan Stay overnight at Bungalow Porn

November 29: 0730 Lv. Mukdahan
0800 Ar. Khamsoi Land Lettlemnt
1200 Lv. " " "
1430 Ar. Ubon
1530 Ar. Lam Dom Yai Land Settlement
1730 Lv. " " " " "
Stay overnight at Phatumrat Hotel

November 30: 0800 Lv. Ubon
1000 Ar. Lam Dom Noi Land Settlement
On duty at the Settlement & Lunch
1400 Lv. Lam Dom Noi Land Settlement
1500 Ar. Ubon Sericulture Station
1630 Lv. Ubon " "
1730 Ar. Ubon Province
2000 Lv. Ubon by Express Train

December 1: 0600 Ar. Bangkok - On duty in Bangkok

December 2: Saturday , December 3: Sunday

December 4: On duty Bangkok

December 5: Holiday

December 6: 0745 Lv. Don Muang Airport
0900 Ar. Khon Kaen
0915 Lv. " "
1140 Ar. Lam Pao Land Settlement
1400 Lv. " " " "
1530 Ar. Kuchinarai Land Settlement
1730 Lv. " " "
1930 Ar. Roi Et Province - Stay overnight

December 7: 0800 Lv. Roi Et
1130 Ar. Ban Kruat Land Settlement
Lunch
1600 Lv. Ban Kruat
1830 Ar. Korat - Stay overnight at Korat

December 8: 0800 Lv. Korat to visit Korat Sericulture
Research and Training Center
1230 Lv. Korat
1600 Ar. Bangkok

APPENDIX M

SERICULTURE/SETTLEMENTS PROJECT

Schedule for the Evaluation Team
January 23 - February 14, 1979

Tuesday, January 23: Arrive Bangkok

Wednesday, January 24-25: At USAID

Friday, January 26: 0700 Lv. Bangkok by USAID & PWD Vehicles
1100 Ar. Korat - Visit Korat Sericulture
Research & Training Center
1230 Lunch at Korat
1330 Lv. Korat
1530 Ar. Prasat Settlement
Stay overnight at Memorial Hotel,
Surin

Saturday, January 27: 0800 Lv. Surin
0930 Ar. Ban Kruat Settlement - Observe the
Sericulture Project at the Settlement
1130 Lv. the Settlement
1230 Lunch at Nang Rong, Buriram Province
1330 Lv. Nang Rong
1800 Ar. Bangkok

Sunday, January 28: WEEK-END

Monday, January 29: 1330 Meet Dr. Chamnien at KU

Tuesday, January 30: Meet with the Evaluation Members at USAID

Wednesday, January 31: 0900 Meet Mr. Vichit at PWD
1400 Meet Mr. Chote at the Sericulture
Division at Bang Khen

Thursday, February 1: 0745 Lv. Don Muang Airport
1000 Ar. Ubon Airport
1015 Lv. Ubon Airport
1130 Ar. Lam Dom Noi Settlement (75 Km.)
Lunch at the Settlement
1430 Lv. Lam Dom Noi Resettlement
1600 Ar. Lam Dom Yai Settlement (129 Km.)
1800 Lv. Lam Dom Yai Settlement
1845 Ar. Ubon Province (54 Km.)
Stay overnight at Pratumrat Hotel

Friday, February 2: 0730 Lv. Ubon Province
0930 Ar. Mukdahan Settlement (136 Km.)
Observe the Sericulture Project
at the Settlement
Lunch at the Settlement
1300 Lv. Mukdahan Settlement
1530 Ar. Kuchinarai Settlement (120 Km.)
Observe the Sericulture Project
at the Settlement
1730 Lv. Kuchinarai Settlement
2000 Ar. Khon Kaen Province (165 Km.)
Stay overnight at Kosa Hotel

Saturday, February 3: 0730 Lv. Khon Kaen Province
0800 Ar. Ubonrat Dam Resettlement

Observe the Sericulture Project
at the Settlement

1100 Lv. The Settlement

1200 Lv. Khon Kaen Airport

1325 Ar. Bangkok

Sunday, February 4: WEEKEND

February 5 - 14, 1979

Monday, February 5: 1500 Meet USAID Director

Tuesday, February 6: At USAID - Draft Report is ready for typing

Wednesday, February 7: 0745 Lv. Don Muang Airport

0935 Ar. Udorn Airport

1000 Lv. " "

1015 Ar. Chiang Phin Settlement (15 Km.)

Observe the Sericulture Project
at the Settlement

Lunch at the Settlement

1300 Lv. Chiang Phin Settlement

1500 Ar. Phon Phisai Resettlement (147 Km.)

1700 Lv. Phon Phisai Resettlement

1900 Ar. Udorn Province (132 Km.)

Stay overnight at Charoen Hotel,
at Udorn

Thursday, February 8: 1135 Lv. Udorn Airport

1325 Ar. Bangkok

Friday, February 9: AT USAID

Saturday, February 10 - Sunday, February 11, WEEKEND

Monday, February 12: At USAID

1400 Forward copies of the draft reports
to the Evaluation Committee members

Tuesday, February 13: 0930 Meet Khun Chamlong Tothong, BAAC

1330 Review the draft report

Wednesday, February 14: Mr. Mitchell plans to leave Bangkok
for San Francisco

APPENDIX N

EVALUATION TEAM

1. Mr. Donald R. Mitchell
Agriculture Advisor, Asia Bureau, AID/Washington
2. Dr. Neungpanich Sinchaisri
Instructor, Department of Entomology, Kasetsart University
3. Dr. Chamnien Boonma
Associate Professor, Faculty of Economics and Business Administration, Kasetsart University
4. Dr. Thomas E. Morgan
Social Science Analyst, Northern Illinois University

PARTICIPANTS

RTG

1. Mr. Prasit Ujchin, Ministry of Finance
2. Mr. Decha Vanichvarote, NESDB
3. Mr. Sombhong Pattanavichaiporn, DTEC
4. Mr. Chote Suvipakit, Sericulture Division, MOAC
5. Mr. Inson Chompoo, PWD
6. Mrs. Panee Sribantao, PWD
7. Mr. Piroj Lattaphiphat, BAAC
8. Mr. Sor Sattayanond, BAAC
9. Mr. Sombat Sakultasathien, BAAC

USAID

1. Mr. Donald D. Cohen, Mission Director
2. Mr. Robert S. Queener, Director, Office of Rural Devl.
3. Mr. Wayne H. Slotten, Asst. Agricultural Devl. Officer
4. Mr. John A. Tennant, Capital Projects Devl. Officer,
Office of Project Development and Support
5. Mr. William D. Fleming, Asst. Program Officer,
Office of Program Planning & Evaluation
6. Mr. Atisai Pangspa, Asst. Project Officer, O/RD
7. Mrs. Thongkorn Hiranraks, Asst. Project Officer, O/RD
(Coordinator)

Interviews and Visits

1. Mr. Vichit Piyarom, Dir. of Land Settlement Div., PWD
2. Mr. Chart Kalayanamit, Asst. Dir., Self-Help Land Settlement Development Section, PWD
3. Mr. Chamlong Tothong, General-Manager, BAAC

Superintendents

1. Mr. Thongkham Bunsamrit, Ban Kruat Settlement
2. Mr. Songtham Savaniya, Prasat Settlement
3. Mr. Praphatpong Komolsavin, Lam Dom Noi Resettlement
4. Mr. Pracha Visuthyothin, Lam Dom Yai Settlement
5. Mr. Sutee Boonyapipat, Kham Soi Settlement
6. Mr. Anek Itthiwatana, Kuchinarai "
7. Mr. Samrit Chantharat, Lam Pao Resettlement
8. Mr. Charin Saphamong, Ubonrat Dam "
9. Mr. Somchai Ruang-Rod, Chiang Phin Settlement
10. Mr. Lamai Boonvit, Phon Phisai "

Sericulture Project Supervisors

1. Mr. Wittaya Rodboonma, Ban Kruat Settlement
2. Ms. Siriluck Sirisap, Prasat "
3. Mr. Preecha Suwannasopee, Lam Dom Noi "
4. Mr. Punlert Sudjit, Lam Dom Yai "
5. Mr. Wittaya Kulsujarit, Kham Soi "
6. Mr. Chaisen Wangsai, Kuchinarai "
7. Mr. Somchai Klaisomboon, Lam Pao "
8. Ms. Ratchanee Tangpong, Ubonrat Dam "
9. Ms. Achana Sripradit, Chiang Phin "
10. Mr. Viroj Koonkhunthod, Phon Phisai "

Chief of the Sericulture Stations

1. Mr. Damrong Srinawat - Ubon
2. Mr. Sombat Maneechote - Kham Soi
3. Mr. Samak Khorwanich - Udorn
4. Mr. Sompote Ackapand - Korat Sericulture Research
and Training Center
5. Mrs. Yuwadee Manakasem - Khon Kaen

BAAC Branches

1. Mr. Thamnoon Suveeraporn
Chief Credit Supervisor - Ubon
2. Mr. Phanomsak Thyatham
Long Term Credit Supervisor - Ubon
3. Mr. Sithipong Ackaraphin
Long Term Credit Supervisor - Udorn