

インドネシア養蚕開発計画 専門家報告書

— 蚕飼育 —

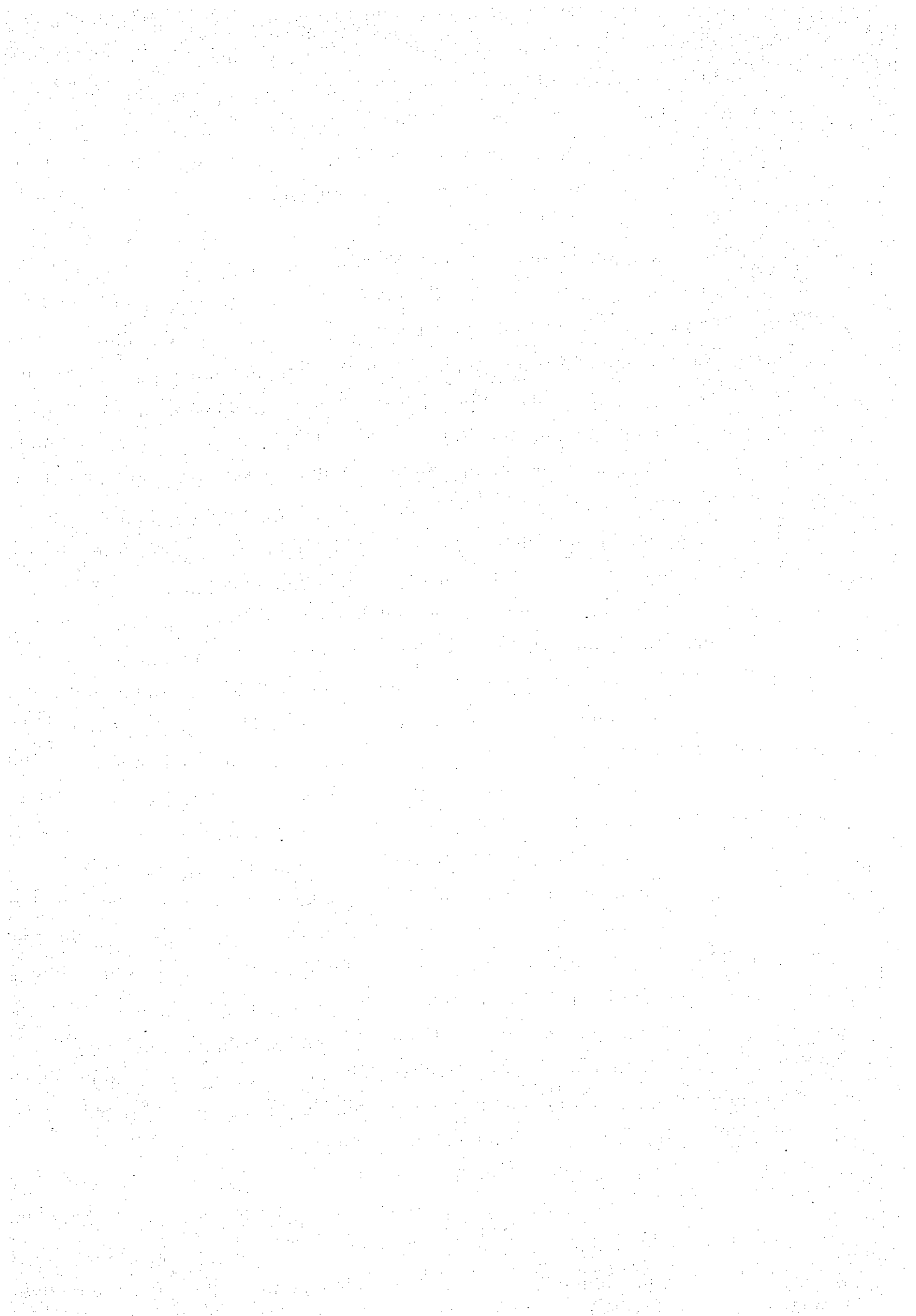
昭和58年2月

国際協力事業団

農開畜

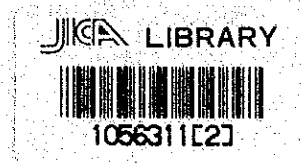
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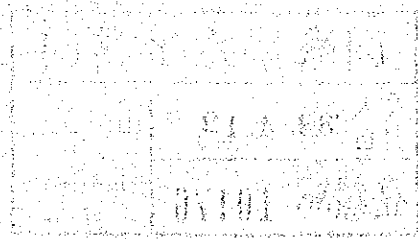


インドネシア養蚕開発計画 専門家報告書

— 蚕飼育 —



昭和58年2月



国際協力事業団

国際協力事業団	
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は　じ　め　に

インドネシア養蚕開発計画は、昭和53年2月28日に締結された「インドネシアとの養蚕の分野における技術協力協定に基づき昭和58年2月27日まで実施された後、協力期間が2カ年延長され昭和60年2月27日までの予定で実施されている。同計画の事業内容は、南スラウェシ州ゴア県の養蚕センター、ソッペン県の副センター及び5カ所のパイロットユニットにおいて、桑栽培、蚕飼育に係る実用及び実証試験、蚕種の製造と配布、技術職員及び農民の訓練等を行なうことであり、これら協力の成果は「イ」側からも高い評価を受けている。

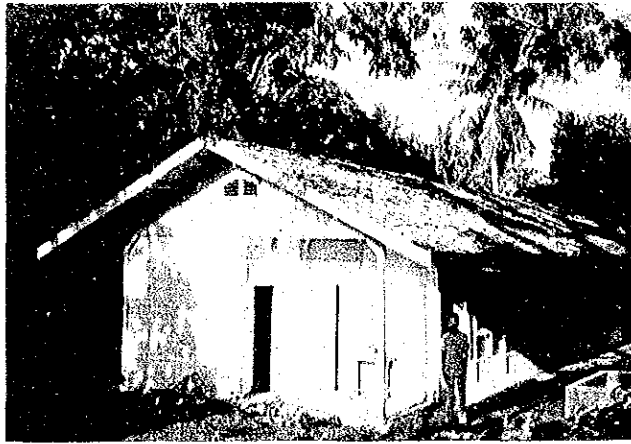
本報告書は、昭和55年11月14日から昭和58年2月27日まで蚕飼育の専門家として技術指導にあられた西　昇一郎専門家の活動の成果を取りまとめたものであり、今後同計画の事業実施上の参考資料として利用されることを期待する。

最後に本報告書を取りまとめられた西専門家及び種々ご指導いただいた外務省、農林水産の関係各位に対し謝意を表する。

昭和58年12月

国際協力事業団
農業開発協力部

部長　田内　堯



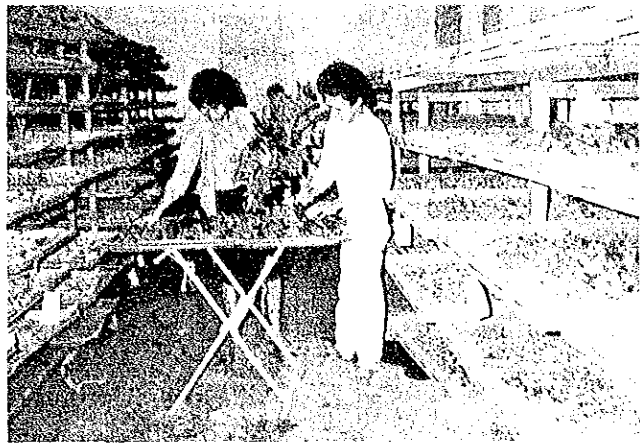
パイロットユニット稚蚕飼育所



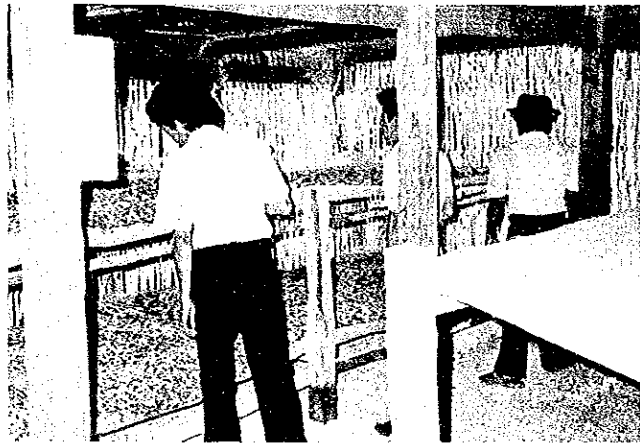
飼育室の外の貯桑室
(パイロットユニットの演示農家)



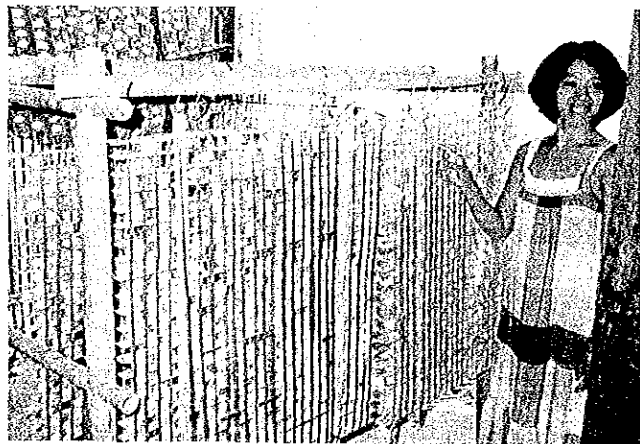
蚕室の入口 (手足の消毒)



パイロットユニット稚蚕飼育状況



農家の飼育状況



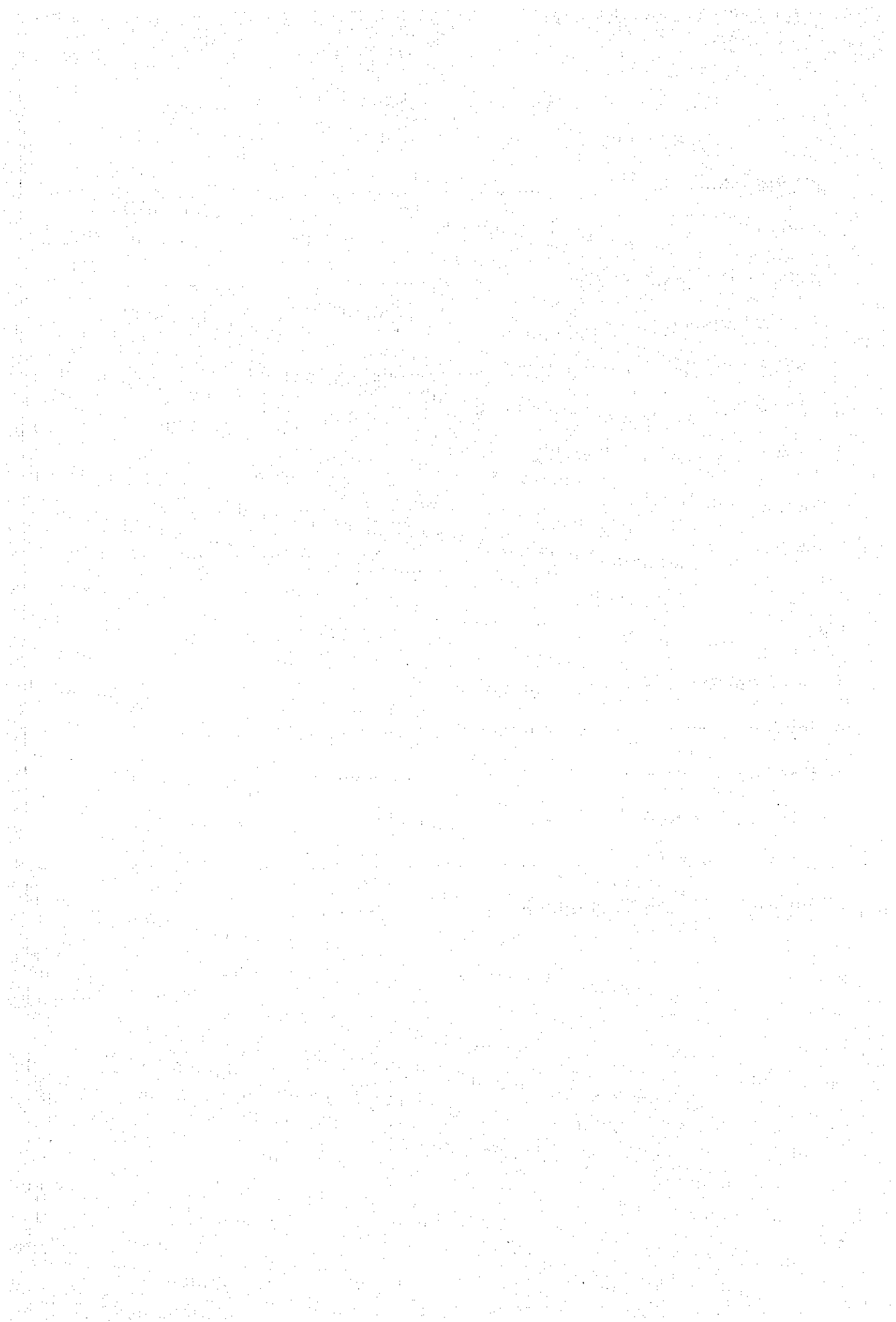
パイロットユニット演示農家の営繭
状況（改良竹簇とひもかけ法）

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インドネシア養蚕開発計画

蚕飼育専門家報告書

1983年2月27日

派遣専門家

西 昇一郎

インドネシア養蚕開発協力のため、蚕飼育の専門家として、1980年11月14日から1983年2月27日までの2年3ヶ月間、インドネシア共和国に派遣された。

その間、インドネシア養蚕開発計画の蚕飼育分野を担当して、養蚕開発センター、副センターおよび現地において、蚕飼育の技術開発実用試験、インドネシア技術職員の訓練、および農民グループへの技術の演示指導等に関する業務に従事した。その業務の概要について、下記のとおり報告する。

記

1. 派遣期間

1980年11月14日から1983年2月27日まで

2. 勤務場所

インドネシア共和国農業省林業総局

インドネシア養蚕開発センター（南スラウエシ州ゴア県）

3. 技術協力の経過

1976年3月30日にR/Dが調印され、その後1978年2月28日、日・伊両国間による協定が締結され、本格的に技術協力事業が進められて5ケ年が経過し、1983年2月27日で協定期間が終了した。これまでの協力事業については、インドネシア養蚕開発計画、総合報告書（1983年2月）のとおりである。

蚕飼育の分野では、協定期間の初め約2ケ年は、現地における協力活動が中心となり、蚕飼育の実態調査と副センターで実証試験を実施する一方、日本の蚕飼育技術を導入し、現地に適応させる形で進められた。

1980年2月に、それまで建設が遅延していた養蚕開発センターの建物、施設の完成に伴い、蚕飼育棟や設備も漸く出来て、蚕の飼育技術開発のための実用試験が軌道に乗る運びとなった。

このような推移の中で、当初2ケ年間の現地における協力活動を通して、養蚕農家の実態調

査や問題点の抽出、現地に適応する蚕飼育技術改善の事業が、私が担当した協定期間後半における事業計画立案の指針となり、事業の推進や成果を挙げる上に大きな役割を果たしたように思われる。

蚕飼育の技術は、1982年末までに稚蚕、壮蚕、上族の技術がほぼ作成された。しかし上族技術の改善開発と繭検査室整備（1982年11月）のおくれから繭質の改善と繭質検査法が遅れている。今後、蚕飼育技術の補完と技術移転の促進が望まれる。

インドネシア技術職員、農民の訓練では、インドネシア人専門家4名（Counter part）やアシスタント・カウンターパート8名の訓練は、かなり進み、カウンターパート4名は全員、日本研修を終了している。（蚕飼育関係）

技術普及職員（Guidance technician）や養蚕農民の訓練は、1981年から1982年にかけて軌道に乗つつあり、最近ではインドネシア全域から研修に参加する傾向にある。

農民グループへの技術の演示指導は、パイロットユニット設置の遅れにより1982年3月から本格的に活動が開始された。

協定期間終了時における蚕飼育分野の協力事業進捗状況は参考資料1のとおりである。

4. 業務の内容

1. 蚕飼育技術開発のための実用試験

(1) 稚蚕飼育法

1) 熱帯の特性と背景

当地方では、高温、多湿、過乾という気象的に特異な環境下で育蚕が行なわれている。蚕室内の温度は、熱帯としてはそれほど異常な高温ではない。しかし雨期の高温と多湿、乾期の高温と過乾という温度と湿度との関連性からみて、蚕を飼いにくく、また蚕病が発生しやすいという蚕の作柄不安定の要因を持っている。

当地方の大部分の地域が保温せずに、年中いつでも稚蚕飼育が可能である。このことは反面、桑の収量や葉質を無視した場当たりの無計画養蚕に走る傾向にある。

2) 経過と現状

1981年は乾期でも時には降雨があったが、1982年は4月下旬から11月下旬まで降雨がなく当地方の乾期としても異常であった。このように異った気象下で2年間、センターにおいては現地適応の目的で試作されていた稚蚕飼育施設で、サブセンターでは普通蚕室を使って稚蚕飼育技術の開発、改善を進めてきた。その結果、1982年までに、稚蚕飼育技術の体系をほぼ作成し、雨期・乾期の飼育標準表を作った。しかし、蚕期の設定と蚕飼育計画案は作成したが、桑の収穫技術体系の確立を待って、策定されるもので未完である。1982年3月、パイロットユニット稚蚕飼育所の開設に伴い、これまで開発、改善された稚蚕飼育技術を組み立てて、技術の演示指導を行っている。

当地方における一般の現状は、稚蚕飼育所で3令まで飼育し、3令就眠中に蚕児を農家に配蚕するのが普通である。稚蚕飼育施設は、窓が少ないため気流の導入や採光が悪く、土間のところが多く消毒がしにくい簡素な施設が大部分である。飼育型式は群馬式箱飼育が主で、蚕座紙や防乾紙、その他の蚕具類や蚕体消毒剤などの資機材が不備である。また貯桑室の整備、貯桑方法、および基本的な飼育技術に多くの問題点が見られる。要するに、蚕の作柄安定の基である稚蚕飼育施設の改善と、稚蚕飼育技術について早急な改善が望まれる現状である。

3) 稚蚕飼育に関する実用試験と調査の成績

本報告書の参考資料2の(1)~(5)、および、インドネシア養蚕開発計画総合報告書(昭58)、同昭55年度年報(JR82-15)、同56年度年報参照。

4) 作出した技術

作出した稚蚕飼育技術の詳細は、テキストブックおよび本報告参考資料6-1)、蚕飼育演示技術の組立を参照。具体的事項は次のとおり。

- a. 1~3令の育蚕技術
- b. 飼育標準表(雨期型-第5表、乾期型-第7表および第9、第10表)
- c. 現地に適応する稚蚕飼育施設、蚕架・蚕箔の試作(パイロットユニット)
- d. 稚蚕期における高度さらし粉による蚕体消毒の実用化
- e. 現地製防乾紙の防乾効果の調査と対応策
- f. アニ・アニの稚蚕用桑収穫への活用

(2) 壮蚕飼育法

1) 熱帯の特性と背景

当地方では一部の高標高地を含め全地域で保温しなくても、年間いつでひ壮蚕飼育ができる温度環境にある。台風や強風のおそれがなく、また東南アジアの一部に見られる多化性の寄生蠅の発生がないので、壮蚕飼育施設は簡易なものでよいという恵まれた面がある。しかし、雨期の高温、多湿、乾期の高温、過乾は、蚕病の誘発や増発を招きやすい。乾期における桑葉質の悪化と給与桑の萎凋、高温による蚕の飼育経過の短縮などによる繭質の低下など気象に左右される問題点が多い。

前述の温度環境と、以前に多化性蚕を飼育していた習慣の影響もあって、無計画な蚕飼育を行う傾向にある。

2) 経過と現状

乾期でも、比較的雨に恵まれた1981年と、厳しい乾期の1982年の両年および、1980年と1981年の雨期を通じて蚕飼育を行った。

センターでは、普通壮蚕室と現地に適用する目的で試作した屋外条桑育施設で、副センターでは、普通壮蚕室で壮蚕飼育技術の開発改善を進めてきた。その結果、1982年

までに壮蚕飼育技術の体系をほぼ作成し、雨期、乾期の飼育標準表を作った。

しかし、蚕期の設定と蚕飼育計画は案に過ぎない。今後、桑の収穫技術体系の確立をまっして策定する必要がある。

1982年3月、パイロット、ユニット稚蚕飼育所の開設に伴い、これまで開発、改善された壮蚕飼育技術を組立てて、演示農家で技術の演示指導を行っている。

当地方の現状を見ると、蚕飼育施設は、大部分が高床式住宅の床下利用蚕室で、別棟蚕室はまだ少ない。2～4段の条桑育台で条桑育を行っており、1日3～4回給桑している。

蚕室が住居の下にあることや構造上の面から、消毒が徹底しないこと、農民の蚕病防除に対する認識が低いことなどから、コージカビ病や膿病等の蚕病が多く、蚕の作柄が不安定である。

蚕室、蚕具や蚕体消毒を初め、蚕室外の貯桑室設置、貯桑方法および給桑技術などについて、改善指導を要する現状である。

3) 壮蚕飼育に関する実用試験と調査の成績

本報告書の参考資料3の(1)～(3)

およびインドネシア養蚕開発計画の総合報告書(昭58年2月)

昭和55年度年報、昭和56年度年報を参照

4) 作出した技術

作出した壮蚕飼育技術の詳細は、テキストブックおよび本報告書参考資料6-1、蚕飼育演示技術の組立を参照。具体的事項は次のとおり。

- a. 4～5令の飼育技術
- b. 飼育標準表(雨期型第6表、乾期型第8表および第9、第10表)
- c. 壮蚕飼育施設(屋外条桑育施設)の試作
- d. 壮蚕期における高度さらし粉による蚕体消毒の実用化と消石灰の利用
- e. 蚕室内(稚蚕、壮蚕)の微気象調査と対応

(3) 上簇技術と繭質の改善

1) 熱帯の特性と背景

当地方では、冷涼と思われる高標高地帯でも、日中の気温は28℃を越え、平地では年中高温で蚕の上簇、簇中の適温よりはるかに高い。雨期の高温、多湿および乾期の高温という特有な気象は簇中環境を悪くし、繭質を悪化する。

しかし、年中保温をしなくてもよい経済効果と高温は低温(20℃以下の)より上簇時の登簇、営繭には都合がよい有利性がある。蚕の飼育技術が適切であれば、熟蚕の発現が斉一で、一斉上簇や自然上簇に好適である。防暑設備をして適度な気流の導入をすれば低湿環境の乾期には良質繭が得られる。(本報告書資料4の(6)、繭質の改善、参

照)。

2) 経過と現状

上簇技術の開発や改善および繭質の調査(繭検査)は、当初計画よりかなり遅れた。1981年から現地における簇器や上簇技術を調査、検討しながら、簇器の試作、上簇技術の開発、改善を進め、1982年中頃までにほぼ竹簇の改良試作と上簇技術をほぼ作出した。

1982年3月パイロットユニットの発足に伴い、これまで開発、改善された上簇技術を組み立てて、改良試作した竹簇の実用化と併せて演示農家で演示指導を行っている。

繭質調査(繭検査)は、1981年に初めてセンター、副センターおよび5地域の生産繭について1粒繰りにより実施された。(短専、友成氏)。また1982年11月末に繭検査棟の改造、施設や機器の整備と設置が終って、カウンターパート以下9名が配置されて稼動するようになった。

当地方の現状を見ると、上簇技術は未熟で水準が低い。簇器は大部分が吊り下げ式竹簇であるが、吊り下げ式二重竹簇や積み上げ式竹簇もある。簇器の構造的な原因や簇中保護の未熟により繭質が劣り、とくに解じよ率が低く、低糸量である。

また、生繭で自家繰糸をする養蚕農家も多いため収穫は早めて適期に行われず、選繭もほとんど実施されない現状である。

当地方の繭取引方法は、繭質を無視した繭の重量売買である。繭検査法の適用や生繭売買方法などの行政指導がなければ、上簇技術の改善指導だけでは繭質の全般的水準の向上はもとより、上簇技術の普及そのものが進展しない状況にある。

3) 上簇技術と繭質の改善に関する実用試験と調査の成績

本報告書の参考資料4の(1)~(6)

およびインドネシア養蚕開発計画の総合報告書(昭58)

昭和55年度年報、昭和56年度年報を参照

4) 作出した技術

- a. 上簇の技術
- b. 竹簇の改良と実用化
- c. 条払いによる熟蚕の収集法と竹簇への熟蚕の振り込み法
- d. 竹簇の効果的使用法
 - a) 竹簇の上下反転法
 - b) 竹簇の外側ひもかけ法
 - c) 竹簇における同功繭を減少する技術
- e. 竹簇による自然上簇法
- f. 交雑種の上簇と発蛾時期との関係からみた殺蛹、乾繭時期

g. 簇器の改良と上簇技術による繭質の改善

2. インドネシア人技術職員および農民の訓練

(1) インドネシア専門家 (Counter part)、アシスタントカウンターパートの訓練

本報告書の「技術協力の経過」の項および参考資料5に記述したとおりである。

(2) 技術普及職員 (Guidance technician) の訓練

インドネシア専門家に指導能力を付与するために、日本人専門家の助言により、インドネシア専門家の主導により訓練を行っている。技術普及職員40名を対象に、センターにおいて、1期5名単位で3ヶ月間、実施している。蚕飼育では、3ヶ月研修の中で1蚕期を目途に実技を中心に学科講習を含めて行っている。

1981年には、パイロットユニット担当の技術普及職員5名を手初めに、グループ単位で1982年にわたり訓練している。パイロットユニット担当の技術普及職員5名については、パイロットユニット活動開始前の1981年11月にLuppangeパイロットユニットで、1蚕期、現地特別訓練を実施した。

(3) 農民の訓練

1981年1月から農民訓練が開始され、1蚕期を目途に数次にわたり実施されてきた。各分野のカウンターパートが教育に当たっている。蚕飼育分野では、サブセンターで集合訓練し、近隣農家を借りて、グループ別に蚕飼育実技訓練を行った。1981年と1982年に各1回、政府主催によるジャワ島、マストラ島における農民研修にカウンターパートが講師として派遣された。

また1982年には、センターにおいて全国各地から参加した農民研修が実施された。

3. 農民グループへの養蚕技術の演示指導

(1) 蚕飼育演示技術の組立 (参考資料6の(1))

稚蚕、壮蚕、上簇および繭質改善について、これまで開発、改善された技術を組立てて、1982年3月から、パイロットユニット5ヶ所において演示指導を行っている。

(2) パイロットユニットにおける演示指導 (参考資料6の(2))

1) パイロットユニットの設置、運営および活動方針等については、インドネシア養蚕開発計画の総合報告書 (昭58) のとおりである。

2) パイロットユニットは、Pising, Luppange, Wanio, Ugi, Baraka の5ヶ所である。稚蚕飼育所は、センターに試作された施設に基づいて設計され、1981年11月から1982年2月までに4ヶ所が、1982年8月にBarakaの建設が終った。演示農家は、演示農家の設置基準により選定し、途中増減はあったが現在10農家が設置されている。

3) 蚕飼育の演示指導は、1982年3月から4ヶ所で開始され、設置が遅れていたBarakaも9月から開始された。活動開始以来1983年2月までにPisingは5回、Luppange, wanio, Ugiは4回、Barakaは2回、蚕飼育が行われた。

1982年は、当地方では10年来ともいわれる早ばつの影響で、第3回目(8月)以降の飼育計画に支障を来した。

養蚕成績としては、第2回目(6月蚕)までは順調に推移したが、第3回(8月蚕)は早ばつの影響もあって低下した。第4回(10月蚕)に掃立てをしたPisingは良好で、現在飼育中の第5回(1月蚕)も順調なようである。

(3) 養蚕農家の技術評価(参考資料6の(3))

1982年6月～7月に、Pising, Luppange, Wanio, Ugiの4パイロットユニットにおいて調査を行った。調査は、稚蚕と壮蚕、上簇の技術評価アンケート表により、稚蚕飼育では、パイロットユニットと一般農家グループのユニット1地区各1ヶ所を、壮蚕飼育、上簇ではパイロットユニット養蚕農家について行った。今後も定期的に調査して、蚕飼育技術の進歩を促え、評価後の技術改善と演示指導の指標にすることが望ましい。

5. 後任者との引継

関係者の尽力によって、現地で引継を行った。養蚕開発センター、および副センターの業務状況および問題点の検討など、カウンターパートと共に行なった。更に、パイロットユニットの現場において、養蚕技術の演示指導の現状、今後の技術移転、普及方法等について検討した。

6. おわりに

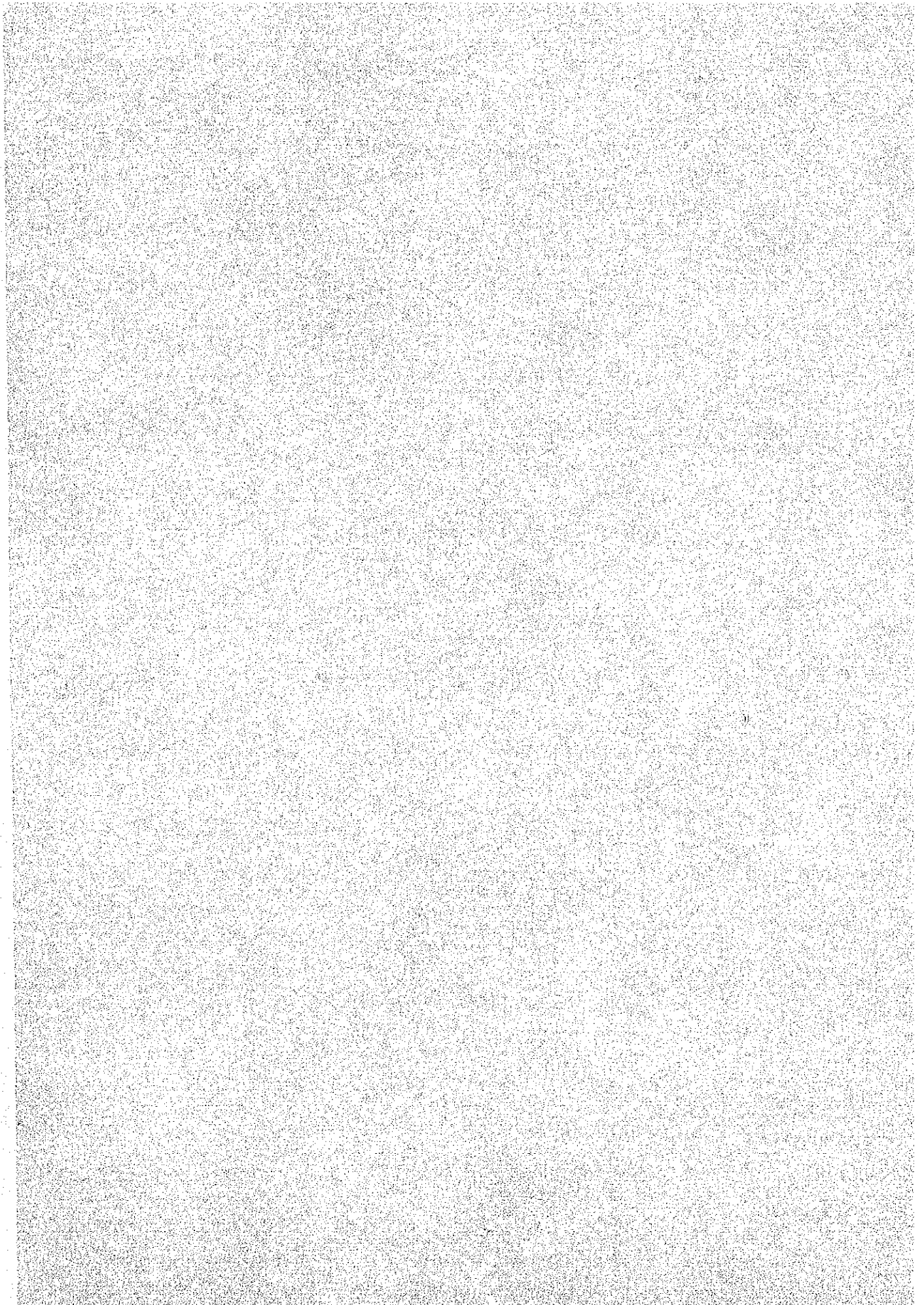
この報告を終るにあたって、インドネシア共和国の蚕糸業が益々発展されることを祈ります。最後に任期中、暖かいご支援を賜った外務省、農林水産省経済局国際協力課、同省農蚕園芸局蚕業課、蚕糸試験場、さらに、ジャカルタの日本大使館、国際協力事業団の関係者に深く感謝いたします。

また、種々ご指導ご協力いただいた当プロジェクトのリーダーをはじめ専門家の方々、インドネシア側関係者に厚くお礼を申し上げます。

参 考 資 料 1

事業の進捗状況、問題点と対策

(蚕 飼 育 分 野)



事業の進捗状況、問題点と対策（蚕飼育分野）

1983年2月

1. センターにおける状況

c. 蚕の飼育技術開発のための実用試験。進捗率は、当初計画に対する到達率。

事業項目	進捗状況	残された問題点	対策（案）
c-3 稚蚕飼育法	% 85	<ul style="list-style-type: none"> ・ 地域に適した掃立時期の設定 ・ 高標高地における飼育技術の作出 ・ 防乾紙の入手難 ・ 蚕室内微気象調査の継続 	<ul style="list-style-type: none"> ・ 桑の収穫体系や気象に相応した掃立時期の策定 ・ パイロットユニット Baraka の稚蚕飼育技術の検討 ・ 防乾紙の代替品の開発と簡易作製法
c-4 壮蚕飼育法	85	<ul style="list-style-type: none"> ・ 年間の飼育時期の設定 ・ 高温、過乾下における給与桑の萎凋防止法 ・ 簡易壮蚕飼育施設の現地適用 	<ul style="list-style-type: none"> ・ 桑の収穫体系や気象に相応した飼育計画の策定 ・ 給与桑の萎凋防止資材の現地入手 ・ 多量飼育と施設の改善現地実証
c-5 上簇技術と繭質の改善	75	<ul style="list-style-type: none"> ・ 改良竹簇による自然上簇法の検討 ・ 繭質の改善 	<ul style="list-style-type: none"> ・ 多量上簇による検討とパイロットユニットでの実証 ・ 不良竹簇の更新—改良竹簇の農民の手製促進
上簇技術	(85)	<ul style="list-style-type: none"> ・ 繭質検査の促進 	<ul style="list-style-type: none"> ・ パイロットユニット農家グループの生産繭の繭質調査
繭質の改善	(65)		

e. インドネシア技術職員の訓練

事業項目	進捗状況	残された問題点	対策（案）
e-1 カウンターパートの訓練	70~85	・カウンターパートの技術開発能力	・インドネシア養蚕に役立つ現場適用の試験の策定と新技術の開発能力の養成および試験成績の分析と考察能力の養成
e-2		・更に実技訓練を積み重ねる	

センター技術 70~85

職員の訓練

f. 農民グループに対する養蚕技術演習計画の作成

f-2 蚕飼育演習技術の組立	80	・現場における問題点の抽出と対応する技術の改善と開発	・素材を集積して、より優れた演習技術の組立
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2. サブセンターにおける状況

d. 技術職員および農民の訓練

d-1 技術職員及び農民訓練のためのカウンターパート等の訓練	70~85	・実技訓練計画の立案と訓練を軌道に乗せる。	・蚕飼育時における実技訓練を重点
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e. 農民グループへの技術の演習指導

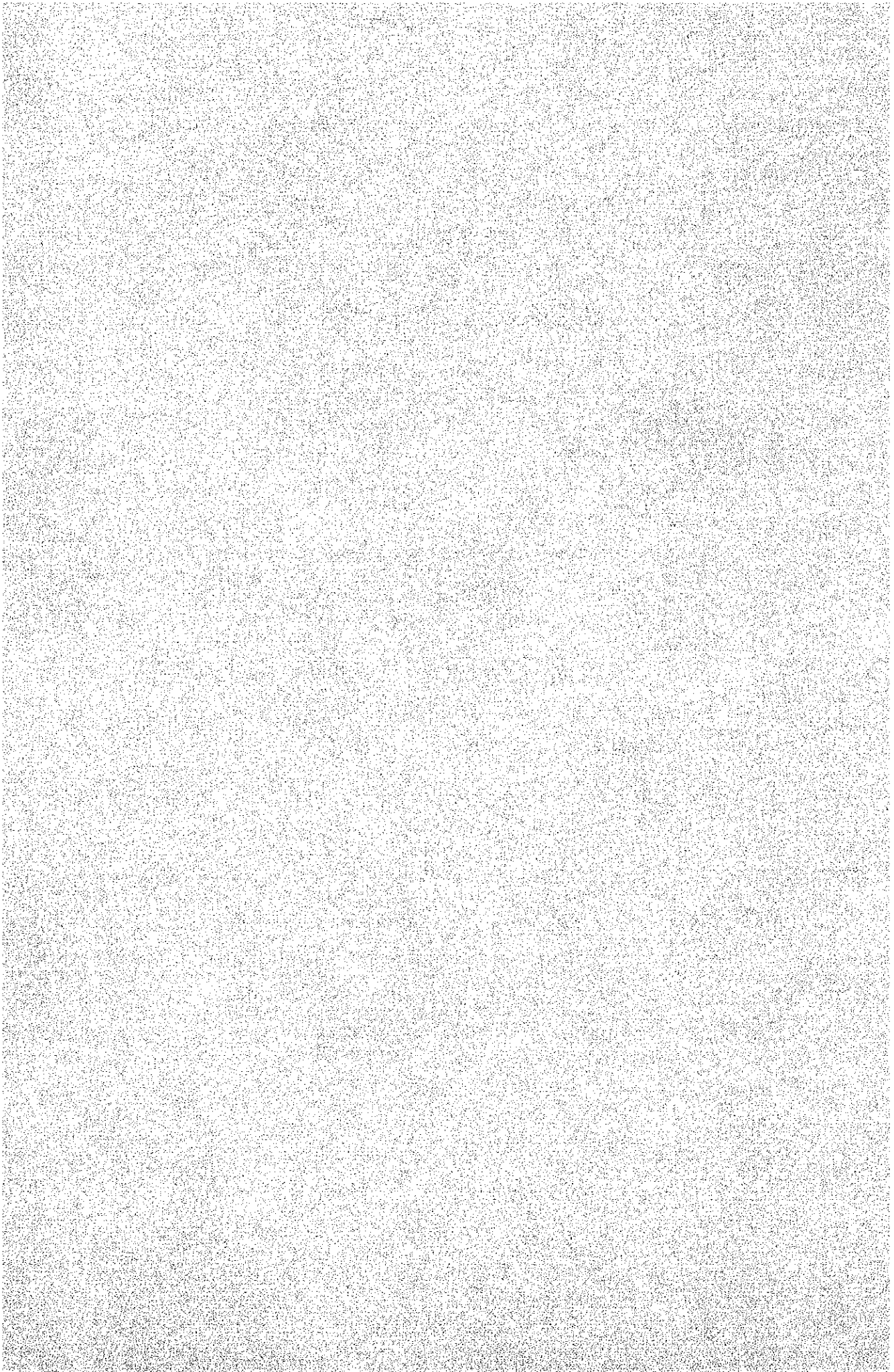
e-1-(2) 育蚕技術の演習指導	65	・現場における問題点の抽出と解明	・パイロットユニット参加農家全般への技術移転
e-2-(2) 養蚕農家の実態調査	75	・普及職員による養蚕農家経営調査	・調査の継続

	進捗状況	残された問題点	対 策 (案)
e-3-(2) 養蚕農家の技 術評価	65	・普及職員による技術評価実 施の継続	・技術評価法の検討と資料の利 活用

参 考 資 料 2

蚕飼育技術開発のための実用試験

1. 稚蚕飼育法
 - (1) 現地に適応する稚蚕飼育施設と蚕架蚕箔の試作および同施設における蚕飼育調査
 - (2) 現地防乾紙の質および使用法と桑葉萎凋率との関係
 - (3) 稚蚕期における高度さらし粉による蚕体消毒の実用化
 - (4) アニ・アニの稚蚕用桑収穫への活用
 - (5) 蚕飼育標準表（雨期、乾期の稚蚕、壮蚕）



(1) 現地に適応する稚蚕飼育施設と蚕架、蚕箔の試作および同施設における蚕飼育調査

(下記の蚕飼育調査は1980年にセンターに試作した施設に関するもので、パイロットユニットに試作建設した施設については、本報告の「パイロットユニットにおける演示指導」の項に記す)

a. 目的

現地に適応する稚蚕飼育施設を試作する。当地方の蚕架、蚕箔は木材、竹材で自製したものが多く、病原菌とくにコウジカビ病菌が附着、侵入しやすく、消毒が不十分となり病原菌が残りやすい。したがって蚕病防除の面から、鉄製の蚕架、蚕箔を現地で試作する。この試作した施設で鉄製の蚕架、蚕箔を使って蚕飼育を行い、試作した施設や蚕架、蚕箔の実用化の可否について検討し、演示指導や普及に役立てる。

b. 試作の経過

a) 稚蚕飼育施設の試作(パイロットユニット)

センターに試作した施設に基づいて設計したものを、1981年4月にその一部を改変して、1981年から1982年8月までにパイロットユニット5ヶ所に一つのモデルとして建設した。この施設には、電灯がなく採光が悪く、蚕の這り上りが懸念されたので、1982年6月から木製の回転窓をガラス窓に取り替え、また耐久性の面からニッパヤシ茸をスレート茸に改造した。

b) 鉄製の蚕架、蚕箔の試作(パイロットユニット)(第1図)

1982年に蚕架は、鉄パイプの代りにL字鋼を使用し、ネジ止め部分を溶接にし、側面を対角線にL字鋼を張って補強する。また蚕架の横段を10段にし、横段の間隔を16.5cm、高さを180cmと改善した。1982年2月に現地生産して1パイロットユニットに蚕架5、蚕箔80枚あて5パイロットユニット稚蚕飼育所に貸与した。

c. 試験の方法と成績

飼育方法：稚蚕は、1～2令防乾紙育、蚕箔育、刈桑1日3回給桑、3令は半防乾紙育、条桑1日3回給桑、壮蚕は条桑育、1日3回給桑。

成績：センターの試作施設で稚蚕(1～3令)を飼い、壮蚕の蚕児は条桑育試験その他に供した。これら試験の一部の成績をかかげて考察する。

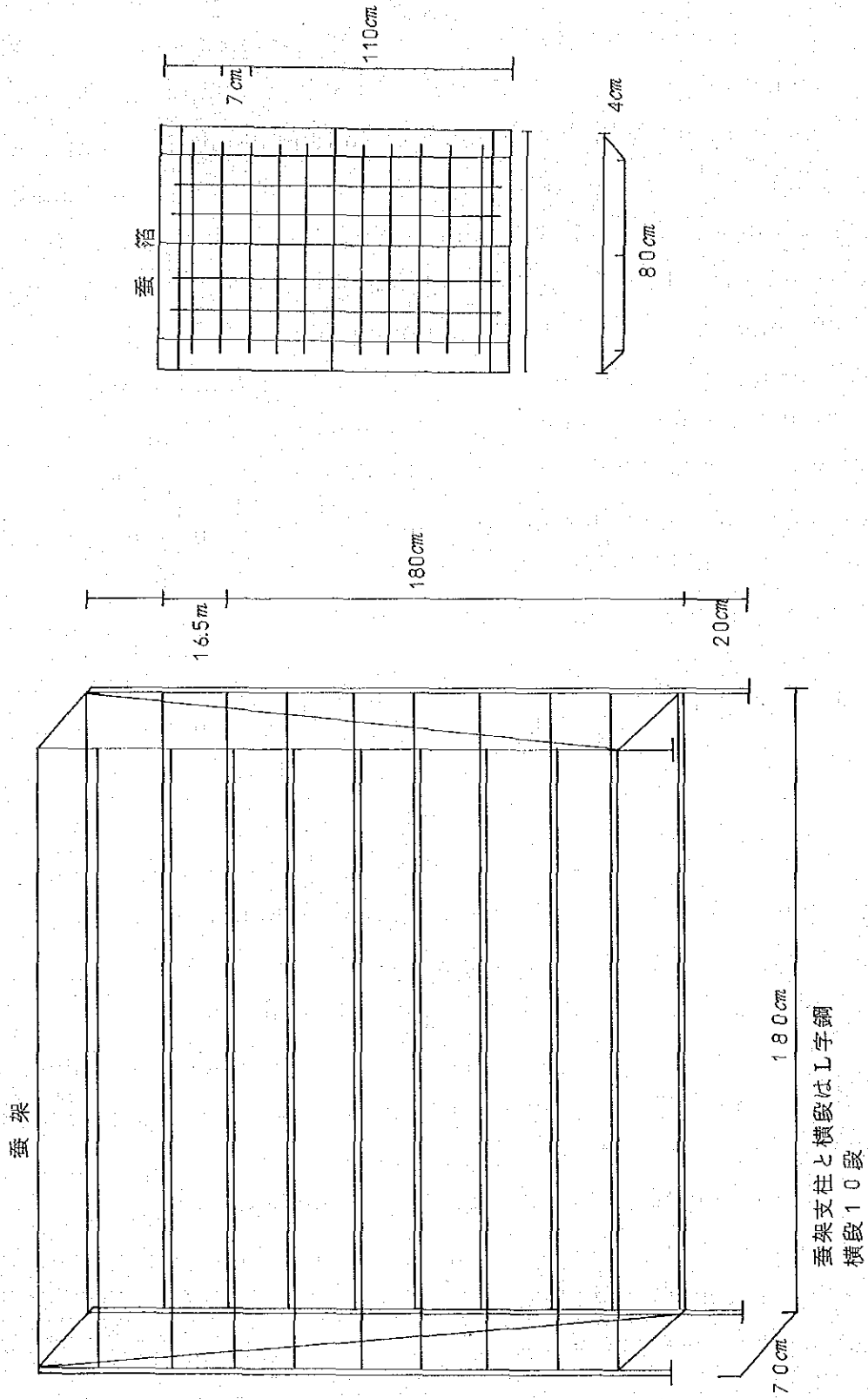
第1表 第2次技術職員(G.T)訓練の養蚕成績

1981年6月～7月

飼育者	掃立箱数	1箱当り 普通繭収量	減蚕歩合 掃立～結繭	繭層重	繭重	繭層歩合	500g 粒数
	箱	Kg	%	cg	g	%	ヶ
A	0.55	3.15	5.6	38.7	1.85	20.9	278
B	0.48	3.47	6.1	41.5	1.93	21.5	262

摘要；供試蚕品種 BN・2×BC・102

第1図 Pilot Unit 適用、現地生産の鉄製蚕架蚕箱の試作



第2表 第3次技術職員(G・T)訓練の養蚕成績

1981年10月~11日

飼育者	掃立箱数	1箱当り 普通繭収量	減蚕歩合 掃立~結繭	繭層重	繭重	繭層歩合	500g 粒数
	箱	Kg	%	cg	g	%	ヶ
A	0.48	27.2	17.9	38.7	1.78	21.7	275
B	0.44	27.4	19.0	38.6	1.79	21.6	287
C	0.40	29.9	11.8	39.3	1.78	22.1	274
D	0.48	27.6	15.5	39.0	1.78	21.9	289

摘要；供試蚕品種 BN・2×BC・102

c) 結果の概要

第1表~第2表の試験成績のとおり1箱当り30Kg前後の普通繭収量を得た。この成績は、雨期、乾期を通して稚蚕飼育を行った結果であり、本施設が現地に適応できることがわかった。

また試作した蚕架、蚕箔も使用上支障はなかった。しかし、段間隔が広ろく、段数が8段で余裕がないので、段間隔を縮め10段にすることが望ましい。(このことは、パイロットユニット用には1982年に改良試作した)

(中村 準一、西 昇一郎 Iyus R. a. Bambang Hr)

(2) 現地防乾紙の質および使用法と桑葉萎凋率との関係

a. 目的

現地の稚蚕飼育所で使われている現地生産のインドネシア防乾紙について、桑葉の萎凋率から防乾効果を調べ、更に効率的使用方法を検討する。

b. 方法と結果の概要

a) 調査方法、成績

第3表 日本、インドネシア防乾紙の桑葉萎凋率

1981年

調査区	時間毎萎凋率				調査室内、温度、湿度
	4時間	6	8	24	
1. 日本、防乾紙上下	6.6	9.0	12.9	26.5	月日 時 °C % 5 6 10 28 85
2. インドネシア防乾紙上下	17.7	30.2	34.8	63.9	14 31 72
3. インドネシア防乾紙上下、包育	18.0	25.1	34.3	65.3	16 30 75
4. 蚕座紙だけ	21.9	32.3	37.8	64.7	7 10 28 85

第4表 インドネシア防乾紙の使用法と桑葉萎凋率

1981年

調査区	時間毎萎凋率				調査室内、温度、湿度
	4時間	6	8	24	
1. 防乾紙上下	30.7	40.2	46.7	62.3	5月12日 10時 28℃ 77
2. 防乾紙上下、蚕座紙	29.5	40.6	48.7	62.6	14 30 72
3. 防乾紙上2、下、蚕座紙	29.9	40.4	47.3	63.6	16 28 77
4. 防乾紙上下、蚕座紙 上に蚕座紙被覆、散水	27.0	34.9	43.5	63.6	13 10 28 77
5. 防乾紙上下、蚕座紙 蚕座にぬれ新聞紙折込み	28.6	37.1	43.8	63.3	

- 摘要； 1. 調査場所 ビリビリ、センター稚蚕飼育室
 2. 桑品種 M.NIGRA、2令用桑、劉桑
 3. 供試量 1点につき第3表150g、第4表100g
 4. 調査方法 材料を試験区別に設定し、時間毎に測定し、桑葉の重量減少率を桑葉萎凋率とみなした。

b) 結果の概要

第3表のように、現地製防乾紙の防乾効果は、日本製にくらべ非常に劣り、時間の経過についてその差が開いている。包育をしてもほとんど効果がない。第4表のように、使用法に手を加えても防乾効果が期待できない。現地生産の防乾紙は、日本製防乾紙にくらべて本質的に違うようである。現地では、その防乾紙を過信して使用しているが、極めて危険であり、むしろ蚕室内の保湿に留意し、乾期には日中の給桑回数を1回多くするなど給与桑の萎凋防止につとめる必要がある。

(西昇一郎 Iyus R. a)

(3) 稚蚕期における高度さらし粉による蚕体消毒の実用化

a. 目的

従来、蚕体消毒剤としてパフソールを使用していたが、現地コウジカビ病菌がホルマリンに耐性を有すること、および同薬剤の入手が困難である。したがって、これに代る薬剤としての高度さらし粉について、当プロジェクト病理部門で開発した方法を実用的に使用し、その効果と蚕への影響を検討する。

b. 方法と結果の概要

a) 方法

- (a) 薬剤は高度さらし粉5%粉剤(高度さらし粉5:消石灰95)で、0.1m²当り1令1gr、2令2gr、3令3grをポリ網製ふるいで蚕座に散布する。
- (b) 散布時期は掃立時と2令桑付時、3令桑付時と3令の眠網入れ時に行う。
- (c) 本調査は、病原菌を接種するなどの試験ではなく、実用的に使用して、蚕の発育観察および作柄や繭質で判断したものである。

b) 結果の概要(成績は、本報告の蚕飼育試験成績を参照)

(a) 結果

1981年にセンターで5回、サブセンターで5回、更に1982年も引続き蚕飼育の都度、本剤による蚕体消毒を実施した結果、硬化病の発生例はなく、その他蚕病も僅かであった。作柄も安定し蚕の発育や繭質への影響も見られなかった。したがって、1982年3月からパイロットユニット稚蚕飼育に演習技術として導入している。

(b) 使用上の注意

掃立時の蟻蚕の消毒で薬剤が落下し過ぎる場合はふるいの内側にガーゼを1枚敷く。掃立時の蟻蚕や2令、3令桑付時の消毒は、消毒後なるべく早く給桑し、3令では桑を良く食べたところで蚕体消毒をして眠網入を行う。なるべく消毒剤を食下しないように、また濡れ桑は絶体にさける。消毒薬剤に混ぜる消石灰は、良質の乾いた消石灰をふるいにかけておき、高度さらし粉とよく混和させむらのないようにつく製する。つく製後2日以上経つと効力が減少するので使用前につく製するようにする。

(西 昇一郎 Iyus R.A. Baharuddin A.)

(4) アニ・アニの稚蚕用桑収穫への活用

a. 目的

東南アジアでは古くからアニ・アニ(ANI-ANI)で稲穂の収穫をしている。稚蚕飼育所では、剪定鋏を使用する傾向であるが、剪定鋏は稚蚕用桑の仕立に利用し、アニ・アニを1~3令用桑の摘梢収穫に活用する。

b. 結果の概要

a) 技術の効用・特長(第2図)

現地農家では、日頃から使い慣れており、一般に要領よく使用できる用具である。稚蚕用桑は、普通伐採後(仕立)30~40日以内に伸長した若い枝を収穫するので、また枝条の木化が進んでおらず細目で切りやすい。パイロットユニットやセンターでの実演結果、十分活用できる。

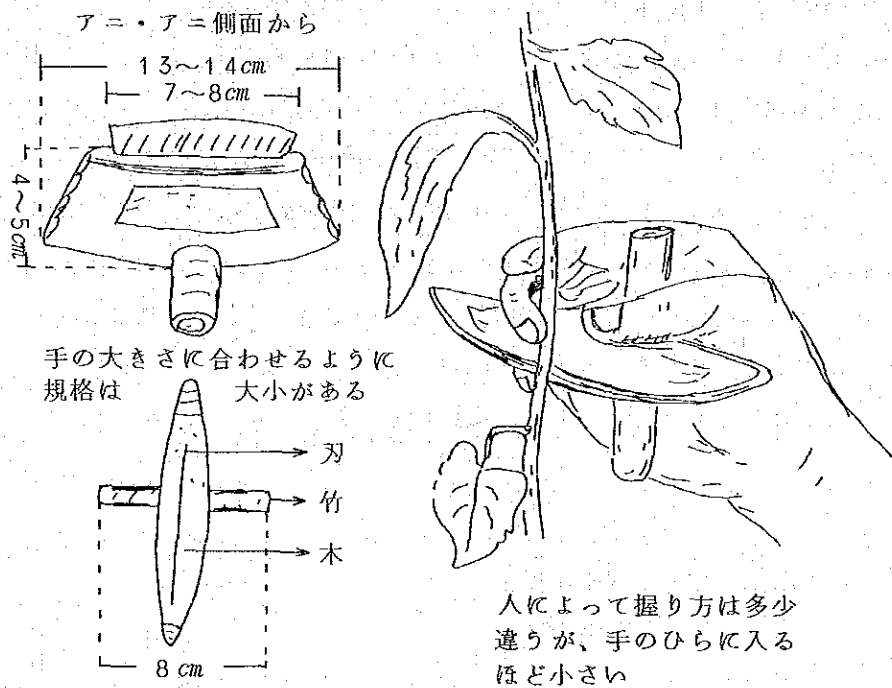
b) 技術の背景と利用上の注意

剪定鋏で稚蚕用桑を収穫する傾向にあるが、日本製の剪定鋏は、高価なうえ入手が難しい。現地で販売されているものは、良質なものが少なく不良品でも1丁2,500~3,000ルピアしている。アニ・アニは1ケ250ルピアで市場(バサール)で容易に入手できる。

利用に当り、替え刃が販売されているので、歯こぼれした場合、刃のみ交換できる。刃は良質のものを選ぶ必要がある。

(西 昇一郎 Iyus R.A.)

第2図 アニ・アニによる稚蚕用桑の収穫



第5表 雨期、蚕飼育標準表(1~3令)

対蚕種1箱当り

令	日 順		給 桑				蚕座面積 m ²	摘 要	備 考
	全令	令中	時刻 時 ⁹	回数 回 ¹	1回量 g ⁵⁰	1日量 g ²⁴⁰			
I	1	1	12	2	60	240	0.07	掃 立 整 座	蟻蚕消毒、高度さらし粉5%、1g/0.1m ² 11時掃下し。
			17	3	130				
	2	2	7	4	100	480	0.20		蚕室の補湿：掃立前日から3日目の昼まで補湿に注意、2令も桑付から2日目の昼まで補湿。
			12	5	130				
3	3	17	6	250	700	0.54		調桑幅：1令—1~2回、0.2~0.3cm 3~5回、0.4~0.5cm 6~10回、0.8cm 桑止め 0.5cm	
		7	7	200					
4	4	12	10	260	380	0.63	桑 ど め 分 箱	蚕箔の差し替え 拭座、消石灰散布、室内の換気乾燥	
		17	11	120					
II	5	1	12	1	300	1,200	0.72	桑 づ け 起 除	消毒：5% 2g/0.1m ² ・網入れ 除沙は、各令とも蚕の這い上りを見て、まだ残桑のある給桑の間に作業
			15	2	300				
			18	3	600				
	6	2	7	4	600	2,400	1.10	網 入	(蚕の経過により5回目にて拭座、網入) 分箱網入
12			5	600	1.30				
7	3	17	6	1,200		1,200	2.16	桑 ど め 分 箱	調桑幅：2令桑付0.9cm 2回目から1.2~2cm、桑止め0.6cm 眠除、消石灰散布、換気、乾燥
		7	7	800					
III	8	1	12	1	1.4	5.4		消毒、桑付	高度さらし粉5% 3g/0.1m ² 、分箱網入
			17	2	4.0				
	9	2	7	3	3.0	13.0	3.20		起除、分箱
			12	4	4.0				
			17	5	6.0				
	10	3	7	6	5.0	12.2	3.40	消毒、網入	経過が早いと8回目で桑どめ
12			7	4.0					
17			8	3.2					
11	4	8	9	1.6	1.6	3.60	桑 ど め 配 蚕	座わり、消石灰散布 就眠したら早朝か夕方に配蚕	
		12							
12	5	7							

第6表 兩期蚕飼育標準表(4~5令)

対蚕種1箱当り

令	日 順		給 桑				蚕座面積 m ²	摘 要	備 考
	全令	令中	時刻	回数	1回量 kg	1日量 kg			
Ⅳ	12	1	15	1	16	16	5.4	消毒、桑付	蚕体消毒：高度さらし粉10%、60g/1m ² か、さらし粉1,000倍液、網入(ロープ入)
	13	2	7	2	8	40	8.1	起 除	
			12	3	8				
	14	3	7	5	10	44		消毒、網入	
			12	6	10				
15	4	7	8	4	6	10.0	引 青	遅眠蚕をとり経過調整 蚕座に消石灰散布	
		12	9	2					
16	5	7							
		12							
Ⅴ	17	1	7	1	6	36		消毒、桑付	網入(ロープ入れ)。消毒は4令に同じ
			12	2	10				
			17	3	20				
	18	2	7	4	20	96	14	起 除	起蚕は弱いので余り早く除沙をしない。
			12	5	26				
			17	6	50				
	19	3	7	7	30	126	16-18	消 毒	蚕体消毒は食桑良好時にする
			12	8	30				
20	4	7	10	40	160		網 入		
		12	11	40					
21	5	7	13	40	160		除 沙		
		12	14	40					
22	6	7	16	35	125		消 毒		
		12	17	30					
23	7	7	16	35	20		網 入		
		12	17	30					
24	7	8	19	15	20		は し り	次の給桑前に除沙、蚕座の平坦化	
		11	20	5					
25	7	11	20	5			終 熟	一斉上簇	

第7表 乾期蚕飼育標準表(1~3令)

対蚕種1箱当り

令	日 順		給 桑				蚕座面積 m ²	摘 要	備 考
	全令	令中	時刻	回数	1回量	1日量			
I	1	1	9	1	50	230	0.07	掃 立 整 座	蟻蚕消毒：高度さらし粉5%、1 μ /0.1m ² 11時掃下し 蚕室の補湿：掃立前日から3日 目の昼まで補湿に注意、2令も桑付から2日 目の昼まで補湿 調桑幅：1令—1~2回、0.2~0.3cm 3~5回、0.4~0.5cm 6~8回、0.8cm 桑どめ 0.5cm
			12	2	60				
			17	3	120				
	2	2	7	4	100	470	0.20		
12			5	120					
3	3	17	6	250	700	0.36			
		7	7	200					
4	4	12	8	300			桑 ど め	蚕箔の差し替え	
		17	9	200					
II		1	7			400	0.63	分 箔	消石灰散布、室内の換気、乾燥
			12						
			17						
			7	1	400				
5	2	7	2	300	1500	0.72	起 除	除沙は、各令とも蚕の這い上りを見て、まだ 残桑のある次の給桑の間に作業	
		12	3	300					
6	3	17	4	900		1.10	網 入 れ	分箔網、早目がよい。	
		7	5	600					
7	3	12	6	600	1400	1.30	眠 除	調桑幅：2令桑付0.9cm 2回目から1.2~2cm 桑止め 0.6cm	
		17	7	200					
III		4	7			400	2.16		消石灰散布、換気、乾燥
			12						
			17						
			7	1	1.4				
8	2	17	2	4.0					
		7	3	2.0					
9	3	12	4	2.4	10.4		起除、分箔		
		17	5	6.0					
10	4	7	6	5.0		3.40	消毒、網入		
		12	7	4.0					
11	4	17	8	2.0			眠 除 桑 ど め		
		7							
12	4	12				3.60	配 蚕	座わり、消石灰散布 就眠したら早朝か夕方に配蚕	
		17							

第8表 乾期蚕飼育標準表(4~5令)

対蚕種1箱当り

令	日 順		給 桑				蚕座面積 m ²	摘 要	備 考
	全令	令中	時刻	回数	1回量 kg	1日量 kg			
Ⅳ	10	1	7時	1	12	12	5.4	消毒、桑付	蚕体消毒：高度さらし粉10% 60g/m ² か、さらし粉、1,000倍液、網入(ロープ入)
	11	2	7	2	8	40	8.1	起 除	
			12	3	8				
	12	3	17	4	24	46		消毒、網入	
			7	5	10				
			12	6	10				
13	4	17	7	26	12		眠 除		
		7	8	6					
14	5	12	9	4	2		引 青	遅眠蚕をとり経過調整	
		17	10	2					
15	1	7			30		消毒、桑付	蚕座に消石灰散布	
		12	1	6					
16	2	17	2	24	77	14	起 除	網入(ロープ入れ)。消毒は4令と同じ	
		7	3	16					
17	3	12	4	16	110	16~18	消 毒	蚕体消毒は食桑良好時にする。	
		17	5	35					
18	4	7	6	25	150		網 入		
		12	7	25					
19	5	17	8	60	160		除 沙		
		7	9	40					
20	6	12	10	30	120		消 毒		
		17	11	70					
21	7	7	12	40	15		網 入		
		12	13	40					
22	8	17	14	80			は し り	次の給桑前に除沙、蚕座の平坦化	
		7	15	30					
23	9	12	16	30			終 熟	一斉上簇	
		17	17	60					
24	10	8	18	10					
		10	19	5					

蚕飼育標準表 付表

1983年1月

第9表 雨期；経過日数、給桑量、温度、湿度

(センター蚕室の月別温度、湿度は第4～7図)

令	経過日数			給桑量	蚕に適する		センター蚕室における温度、湿度(11～4月)						
	食桑中	眠中	令中		温度	湿度	年	温度	最高	最低	湿度	最高	最低
	日時	日時	日時	kg	℃	%		℃	℃	℃	%	%	%
1	3.03	1.00	4.03	1.8	27～28	90	1981	25.6	28.0	23.6	78.8	85.8	70.0
2	2.00	1.00	3.00	4.8	26～27	80	1982	27.1	30.0	25.3	77.0	85.2	66.8
3	2.20	1.07	4.03	32.2	25～26	75							
4	2.22	1.18	4.16	106.0	22～25	75	1981	25.3	27.3	23.8	80.3	86.8	72.7
5	6.04	—	6.04	723.0	22～25	75	1982	26.5	28.9	24.7	80.3	87.2	71.7
全令	17.01	5.01	22.02	867.8									

備考：1. 経過日数では、wanio, Ugiのような平坦地では本表より1日くらい早くなり、Barakaのような高標高地では3日くらい遅い傾向がある。

2. 桑付けは、本表の眠中時間にこだわらず、2令は起きそろうってから、3～5令は起蚕が約90%の頃行う。4眠で経過を早口、遅口に別けたら起きそろうてからやる。

3. 蚕に適する温度、湿度は基準を示したに過ぎない(総合養蚕学ほかより引用)

4. センターは、標高約200mの小高い山頂にある。雨期の温度・湿度は1～2月を中心に6ヶ月間、1～3令数字は稚蚕室、4～5令は壮蚕室の調査。

第10表 乾期；経過日数、給桑量、温度、湿度

(センター蚕室の月別温度、湿度は第4～7図)

令	経過日数			給桑量	蚕に適する		センター蚕室における温度、湿度(5～10月)						
	食桑中	眠中	令中		温度	湿度	年	温度	最高	最低	湿度	最高	最低
	日時	日時	日時	kg	℃	%		℃	℃	℃	%	%	%
1	2.08	1.00	3.08	1.4	27～28	90	1981	27.1	30.4	24.5	73.8	83.8	60.5
2	2.00	0.20	2.20	3.3	26～27	80	1982	28.5	32.5	25.4	59.4	69.9	47.5
3	2.04	1.00	3.04	26.8	25～26	75							
4	3.00	1.19	4.19	110.0	22～25	75	1981	27.3	30.4	24.8	69.5	79.2	55.8
5	5.22	—	5.22	662.0	22～25	75	1982	26.0	29.8	23.1	63.7	73.2	52.2
全令	15.10	4.15	20.01	803.5									

備考：1. 給桑量は掃立月(乾期、雨期とも)により差が見られる。乾期、雨期とも、稚蚕期(1～3令)は新消量で、壮蚕期(4～5令)は条桑量である。

2. センターにおける乾期の温度湿度は、7～8月を中心に6ヶ月間の調査である。1～3令数字は稚蚕室、4～5令数字は壮蚕室の調査。

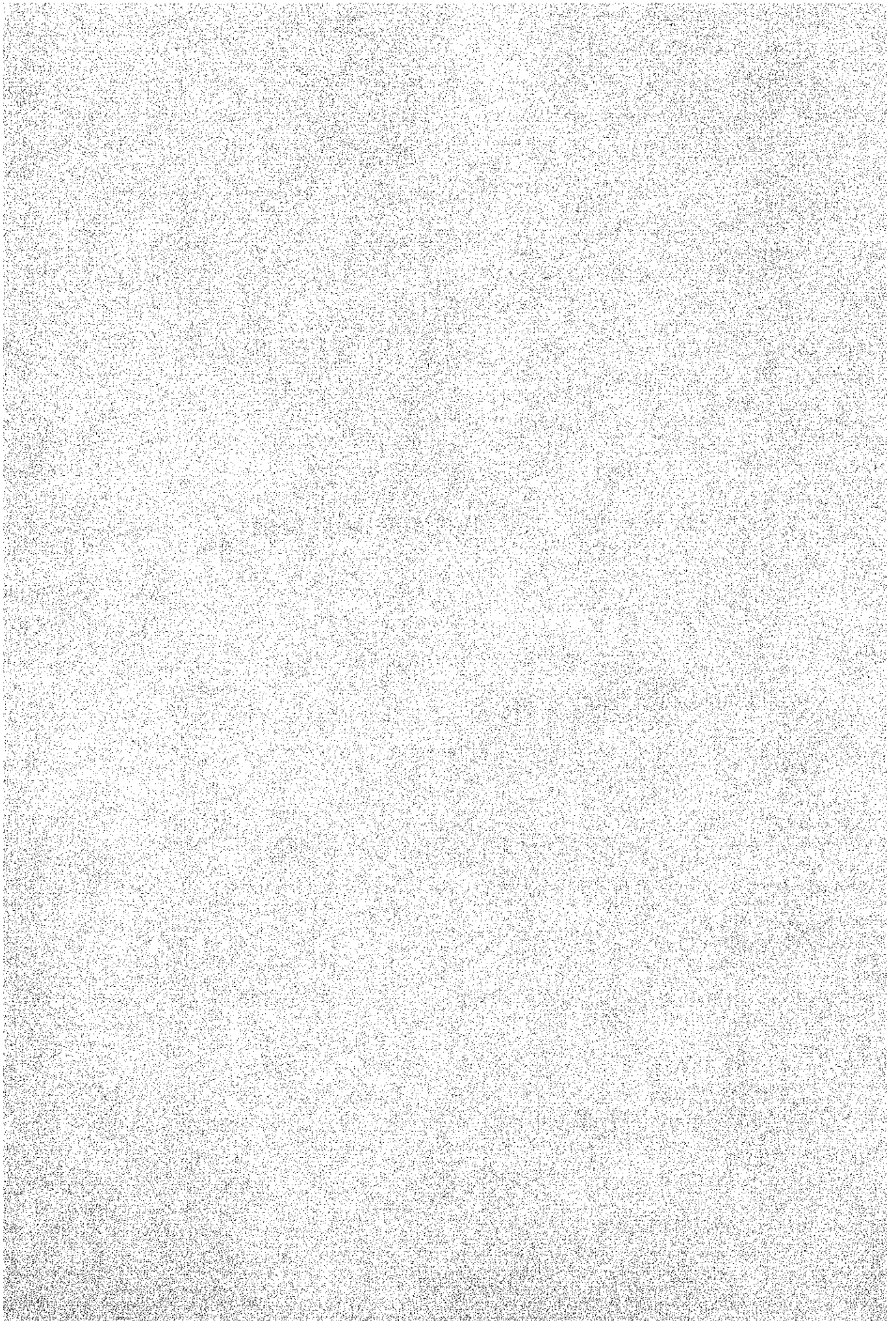
3. 上記のほかは、雨期と同様。

参 考 資 料 3

蚕 飼 育 技 術 開 発 の た め の 実 用 試 験

2. 壮蚕飼育法

- (1) 壮蚕飼育施設（屋外条桑育施設）の試作と蚕飼育調査
- (2) 壮蚕期における消石灰、高度さらし粉液使用が蚕に及ぼす影響
- (3) 蚕室内の微気象調査（稚蚕、壮蚕室の温湿度）



(1) 壮蚕飼育施設（屋外条桑育施設）の試作と蚕飼育調査

a. 目的

蚕の飼育量に対する効率面を中心に、防暑、防乾、適度な気流の導入を考えて、現地資材を使い自作可能な施設を試作して、現地に適用する。

b. 試作の経過と結果の概要

a) 試作の経過

センターに現地に適用する目的で試作されていた屋外条桑育1型（JR80-55参照）で1981年5月に飼育試験を行ったが、荒風により桑は萎凋するので、周囲の竹囲いをアンペラ囲いに改造して6月に飼育試験をした。次いで1982年6月にこれまで設計した4令別棟蚕室（2箱用）壮蚕飼育施設（1箱用）、同（1.5箱用）の中で、壮蚕飼育施設（1.5箱用）Ⅱ型を試作した。（第3図）

同施設で6月と8月に蚕飼育を行ったが、今後大量飼育により検討する。

b) 蚕飼育調査

第11表 飼育成績

（1981年5月）

試験区	供試箱数	普通繭収量 （対1箱）	減蚕歩合 掃立～結繭	繭層重	繭重	繭層歩合	500g 粒数
	箱	Kg	%	cg	g	%	ヶ
室内条桑育	0.5	29.9	8.0	38.2	1.83	20.9	289
屋外条桑育	0.15	29.6	10.9	36.8	1.81	20.4	289

第12表 飼育成績

（1981年6月）

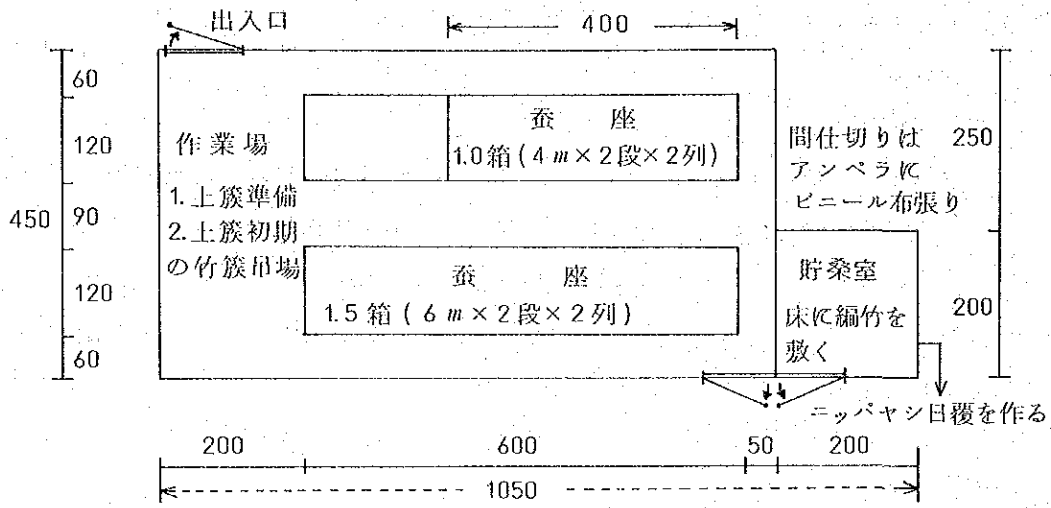
試験区	供試箱数	普通繭収量 （対1箱）	減蚕歩合 掃立～結繭	繭層重	繭重	繭層歩合	500g 粒数
	箱	Kg	%	cg	g	%	ヶ
室内条桑育A	0.55	31.5	5.6	38.7	1.85	20.9	278
＃ B	0.48	34.7	6.1	41.5	1.93	21.5	262
屋外条桑育	0.44	29.9	13.3	37.8	1.79	21.1	280

c) 結果の概要

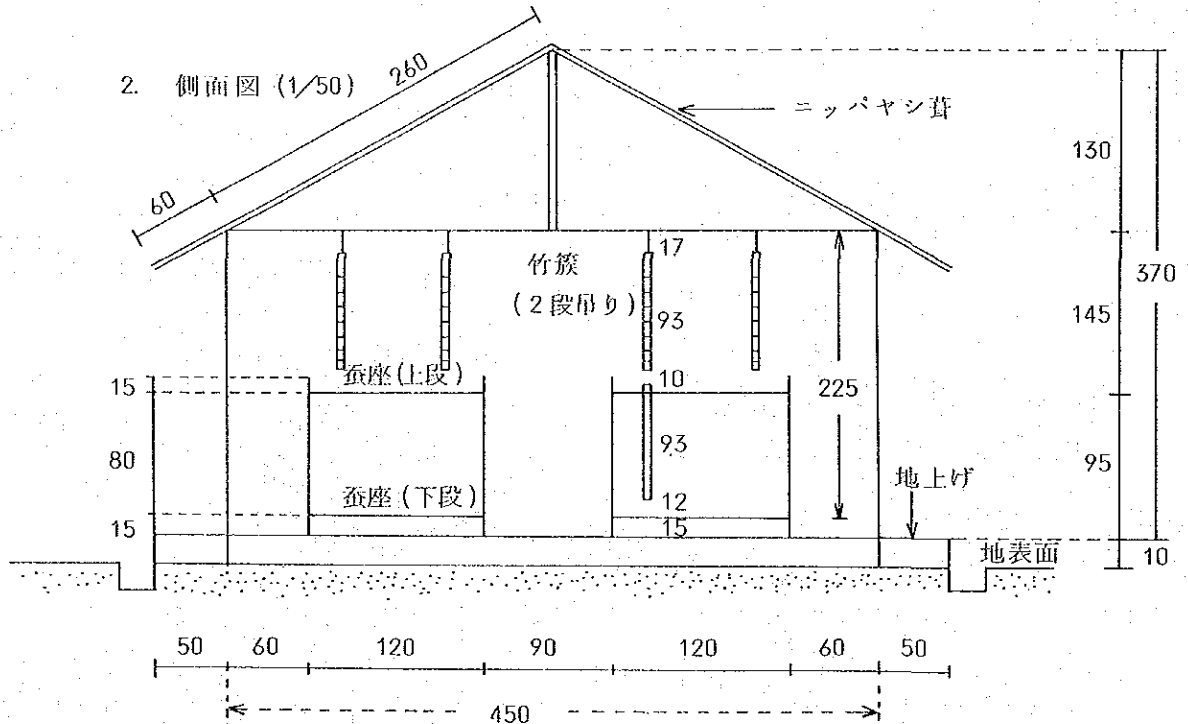
(a) 蚕飼育成績では、室外育は室内育に較べて5月蚕ではほとんど差がない。6月蚕では、室外育は減蚕歩合が多く、収繭量や繭質がやや劣った。しかし当地方の成績としては良

第3図 屋外糸桑育施設 (1.5箱)

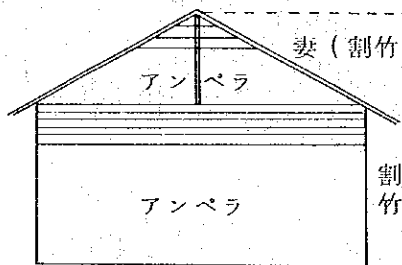
1. 平面図 (1/100)



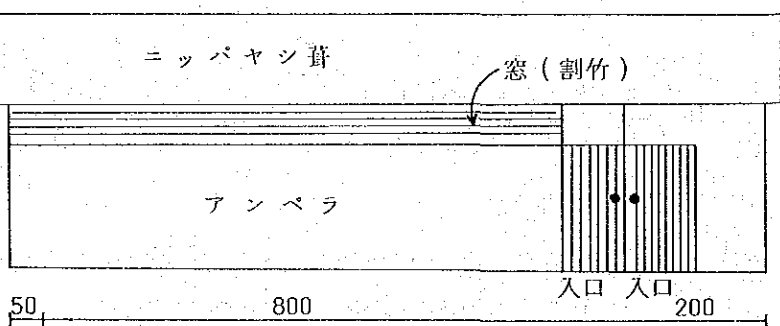
2. 側面図 (1/50)



3. 東側面図 (1/100) (西側は窓なし)



4. 北正面図 (1/100)



好である。乾期における高温乾燥に対して、給与桑の萎凋防止につとめると共に、葉質悪化の場合は4回給桑にするなど臨機の措置をとる。

(b) 施設では、棟の高さを低く、建物の幅を狭くすれば、製作は容易であるが、高温、乾燥時に外気の影響を受けやすく、幅が狭いと1列飼育になり、かえって蚕飼育量に対する経済効率が低くなる。したがってⅡ型では、改良竹簇の2段吊り下げが可能な程度にやや高くし、やや幅を広くとり2列2段飼育を可能にした。また農家の住宅密集地帯で風が少ないところでは、周囲は竹囲いで良いが、風が強いところでは、アンペラ囲いで側壁上部(軒下)を横竹囲いにすれば、明り窓になり気流の導入にも好適である。竹材には消石灰乳を塗布し、土間に消石灰を散布する。陽当りの強い方に日覆いや植樹をして防暑対策を講ずることが望ましい。鼠の被害対策としては、決め手はないが、殺鼠剤(凝血剤)の「Racumin」を蚕飼育前に根気よく使用して予防しておく必要がある。

(西 昇一郎 Iyus R. a. Bambang Hr)

(2) 壮蚕期における消石灰、高度さらし粉液使用が蚕に及ぼす影響

a. 目的

蚕座における病原菌の隔離作用や不良ガスの吸収に役立つといわれる消石灰(現地製)および1980年度後期から蚕体消毒剤としてパフソールに替えて使用しようとしている高度さらし粉1,000倍液が、蚕児の発育や収繭、繭質に及ぼす影響について試験する。

b. 方法と結果の概要

a) 試験の方法、成績

第13表 飼育成績

試験区	4令～結繭 減蚕歩合	普通繭 蚕歩合	対4令1万頭 普通繭収量	1ℓ粒数	繭重	繭層重	繭層歩合
	%	%	Kg	ヶ	g	cg	%
対 照	12.6	98	15.9	83	1.88	40.8	21.7
消 石 灰	9.2	97	16.5	83	1.88	41.0	21.8
高度さらし粉液	9.0	98	16.6	82	1.90	40.8	21.6

- 摘要：1. 試験時期 1981年2月11日掃立蚕4～5令期
 2. 供試蚕品種 BN・2×BC・102
 3. 供試蚕数 1小区2,000頭3連制
 4. 供理方法 (1)対 照：無処理。(2)消石灰：1日1回給桑前10g/0.1m²散布。
 (3)高度さらし粉液：1日1回給桑前1,000倍液1～2ℓ/1箱散布。

b) 結果の概要

減蚕歩合や普通繭収量では、分散分析の結果、有意差はなく、繭質の成績でも、試験区間に差は認められない。本試験は、病原菌の接種など行わず、蚕に対する生理的な影響を見たものであるが、眠中や壮蚕期の給桑前の蚕座に消石灰を散布することや、蚕体消毒に高度さら粉液（1000倍）を散布しても、蚕への悪影響はない。したがってコウジカビ病など蚕病予防に高度さらし粉液を蚕体消毒剤として使用することは有効であると思われる。

（西 昇一郎 Iyus R. a. Bambang Hr）

(3) 蚕室内の微気象調査（稚蚕、壮蚕室の温湿度）

a. 目的

温湿度の自動制御装置が望めない当地方においては、熱帯下における自然環境に左右される飼育室の微気象について把握し、蚕期の選択や飼育技術の改善に資する。

b. 方法と結果の概要

a) 調査方法

1980年12月にセンターで予備調査を行い、1981年1月1日から長期にわたる調査を開始したもので、現在、ソツベン地方（サブセンター）でも調査中であり、今後、年次の、地域的に調査を継続する。調査は週巻自記温湿度計による。

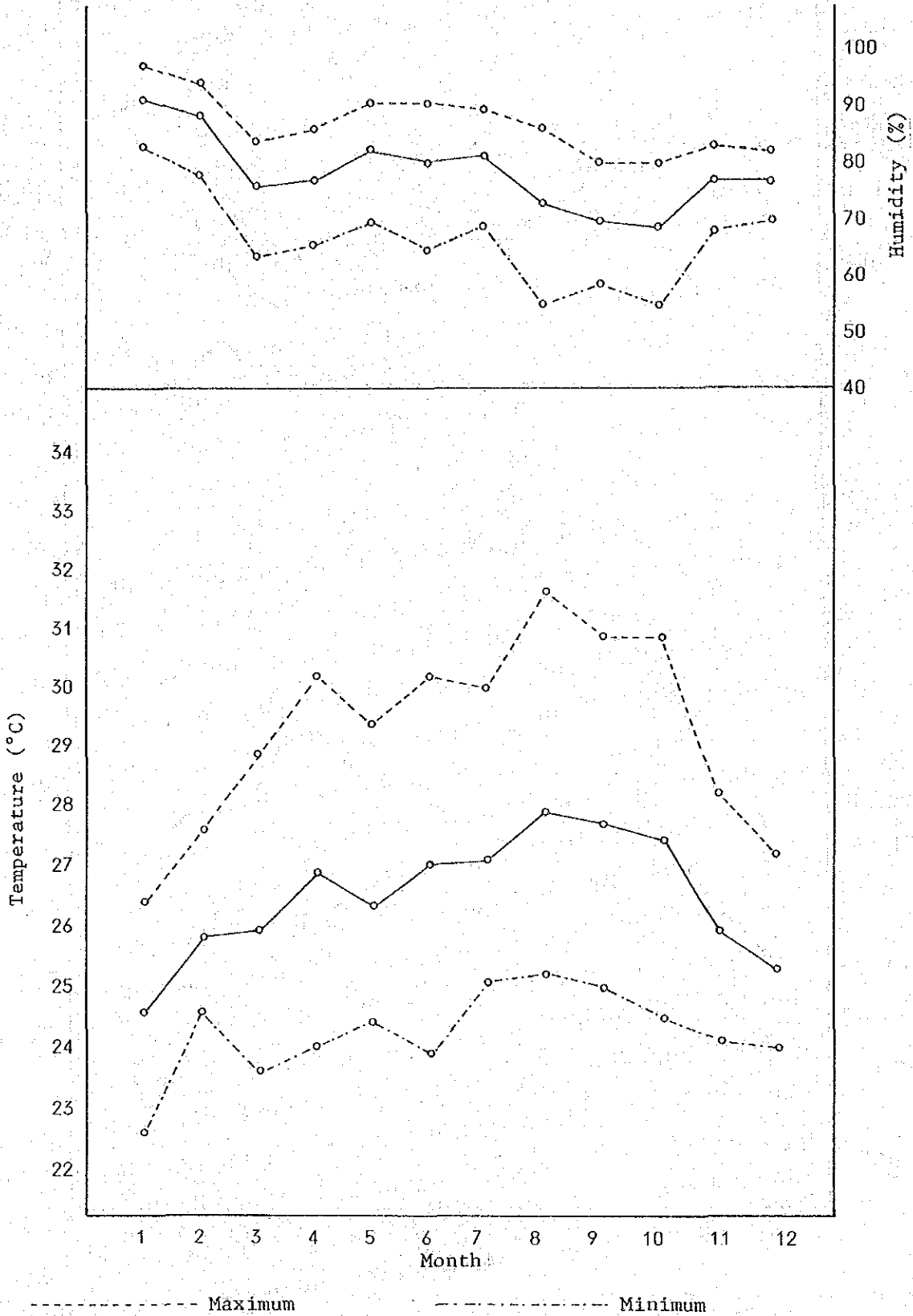
b) 結果の概要

調査結果は、第4図～第7図のとおりである。1981年と1982年の雨期と乾期の様相は、ほぼ似ており、両年とも温湿度の時期的変化がみられるが、1982年は8月以降とくに温度が高く湿度も低く、9月の月平均湿度が50%と極端に低い。

9月頃に乾期の山があり、温度が高く、湿度は極端に低い。この時期は、桑の収量が低く、葉質も悪化する上、湿度がとくに低いので給与桑が萎凋しやすく、蚕飼育の時期としては好ましくないように思われる。今後、集積される資料に基づいて、当地方に適切な蚕期の選択が望まれる。

（西 昇一郎 Wariso P.）

Fig 4. Temperature and humidity inside of the young silkworm rearing building 1981.



— Average of room temperature / humidity of every two hours throughout a day.

Fig 5. Temperature and humidity inside of the young silkworm rearing building 1982

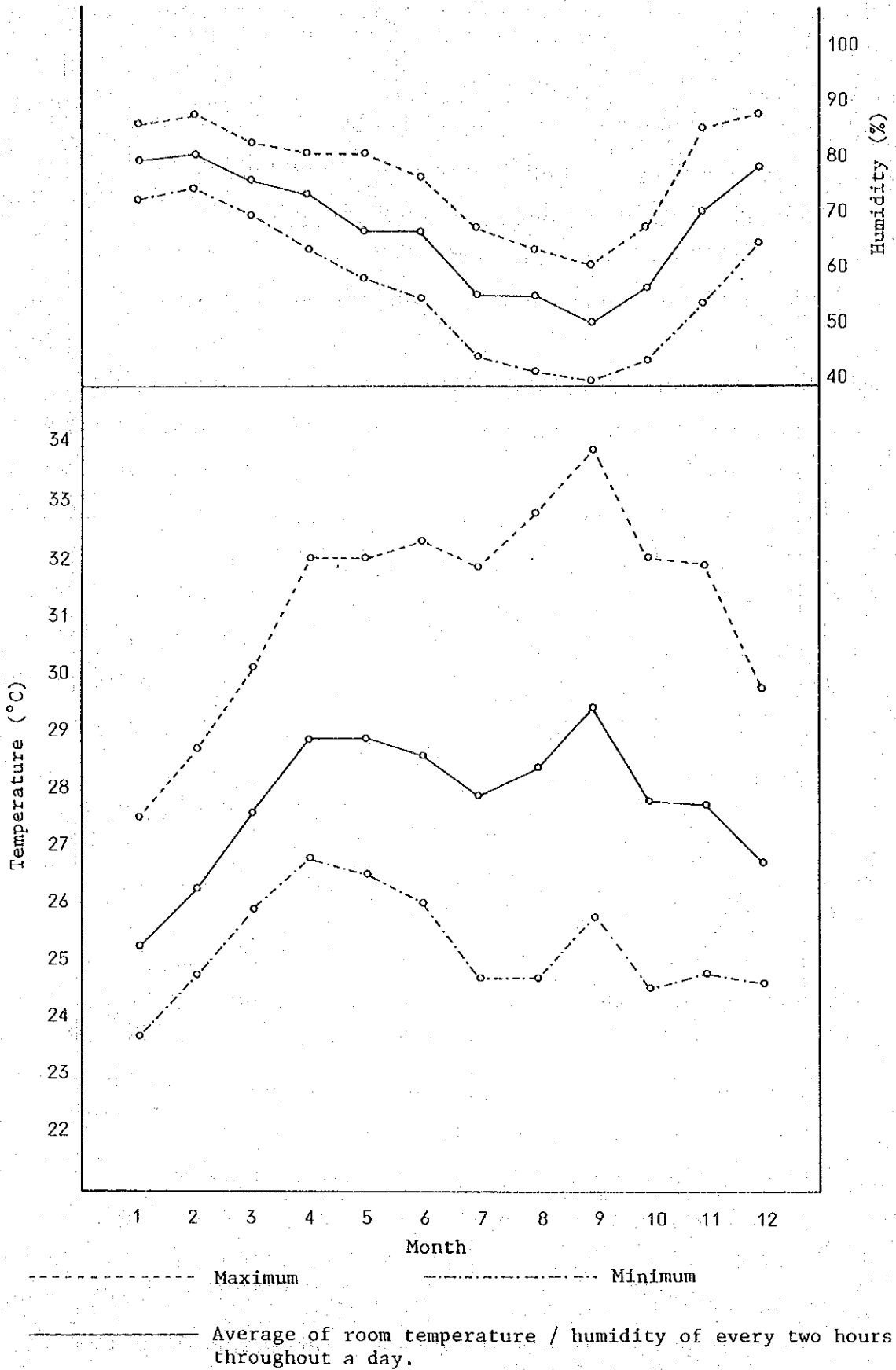
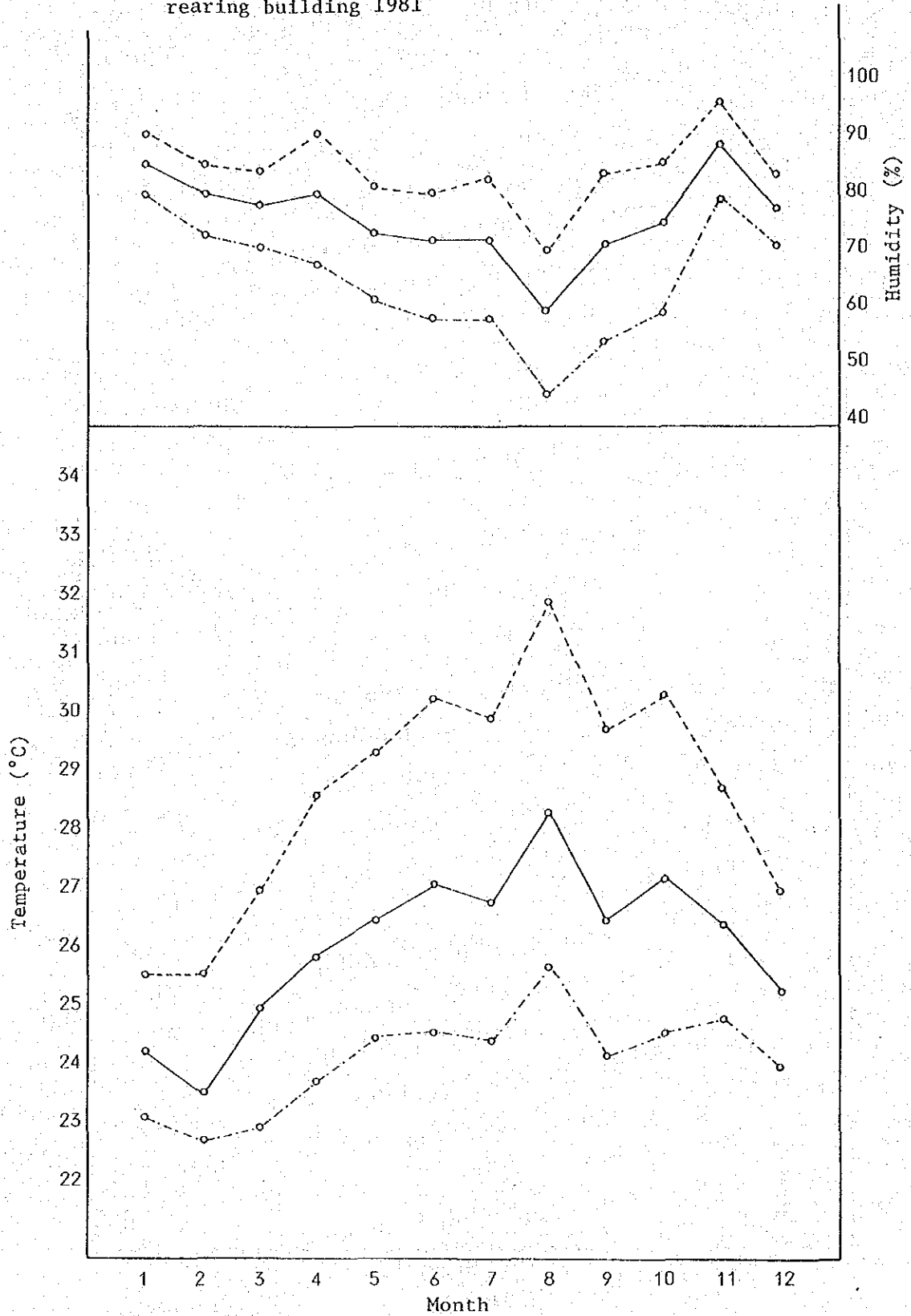
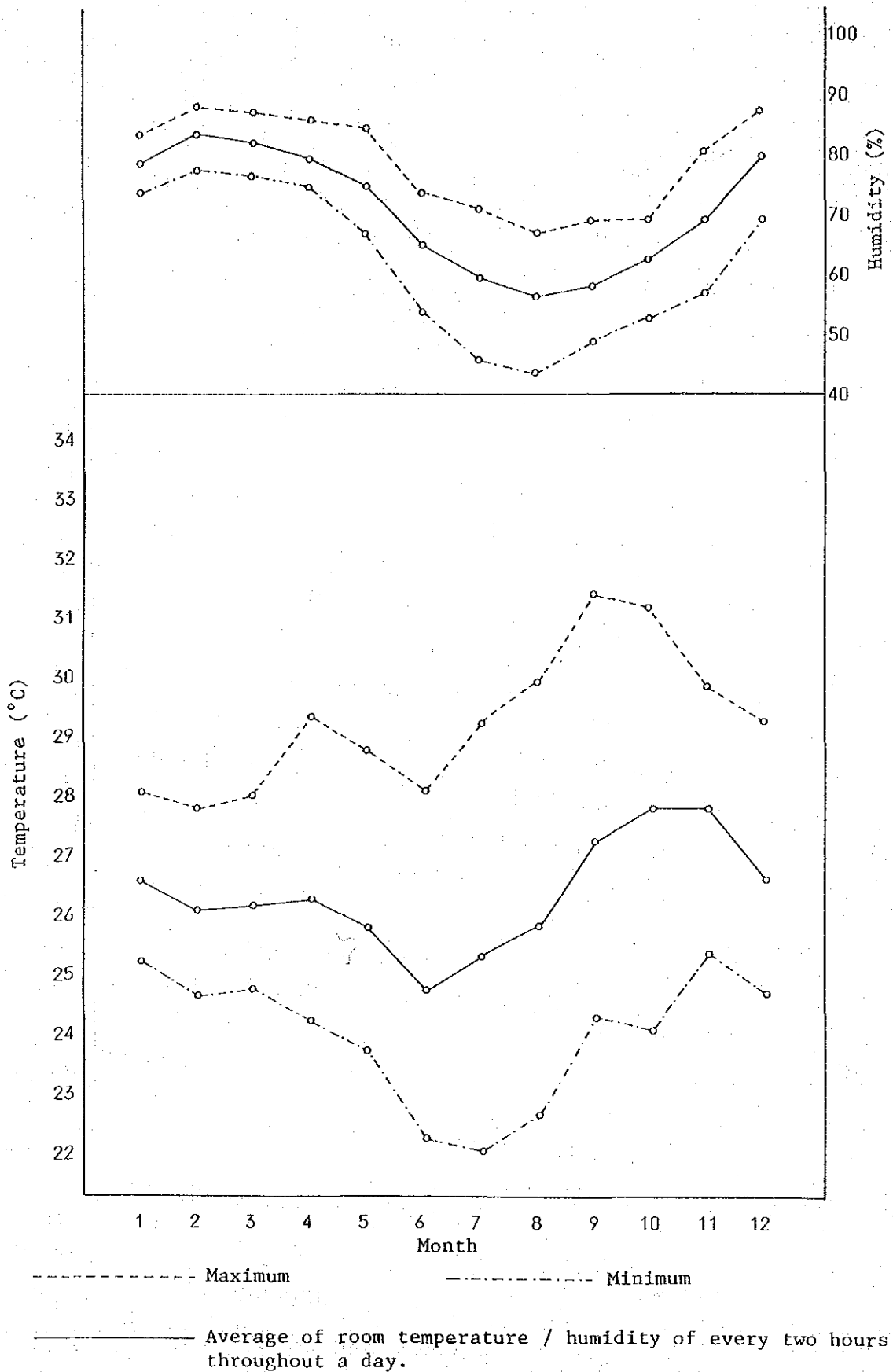


Fig 6. Temperature and humidity inside of the grown silkworm rearing building 1981



----- Maximum
 ----- Minimum
 _____ Average of room temperature / humidity of every two hours throughout a day.

Fig 7. Temperature and humidity inside of the grown silkworm rearing building 1982

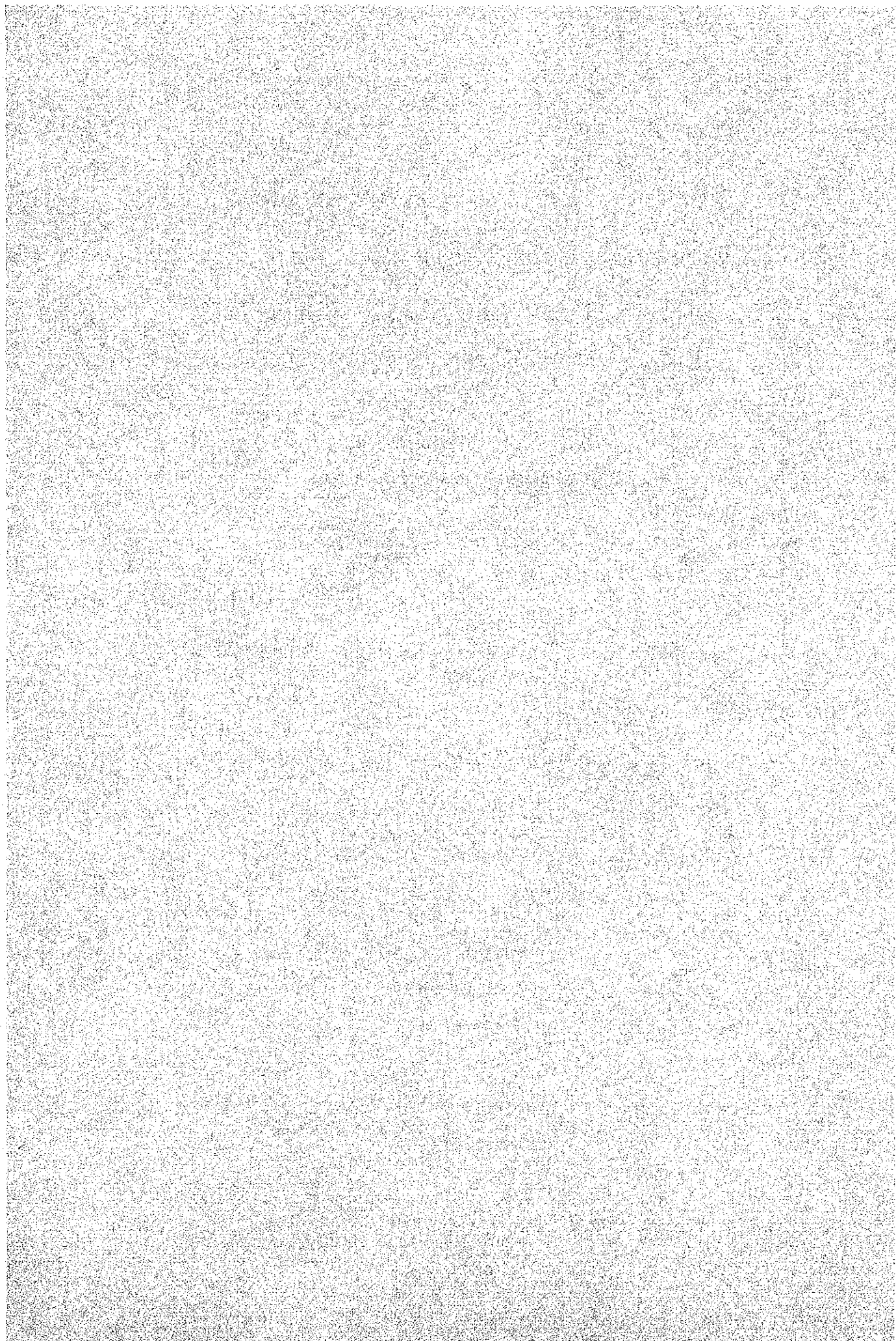


参 考 資 料 4

蚕飼育技術開発のための実用試験

3. 上蔭技術と繭質の改善

- (1) 竹蔭の改良と実用化
- (2) 条払いによる熟蚕の収集法と竹蔭への熟蚕の振り込み法
- (3) 竹蔭の効果的使用法
- (4) 竹蔭による自然上蔭法
- (5) 交雑種における上蔭と発蛾との関係調査
- (6) 繭質の改善



(1) 竹簇の改良と実用化

a. 目的

現地で利用できる簇器の素材では竹が適当で、簇器の形としては、当地方の飼育法や蚕室の構造からみて、長方形か正方形で吊り下げ方式が合理的である。上簇技術の改善に連動し、繭質向上をねらいとして竹簇を改良試作し実用化をはかる。

b. 試作の経過と結果の概要

a) 試作の経過

(a) 現地における竹簇の状況

1981年1月～3月に行われた農民訓練で、農家が使用している竹簇で上簇作業を行い、考察する機会を得た。現地の竹簇は、大型で重いため取り扱いが不便で、汚染繭や奇型繭が多く、営繭場所が簇の上部に集中するため登簇、営繭の効率が極めて悪いことがわかった。

(b) 改良試作の方針

登簇、営繭を効率化するには、蚕の趨向性である背地性の応用から人為的に簇の上下を反転する必要がある。そのために試作の重点を簇の取り扱いなど作業が容易になる程度に簇を軽量化する。

軽量化の目標を在来簇に対して、大きさを70%ぐらい、重さを1/3程度にする。

(c) 試作の経過と試作品

簇の軽量化には、使用する竹の厚さのほか、横竹の段間隔や横竹の幅をどの程度縮小できるか、試作の途中で試作竹簇を使って、熟蚕の営繭行動に差し支えなく、正常繭を得られる範囲を知るために次の調査を行った。その結果、a. 横竹の間隔は2.8cm、b. 横竹の幅は2.8～3.0cm、c. 横竹の厚さは、最上段、中段、下段の3本は補強のため0.5～0.6cm、他の横段は0.3～0.4cmを目安に製作することにした。

更に竹簇の大きさと上簇蚕数の関係から、次表のように当初よりやや大型化した。

第14表 横竹の段間隔と繭長、繭幅との関係

簇器別	試作竹簇(4種)の場所別						回転簇A		回転簇B	
	2.0～2.4cm		2.5～2.9cm		3.0～3.5cm		(3.0cm)		(3.0cm)	
繭長、繭幅	長	幅	長	幅	長	幅	長	幅	長	幅
最高	3.6cm	1.9cm	3.6	2.1	3.5	2.1	3.4	2.0	3.5	2.2
最低	3.1	1.7	3.3	1.8	3.2	1.8	3.1	1.8	3.1	1.8
平均	3.3	1.8	3.5	1.9	3.4	1.9	3.2	1.9	3.3	1.9

注：1. 横竹の間隔別に繭10粒をカリッパースで測定。

繭重の平均は1.81gで当地方としては大粒。

2. 回転簇の1区割は3×3×4.5cm

第1.5表 試作竹簇(規格、構造別の代表的試作品)

規格 簇別	重量	有効段数	簇の		横竹の 段間隔	横竹の幅 (奥行)	横竹の厚さ	
			長さ(縦)	幅(横)			上、中、下の3本	左以外
在来簇	6.8Kg	28~29段	110cm	110cm	2~4.5cm	4cm	1cm以上	1cm以上
試作No.1	2.8	20	78	70	3~3.5	3.0	1.0	0.5~0.8
" 2	2.2	20	76	70	2.7	3.0	0.7	0.5~0.7
" 3	1.9	24	82	74	2.5~3.0	2.8	0.5	0.4~0.5
" 4	1.9	26	83	81	2.8~3.0	2.8	0.4	0.3~0.4
" 5	2.1	28	93	90	2.8	3.0	0.5	0.3

注；1. 在来簇は、地方で使われている標準的かやや小さいもので、規格の開差が大きい。

これを二重に組合せて1組にしたものもありかなり重い。

2. 縦竹2本の厚さは0.7cmが適当。

3. 横竹の段数は有効段数+1段

b) 結果の概要

試作竹簇No.5 第1.5表および第8図は、在来簇に対して重量は約1/3、大きさ(面積)は約70%で軽量化ができた。この大きさは、農家蚕室で2段吊り下げが可能である。簇1組の上簇蚕数(収容可能蚕数×90%)は500頭で、蚕1箱当り32~35組が必要である。この試作竹簇No.5は、標準型として現地に適用できる改良竹簇である。

(西 昇一郎 Iyus R.A. Bambang Hr, Wariso P. Baharuddin A.)

(2) 条払いによる熟蚕の収集法

A. 条払いによる熟蚕の収集法

a. 目的

現地では、慣行法として1頭拾い上簇を行っている。高温の当地方では、蚕の飼育法が適切であれば一斉に熟蚕が発現し、1頭拾いでは、熟蚕拾いに追われて過熟蚕上簇の傾向が見られる。適熟蚕の上簇と省力化のため条払い法を検討する。

b. 方法と結果の概要

a) 3令まで稚蚕飼育所で飼育されるので、4令就眼前に15~20%の遅眠蚕をとり、これを遅口とする。その要領は、約80%就眠した頃蚕座に石灰を散布して、その上に1枝並びに条桑を給与し、遅眠蚕が這い上った頃、石灰から上の条桑をはぎ取って別座に移す。

このように4眠時に蚕を早口と遅口の2段階に経過差をつけておき、そのまま5令桑

付から上簇まで別々に飼育する。こうすれば、上簇時に蚕の熟度が一斉で糸払いが容易である。

b) 早口から糸払いをすることになるが、初熟蚕を拾った後は、80%以上熟蚕が出るまで放置しておき、糸払い用の糸桑を1枚並びに給与する。糸払い用の糸は長い方が能率的であり、濡れ桑は使用しない。1回の糸払いでは、十分熟蚕を収集できないので、その糸を蚕座に戻し2回繰り返して、その後残蚕(未熟蚕が多い)を集めて別座にまとめ新鮮桑を給与する。

c) 糸払い作業の際、床上(土間)に熟蚕を払い落とす場合、ビニールネットがない現地では、バナナの葉を4枚敷いて、その上に1.8×2mのビニールフィルム(或は現地製プラスチック布)を置いてすれば、熟蚕を損傷しない。糸払いで集めた熟蚕を一斉上簇すれば更に能率的である。

d) センター、サブセンターおよび現地で実施した結果、現地に適応できる技術である。しかし膿病やコウジカビ病など蚕病発生農家では適用しない方がよい。

B. 竹簇への熟蚕の一斉振り込み法

a. 目的

農家では、竹簇の横竹上に熟蚕を1頭ずつ手で並べるように載せていくのが一般的な手法である。これでは熟蚕を円滑に処理することはできず、徒らに過熟蚕を多くする。上簇の合理化をはかるため一斉振り込み法を検討する。

b. 方法と結果の概要

a) 方法(第8図)

できれば室内を20Luxぐらいに(机の下の明るさ)やや暗くする。

住宅高床下の蚕室は、一般的にやや暗く適当である。

1. 蚕座紙(または新聞紙)の上に竹簇を置いて
2. 上から竹簇の収容頭数に見合う熟蚕を簇全面に手で振り込む。適当な上簇蚕数は収容可能蚕数(竹簇の幅/4.5cm×段数)×90%
3. 次にその上を蚕座紙(または新聞紙)で被覆して暗くしておく。
4. そのまま放置しておき1~2時間後に竹簇を吊り下げる。

b) 成績

第16表 竹簇への熟蚕の一斉振り込み法

— 蚕座紙被覆の有無と残蚕歩合 —

調査区		①被覆紙裏 の附着蚕	②竹簇下の 残蚕	①+②
簇器別	蚕座紙被覆			
1. 竹簇・単・ひもかけ	有	1.4%	5.0%	5.4%
2. 竹簇・単	有	6.6	12.2	18.8
3. 竹簇・単	無	—	23.6	23.6
4. 竹簇・二重	有	4.8	6.9	11.7

- 摘要：1. 調査時期 1981年9月
 2. 供試蚕数 No.1～No.3は500頭、No.4は1000頭
 3. 熟蚕振り込み2時間後の調査

c) 結果の概要

熟蚕振り込みは容易であり、竹簇の上を蚕座紙等で被覆すれば竹簇下の残蚕が少ないとくに竹簇の外側ひもかけ法では、被覆紙にとりつく蚕も少なく残蚕が少ないので手による再上簇の手間が省ける。竹簇の外側にひもをかけていても、熟蚕の振り込みに当り、ひもに留った熟蚕は中へ這い込み支障はない。

(西 昇一郎 Iyus R.A. Baruddin A.)

(3) 竹簇の効果的使用法

A. 竹簇の上下反転法

a. 目的

現地農家では、大型で重い竹簇を単一か2ヶ重ねて1組にして使用しており、吊り下げ後はそのまま放置しておくのが一般的手法である。その結果、営繭場所が上部に集まり中段以下の営繭が少なく簇器の利用効率が低く、竹簇二重の場合、簇中の病へい蚕除去が困難で、排尿による汚染繭も多くなる。したがって、簇を単一で使って上記の欠点を補うとともに、営繭分布を均当に更に営繭歩合を高めるために、人為的に簇器の上下反転法を試験する。

b. 方法と結果の概要

- a) 方法と成績 (成績の1例を記す。詳細はインドネシア養蚕開発計画昭和56年度年報参照)

竹簇の上下反転試験

(a) 試験方法

試験区	供試蚕数		簇器数	処理方法
	小区	計		
1. 回転簇 (対照)	1,600頭	1,600頭	1ヶ	這い回り蚕処理 (1.5時間後)
2. 竹簇単、うろつき蚕処理	400	800	2ヶ	吊り下げたまま、這い回り蚕処理 (15h)
3. 竹簇単、無処理	400	800	2ヶ	上簇して簇を吊り下げたまま放置
4. 竹簇単、反転	400	800	2ヶ	簇吊り下げ6時間後に簇の上下を反転
5. 竹簇二重、無処理	800	1,600	2ヶ	上簇に簇を吊り下げたまま放置

- 摘要： 1. 試験時期 1981年7月
 2. 供試蚕品種 BN・2×BC・102
 3. No.2～5は2連制

(b) 試験成績

第17表 営繭状態調査 (収繭、繭質調査表省略)

試験区	営繭蚕数歩合(%)			横竹1段の営繭蚕数(頭)				
				1段の平均数			最多蚕数	最少蚕数
	A	B	平均	A	B	平均		
1. 回転簇 (対照)	—	—	94.1	—	—	—	—	—
2. 竹簇単・うろつき処理	75.5	77.3	76.4	10.8	11.0	10.9	36	3
3. 竹簇単・無処理	85.0	79.0	82.0	12.1	11.3	11.7	43	5
4. 竹簇単・反転	90.0	92.0	91.0	12.9	13.1	13.0	27	8
5. 竹簇二重・無処理	90.1	88.8	89.5	12.9	12.7	12.8	39	6

注：簇の上下反転について、本試験のほかに反転回数、反転する時間について数度、試験を行った。

b) 結果概要

営繭蚕数歩合では、回転簇に次いで、竹簇単・反転が高く、横竹1段の営繭蚕数(平均)も多く、各段に平均的に分布している。竹簇二重・無処理がこれに次いで営繭蚕数歩合は高いが、横竹1段の営繭蚕数の最多、最少の開差が大きく、簇上部の営繭蚕数が多く、汚染や奇形の繭が多い。また竹簇と竹簇の間の病へい蚕を除去しにくく良繭が汚染され、病原菌の残存、飛散が懸念される。竹簇二重の営繭蚕数歩合が意外に高いのは、竹簇と竹簇の間にも営繭場所があること、蚕が営繭しやすい寄りどころがあるためと思

われる。

要するに竹簇を吊り下げ後、人為的に簇を上下反転する効果が認められる。簇吊り下げ後の反転時間は、第1回は4時間、第2回目は8時間後を目安にする。熟蚕の背地性（登簇性）が衰える10時間以後はその効果が少ない。

（西 昇一郎 Iyus R. A. Baharuddin A.）

B. 竹簇の外側ひもかけ法

a. 目的

小型で軽量化を目的に試作した竹簇について、単一使用しても、簇を吊り下げ後、上下を反転することで営繭歩合を高め得る。

本試験では、その方法に加えて、竹簇の外側にビニールひもをかけ、横の線が多い竹簇に縦の線を作り、熟蚕に営繭の寄りどころを与え、登簇や営繭に効果があるかを試験する。

b. 方法と結果の概要

a) 方法と成績（成績の1例を記す。詳細はインドネシア養蚕開発計画昭和56年度年報参照）

竹簇の外側ひもかけの効果

(a) 試験方法

試験区	供試蚕数	処理方法
1. 回 転 簇 (対 照)	1,600 ^頭	簇吊り下げ後自然回転
2. 竹簇 (小) ・ 反 転 ・ ひ も かけ	300	簇の上下反転 (簇吊り下げ後第1回は5時間、第2回は13時間)
3. " ・ 反 転	300	同 上
4. " ・ 無 処 理	300	簇吊り下げ後、そのまま放置
5. 竹簇 (大) ・ 反 転 ・ ひ も かけ	400	簇の上下反転 (簇吊り下げ後第1回-3時間、第2回-9時間)
6. " ・ 反 転	400	同 上
7. " ・ 無 処 理	400	吊り下げ後、そのまま放置

摘要：1. 試験時期 1981年9月

2. 供試蚕品種 BN・2×BC・102

3. ひもかけ方法 竹簇の外側にビニールひもを約3cm間隔で縦に巻きつける。収繭時はひもを解いて繭をかき取る。

(b) 試験成績

第18表 営繭状態調査

試験区	営繭蚕 数歩合	竹簇表面の うろつき蚕歩合	横竹1段の営繭蚕数		
			平均	最多蚕数	最少蚕数
No.1	90%	—%	—頭	—頭	—頭
2	93	3	14.0	18	12
3	76	11	11.4	17	6
4	68	19	10.2	27	1
5	89	2	14.9	20	11
6	77	4	12.8	20	9
7	73	12	12.1	29	3

第19表 収繭、繭質調査

試験区	結繭蚕数歩合%			繭層重	繭重	繭層歩合	1ℓ粒数
	上繭	中繭	同功繭				
No.1	96	2	1	31.2cg	1.41g	22.1%	95ヶ
2	72	11	13	29.2	1.38	21.2	90
3	71	11	16	32.6	1.51	21.6	97
4	67	21	10	28.1	1.35	20.8	93
5	68	3	26	32.9	1.48	22.2	93
6	77	6	14	32.1	1.46	22.0	97
7	74	7	17	31.0	1.38	22.5	97

b) 結果の概要

- (a) 竹簇にひもをかけると営繭蚕歩合が高く、横竹各段の営繭蚕数が平均化している。またうろつき蚕が少なく営繭速度が早いことが観察された。簇吊り下げ後、自然放置すると営繭蚕歩合が低下し、営繭部位が片寄り、上段に営繭が集中する。したがって、ひもかけ法と簇の上下反転法を併用する。
- (b) 竹簇ひもかけは、同功繭蚕歩合が高い欠点が見られる。竹簇放置 (No.4) は中繭歩合が高い。繭質では一定の傾向が認められない。
- 以上のことから、簇の効率面からは「ひもかけ」の効果は高いが、相関的に同功繭が増加する欠点があるので、同功繭蚕歩合の低下を検討する必要がある。

(西 昇一郎 Iyus R. A. Baharuddin A.)

C. 竹簇における同功繭減少に関する試験

a. 目的

竹簇を効果的に使用すると、登簇率や営繭蚕歩合を高めることができるが、その反面、同功繭蚕歩合が高くなる欠点が見られる。したがって、竹簇の構造の点、簇1組の上簇蚕数および上簇後のうろつき蚕処理方法など同功繭蚕歩合の多少との関係を調査して、同功繭を減少する資料とする。

b. 方法と結果の概要

a) 方法と成績 (成績の1例を記す)

同功繭の発生と竹簇の構造などとの関係

(a) 試験方法

試験区	小口	上簇蚕数	簇器の構造差			簇の上下 反転時間	摘 要
			段数	かけひも間隔	横段間隔		
A	a 1	400頭	25	3cm	3.0cm	1回 2時間 2回 8 "	1. 試験時期 1982年7月 2. 供試蚕品種 BN×BC 3. A、BおよびC、Dの上簇蚕数は簇収容頭数の90% 4. うろつき蚕は約10時間後に処理して別の上簇
	a 2	"	"	"	"	"	
B	b 1	"	"	4	"	"	
	b 2	"	"	"	"	"	
C	c 1	500頭	28	3	2.7	1回 4時間 2回 8 "	
	c 2	"	"	"	"	"	
D	d 1	"	"	"	3.0	"	
	d 2	"	"	"	"	"	

(b) 試験成績

第20表 営繭、結繭状態

試験区	営繭蚕歩合	横竹1段の営繭蚕数(頭)			結繭蚕歩合%			繭 重
		平均	最多蚕数	最少蚕数	普通繭	同功繭	下 繭	
A	90%	1.4.4	19	10	87	(1) 11	2	1.34g
B	87	1.3.5	19	11	87	(8) 9	4	1.33
C	86	1.5.4	20	10	87	(9) 10	3	1.31
D	82	1.4.6	19	10	91	(4) 5	4	1.33

注：結繭蚕歩合の同功繭()内数字はうろつき蚕、落下蚕を含めて算出した場合のもの。

b) 結果の概要

前述の試験のほかに、簇器の収容可能蚕数と同数の上簇蚕数を用い、簇吊り下げ後のうろつき蚕処理法をかえた試験を含めて考察する。

その結果、改良竹簇において本試験程度の構造差では同功繭歩合との関係は少く、上簇蚕数を簇器の収容可能蚕数の90%とやや少なくし、更に簇吊り下げ後約10時間後にうろつき蚕処理をすれば同功繭歩合を低下できる。

実用場面では、うろつき蚕処理をこの程度に早目にするこゝで、全般的に繭質の低下を防止する効果もあると思われる。

(西 昇一郎 Bambang Hr. Wariso P.)

(4) 竹簇による自然上簇法

a. 目的

農家では、熟蚕の1頭拾い上簇が多く、その熟蚕を1頭づつ手で竹簇に載せて上簇している。労力を要するだけでなく、高温下の当地方では過熟蚕上簇の傾向がある。このようなことから、上簇作業場所を要せず、熟蚕収集の省力化をかねて、竹簇による自然上簇法を検討する。

b. 方法と結果の概要

a) 方法と成績(第8図)

- (a) 自然上簇の条件としては、蚕の経過をそろえておくこと。4眠時に蚕を早口と遅口の2段階に経過差をつけて、そのまま5令桑付から上簇まで別々に飼育する。
- (b) 竹簇は軽量のものを使用し、外側に3cm間隔でビニールひもをかけておく。
- (d) 竹簇の面積に見合うように蚕座を縮座するかやや厚飼いにし、過熟蚕だけを手拾いする。次にこき取った全葉を1~2回給与し80%以上熟蚕が発現した頃を見はからって、蚕座上に竹簇を平らに設置する。
- (e) 設置した竹簇の上面に新聞紙を被覆してやや暗くする。
- (f) 竹簇を設置して1~2時間後に熟蚕の登簇状況を見て竹簇を吊り下げる。
- (g) 蚕座の残蚕を拾って別上簇するか、未熟蚕は集めて給桑し、蚕座を片着ける。

第21表 登簇率、収繭、繭質調査

試験区	登簇率	蚕座の残蚕率	普通繭蚕数歩合	繭層重	繭重	繭層歩合	500g粒数
1.回転簇・熟蚕振りこみ	—%	—%	96%	40.9cg	1.85g	22.1%	275ヶ
2.竹簇・熟蚕振りこみ	—	—	86	39.0	1.82	21.4	281
3.竹簇・自然上簇	74	26	86	39.9	1.84	21.7	276

- 摘要： 1. 試験時期 1982年6月
2. 供試蚕品種 BN×BC
3. 竹簇自然上簇区には改良竹簇3クを使用

4. 登簇率 = $\frac{\text{登簇蚕数}}{\text{登簇蚕数} + \text{蚕座残蚕数}}$

b) 結果の概要

竹簇による自然上簇の登簇率は良好で、蚕座の残蚕手拾いの手間が少なくてすむ。座中繭はほとんどなかった。

普通繭蚕歩合は竹簇としては良好である。繭質においては開差が少ない。当地方では、桑の枝条が細目で真直ぐなものが多く蚕座の平坦化が容易なこと、気温が高いことなど自然上簇には好条件と思われる。実用化に当り、更に検討したい。

(西 昇一郎 Iyus R.A. Wariso P.)

(5) 交雑種における上簇と発蛾との関係調査

a. 目的

現地では、折角の良繭を殺蛹乾繭のおくれから、発蛾により繰糸不能繭にする例が見られる。当地方において交雑種が、上簇後何日目に発蛾するかを雨期、乾期にわたり調査して、繭出荷と殺蛹乾繭の対策を講ずる。

b. 方法と結果の概要

a) 方法と成績

同日上簇した繭100粒を切開せず、そのまま蚕室で保護して、上簇後毎日発蛾状態を調査する。同時に上簇当日から終発蛾日まで毎日の温度、湿度、最高、最低温度を調査する。

第22表 調査成績 (集計表) (第9図参照)

調査場所	BILI-BILI	BILI-BILI	SOPPENG	BILI-BILI	BILI-BILI	
調査時期	1,1981	2,1982	4,1982	6,1982	9,1982	
蚕品種	BN×BC	BN×BC	BN×BC	BN×BC	BC×BN	
温度℃	26.9	26.3	27.3	24.3	27.0	
湿度%	87	82	82	66	59	
最高温度℃	27.0	28.3	28.8	27.8	31.6	
最低温度℃	25.3	24.5	25.7	21.9	23.8	
上簇後の日順	発 蛾 歩 合 (%)					平均
12日目	0	0	0	0	0	0
13	0	0	0	4	7	2
14	0	4	1	36	75	23
15	29	35	11	34	17	25
16	58	35	26	10	1	26
17	13	26	58	6	0	21
18	0	0	3	10	0	3
19	0	0	1	0	0	0
20	0	0	0	0	0	0

b) 結果の概要

上簇後、初発蛾は13日目、最盛発蛾は15日目前後、終発蛾は19日目である。6月や9月の乾期では、温度はそんなに高くないのに発蛾は雨期よりやや早い傾向がみられる。これは、湿度が低いためと思われる。(湿度60~90%では、60%より発蛾が1日早い—牛込氏報告)

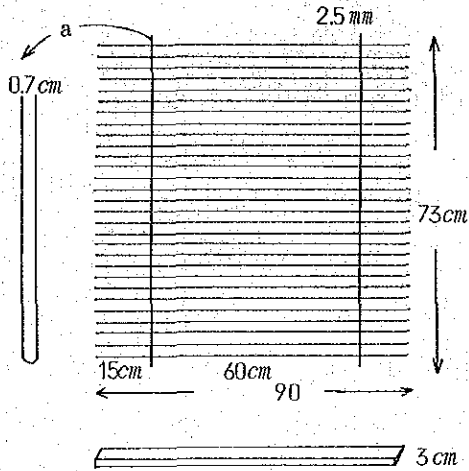
以上の結果から、初発蛾の2日前、すなわち上簇後11日目までに殺蛹乾繭を終了すること。

言いかえれば、収繭日(上簇中心日から6日目)から5日~6日以内に殺蛹乾繭することが安全である。乾繭を他に依頼する場合は、収繭日から4日以内に繭を出荷することが望ましい。本試験は更に1年実施し、湿度と発蛾との関係を検討する。

(西 昇一郎 Wariso P. Bambang Hr. Baharuddin A.)

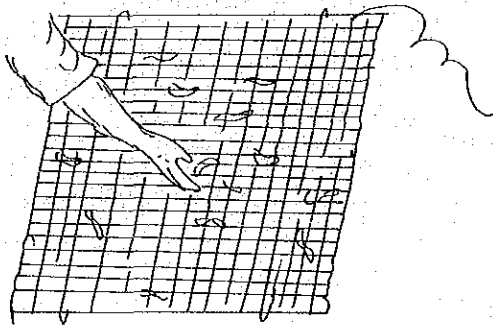
第8図 竹簇の改良と効果的使用法

竹簇の構造



1. 横竹の段数；2.9段
(使用有効段数；2.8段)
2. 横段の間隔；2.8cm
3. 横竹の厚さ (a.b.c)；0.5cm
その他の横竹の厚さ；0.3cm
4. 横竹の幅 (奥行)；3cm

熟蚕の一斉振り込み法など



1. 熟蚕の振り込みは左図の要領
2. 竹簇には、あらかじめ外側にビニール紐を縦に3cm間隔に巻きつけておく
3. 竹簇を吊り下げ後、約4時間目と8時間目の2回、簇の上下を反転する

竹簇による自然上簇法

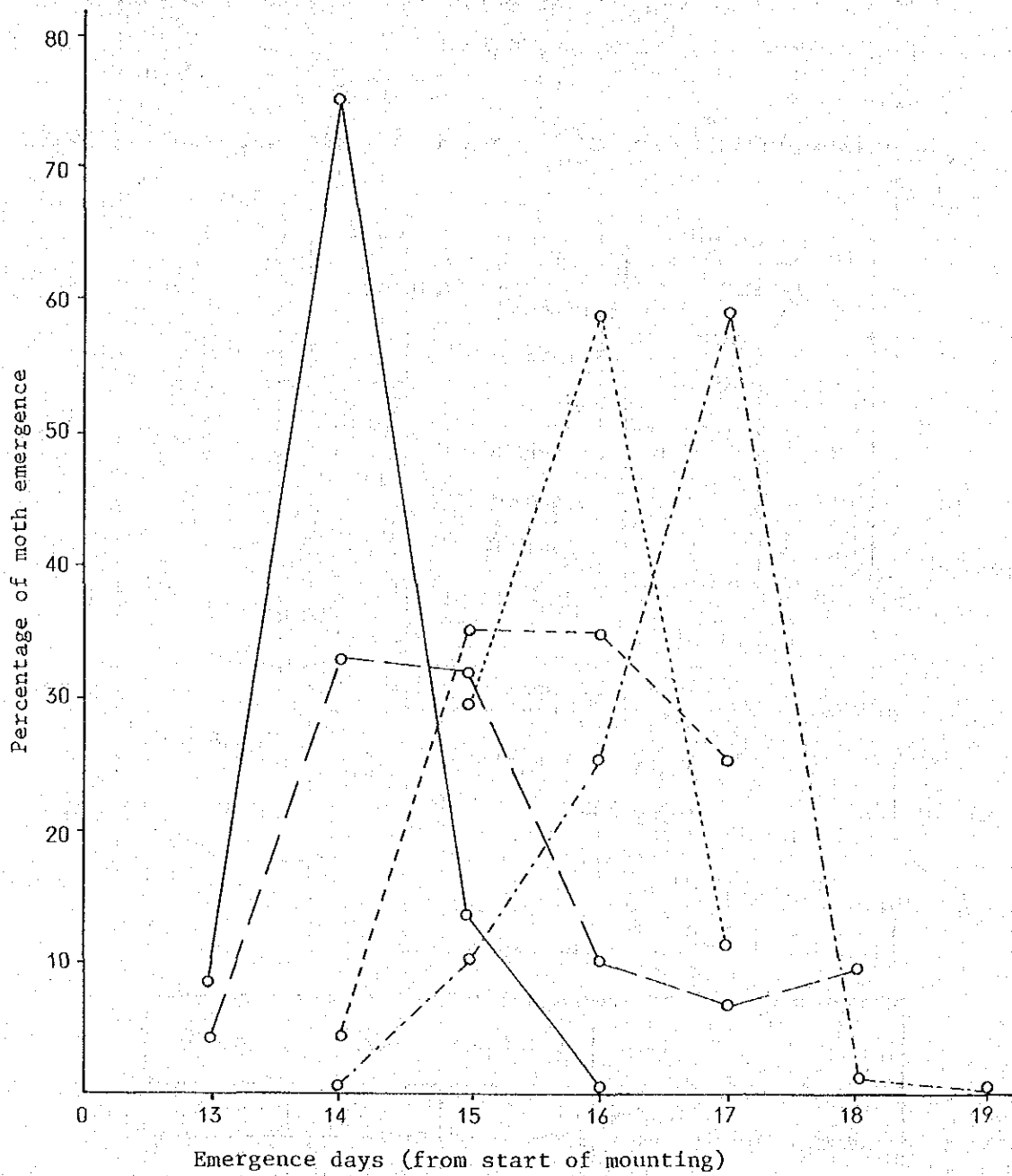
蚕座

竹簇の設置

1. 蚕座を竹簇の面積に見合うように縮座するか、やや厚飼にする。
2. 蚕座の両側に石灰か、のこくずを散布しておく。
3. 簇設置前に1~2回全葉を給与。

1. 竹簇を蚕座に平らに設置する。
2. 簇を設置したら竹簇の上を新聞紙等で被覆しておく。
3. 設置して約1~2時間後に吊り下げる。

Fig 9. Relation between the time of mounting and the time of moth emergence



..... Bili-Bili, Nov. 1981
 Bili-Bili, Feb. 1982
 - - - - - Soppeng, April 1982
 - - - - - Bili-Bili, June 1982
 - - - - - Bili-Bili, Sept. 1982

(6) 繭質の改善

a. 目的

蚕の作柄の安定と、壮蚕飼育技術や簇中保護を含めた上簇技術および選繭方法等の改良により、繭質の改善をはかり、優良繭の生産に資する。

b. 調査方法

(方法と成績の詳細は、農開畜JR82-33参照、この繰糸調査は、短期専門家友成氏による)

区別	産期	繭産地	件数
A区	7.1981	Center	2
		Enrekang	2
		Wajo	2
B区	9.1981	Center, Sub. C	4
		Soppeng A	1
		Soppeng B	4
		Sidrap	2
		Wajo	3
		Enrekang	2

- 摘要：1. 供試量 1件 200g
 2. 繰糸巻取速度 100m/1min

c. 成績

A区 第23表

項目 産地	生糸量	解じよ率	繭糸長	セント
Center	18.69%	80%	1,137m	2.46d
"	18.66	77	1,129	2.42
Enrekang	17.10	64	—	—
"	19.25	61	—	—
Wajo	11.50	37	—	—
"	12.70	40	—	—

B区 第24表

項目 産地	生糸量	解じよ率	繭糸長	セント
Center	16.85%	74	965 m	2.45 d
"	16.90	81	981	2.30
Sub Center	16.77	64	931	2.39
"	17.00	54	948	2.46
Soppeng A	12.45	32	821	2.02
" B	14.25	44	921	2.10
"	12.10	22	815	2.00
"	14.75	47	834	2.34
"	11.15	37	717	2.23
Sidrap	11.18	39	720	2.19
"	11.25	39	686	2.12
Wajo	12.48	36	745	2.36
"	14.10	59	939	2.05
"	14.80	53	804	2.50
Enrekang	14.77	54	726	2.23
"	14.30	50	727	2.45
最 高	14.80	59	939	2.50
最 低	11.15	22	686	2.00
平 均	13.13	43	788	2.22

注：センター、サブセンターの成績は最高、最低、平均より除外

d. 結果の概要

センターおよび地方ともに、9月産は7月産にくらべて全般的に繭質が劣る。現地の繭は各項目で成績が劣り、とくに解じよ率が非常に低く、生糸量歩合が13%前後と低糸量である。本成績で明らかなように、同じ時期、気象下で飼育したセンターおよびサブセンターの繭質は、農家の繭質にくらべて、かなり優れた成績を示している。また農家の繭質でもエンレカンの7月産は優れている。このことは、当地方においても作柄の安定、蚕飼育や上簇技術の改善により、良質繭生産の可能性が十分あることを示している。しかし、乾期で低湿にもかかわらず、解じよ率が非常に低いのは、二重竹簇や積み上げ式竹簇および熟蚕逃避防止にビニール布やサルーンで簇器を包むため、多湿をまねき通風が悪いためと思われる。竹簇を

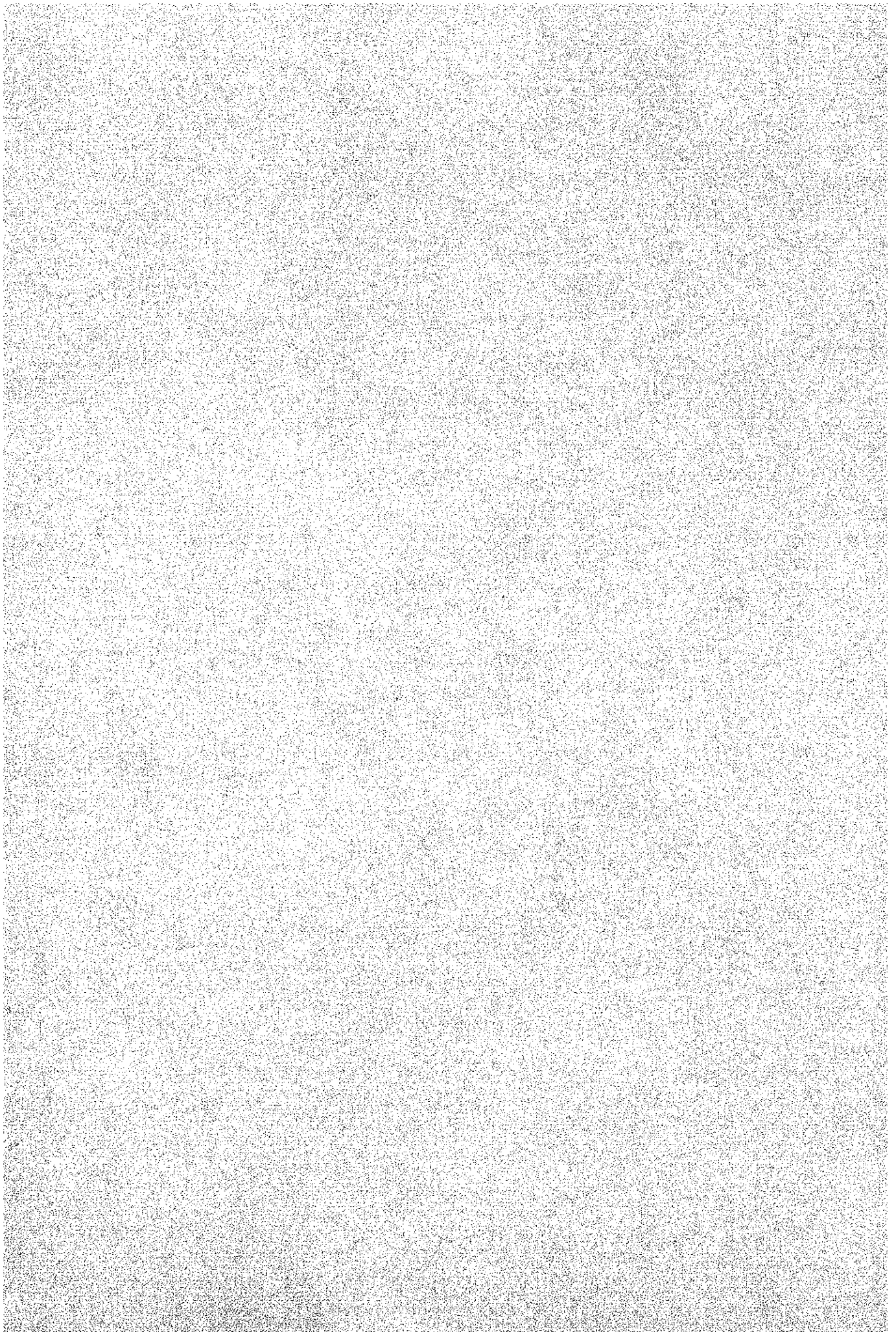
改良し、竹簇外側ひもかけ法を行うなど技術を改善する必要がある。

(友成 進、 西 昇一郎 Baharuddin A. Iyus R. A.)

参 考 資 料 5

インドネシア人技術職員の訓練

(蚕 飼 育 分 野)



インドネシア人技術職員の訓練 (センター、副センター)

(1) カウンターパートの訓練

2) 蚕飼育

A. 実技訓練

a. 目的

インドネシア養蚕開発に必要な蚕飼育技術の実技を訓練する。

b. 方法

センターにおける蚕飼育に関する技術開発試験、副センターでの実証試験、現地における実用化試験や技術演示指導を通じて実技を指導する。

c. 成果

カウンターパート全員がほぼ技術を習得し、技術移転が進んだ。

B. 試験の設計、実施、とりまとめ

a. 目的

インドネシア養蚕開発に必要な蚕飼育に関する試験の設計、実施と結果のとりまとめ能力を付与する。

b. 方法

蚕飼育に関する技術開発試験、実証試験の中で、試験計画の立案、実施要領、結果の整理法などを指導する。

c. 成果

未熟な面はあるが、かなり向上し独自でできる能力が認められる。

C. 技術開発、技術指導能力

a. 目的

インドネシア養蚕開発に必要な新技術を開発する能力、アシスタント、普及員、農民を訓練する技術指導能力を付与する。

b. 方法

技術の作出については、当プロジェクトは技術開発を急ぐ要があったので、日本人専門家が主導的役割を果たしてきたが、1981年後半から技術作出能力の養成のために、カウンターパートの主導で試験計画の立案、技術開発の発想法などを指導している。また数次にわたる普及員の研修農民訓練、日頃のアシスタントの訓練で指導能力を養成している。

c. 成果

技術の作出能力では、まだ不十分である。

訓練の計画、指導能力は進んだが、実技訓練を軽視し、講義中心の傾向が見られる。

D. 残された問題点と将来への提言

- a. 実技訓練では、更に高い水準での実技訓練。
- b. 試験の設計、実施、とりまとめでは、新鮮な感覚による立案につとめ、成績の分析と考察能力を高める。論文発表能力を高める努力を要する。
- c. 技術開発能力では、経験の積み上げと、現場における問題点の摘出と対応する研究課題の策定につとめる。
指導能力では、実技を中心にする心構えと、相手の理解度を測りながら指導することにつとめる。

(2) センター技術職員の訓練

A. 実技訓練

a. 目的

インドネシア養蚕開発に必要な試験の実施に当り、蚕の飼育準備、育蚕、飼育後の整理等について、カウンターパートの助手としての能力を養成する。

b. 方法

カウンターパートの主導により実技を訓練。蚕飼育の試験や、パイロットユニットの演示指導にも助手として参加させて訓練。

c. 成果

新任者以外は、実技訓練が進み、カウンターパートの指示により活動できる。

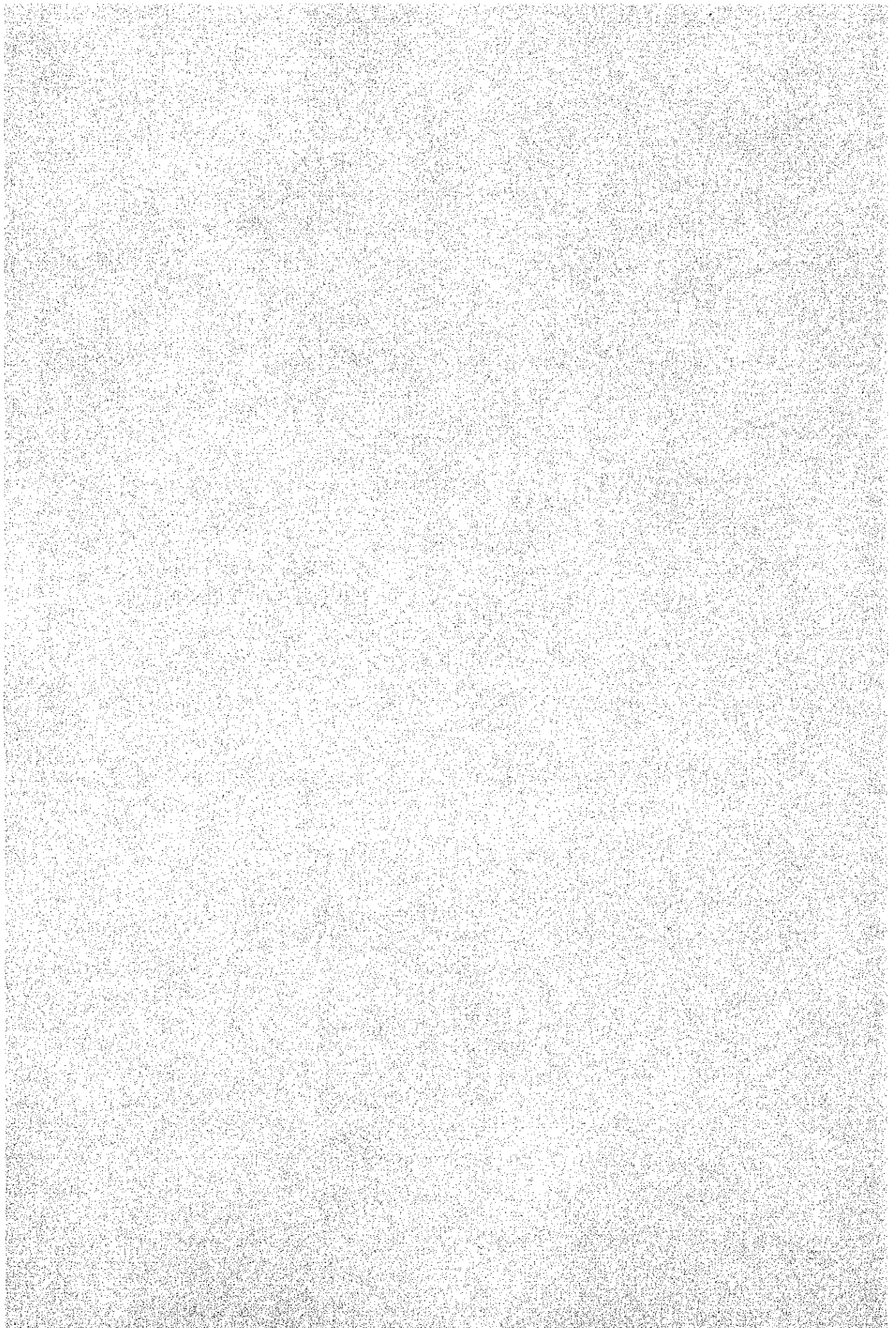
B. 残された問題点と将来への提言

更に実技を積み重ねる。

参 考 資 料 6

農民グループへの養蚕技術の演示指導 (蚕 飼 育 分 野)

- (1) 蚕飼育演示技術の組立
- (2) パイロットユニットにおける演示指導
- (3) 養蚕農家の技術評価



(1) 蚕飼育演示技術の組立

1) 目的

これまで実施してきたセンターにおける技術開発実用試験、サブセンターでの実証試験および現地での実用化試験を通して、改善、開発された蚕飼育技術を組立てて、農民グループへの養蚕技術の演示指導に資する。

2) 組立てた蚕飼育の演示技術

年6回の蚕飼育計画を基準に、1令から3令まで稚蚕飼育所で、4令以降は、農家で蚕飼育を行うことを基本にする。

パイロットユニットに適用するために、センターに稚蚕飼育施設の試作型を建設した。(蚕飼育専門家、中村準一氏)この試作型に基づいて稚蚕飼育施設センター1型を設計し、1981年から5ヶ所のパイロットユニットに稚蚕飼育所を建設した。この稚蚕飼育施設センター1型をモデルの1つとして演示する。

また現地生産の鉄製蚕架、蚕箔を試作して(第1図)、蚕架を第10図のように配置して演示する。

壮蚕飼育施設は、住宅高床下の蚕室を改善し、あるいは別棟蚕室の場合は、屋外条桑育施設センター2型(第3図)を1つのモデルとする。

技術の概要は次のとおり。

A. 稚蚕飼育

a. 1～2令判桑育(新梢)、防乾紙育、1日3回給桑

b. 3令条桑育、半防乾紙育、1日3回給桑

c. 技術の要点

a) 蚕室蚕具の洗浄、消毒

b) 飼育標準表の適用

c) 蚕室の保湿と乾燥、気流の導入

d) 用桑の準備と桑採り、貯桑の要領

e) 眠起の取り扱い

f) 遺失蚕、埋没蚕の防止

g) 配蚕の方法と受け入れ

h) 蚕体消毒法

i) 蟻や鼠などの被害防止

j) 蚕室内外の清潔と手足の消毒

B. 壮蚕飼育

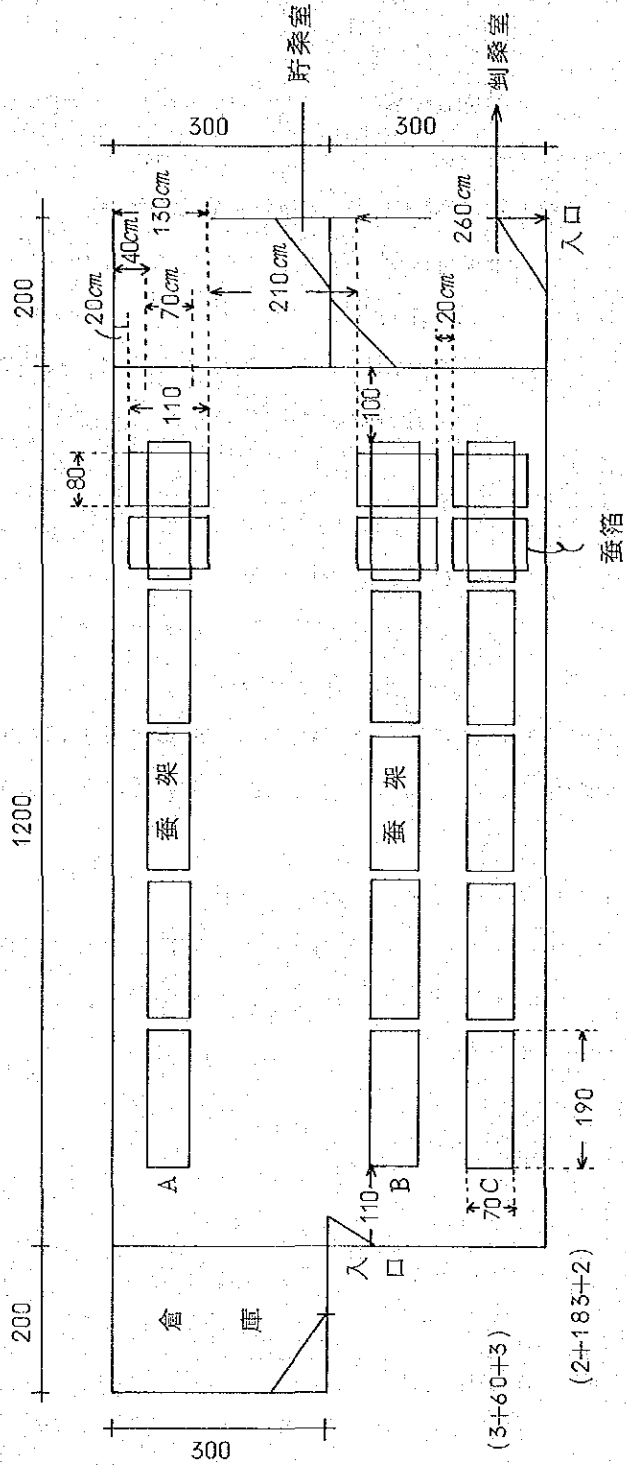
a. 掃立量1蚕期1箱程度、年6回飼育

b. 2段の棚飼育を基準

- c. 糸桑育、1日3回給桑
 - d. 飼育施設の改善
 - e. 技術の要点
 - a) 蚕室蚕具の洗浄、消毒
 - b) 飼育標準表の適用
 - c) 桑採り、貯桑の要領
 - d) 眠起の取り扱い
 - e) 除沙と蚕座の清潔
 - f) 蚕体清毒
 - g) 蟻や鼠などの被害防止
 - h) 蚕室内外の清潔と手指の消毒
 - C. 上簇と繭質の改善
 - a. 簇器：竹簇の改善
 - b. 上簇準備：簇器の洗浄、消毒等
 - c. 技術の要点
 - a) 蚕座の平坦化と初熟蚕の処理
 - b) 上簇時の給桑
 - c) 適熟蚕の上簇
 - d) 糸払いによる熟蚕の収集法
 - e) 熟蚕の簇器への振り込み法
 - f) 竹簇の外側ひもかけ法
 - g) 竹簇吊り下げ後の処理法
 - h) 簇中の保護
 - D. 収繭と選繭および繭の出荷
 - a. 収繭の時期と方法
 - b. 選繭方法
 - c. 出荷の時期
- 3) 残された問題点と将来への提言
- a. 現場における問題点の摘出と対応する技術の改善と開発
 - b. 素材を集積して、より優れた演示技術の組立

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第10図 Pilot Unit 稚蚕飼育所、3令までの30箱飼育時の蚕架の配置図



1. 各令の必要蚕箔数 蚕種1箱(30箱) : 1令、2枚(60)、2令、4枚(120)、3令、8枚(240)

2. 必要蚕架数

(1) 蚕種50箱(3令まで) : 棚を8段だけ使用の場合は蚕架は15ヶ

棚を10段全部使用の場合は蚕架は12ヶ

3. B列の蚕架は、ローラーつきの移動式を用い、給桑作業のときは、A列かC列側に移動する。中央の作業場の幅は210cmあれば支障はない。

(2) パイロットユニットにおける演示指導

蚕飼育分野

A. 目的

パイロットユニットにおいて、稚蚕飼育所や演示農家で、稚蚕飼育法、および仕蚕飼育法、上簇法の演示指導を行い、早急に技術移転をはかり、周辺農民への波及をはかる。

B. 方法と経過

- a. 蚕飼育の演示技術を組立て、それを5ヶ所のパイロットユニットの稚蚕飼育所および8戸の演示農家で演示指導を行っている。
- b. パイロットユニット稚蚕飼育所は、センター試作型に基づいたモデル設計により建設された。第1号として建設されたLuppangeにおいて、1981年11月～12月に演示指導に対応するため実証をかねて、パイロットユニット担当普及員5名の実技訓練を実施した。
- c. 1982年3月、パイロットユニット4ヶ所の第1回蚕飼育の前に、蚕飼育の演示技術の資料を専門家、カウンターパートより担当普及員と関係者に示し、演示指導の内容を明らかにした。
- d. パイロットユニットの演示指導について、蚕飼育の第1回は、専門家が主導性を持って、カウンターパートを帯同して、担当普及員、農民の演示指導に当った。第2回目は専門家の助言によりカウンターパートの主導で、更に第3回目からカウンターパート独自で演示指導を行っている。
- e. 演示指導のための蚕飼育関係資機材の供与については、稚蚕飼育所に対して日本の供与資機材および現地調達資機材を、演示農家に対しては、改良竹簇等できるだけ現地調達のものを中心に貸与した。
詳細は別項、パイロットユニット活動運営計画のとおり。
- f. 蚕期終了後、5ヶ所のパイロットユニットの農民グループ代表を含めて関係者が現地において、検討会を開催し、カウンターパート、専門家の助言を得て、反省と今後の対策を協議して演示指導の成果を期している。

第25表 パイロットユニットの桑および繭の生産現状と目標

パイロットユニット 項目	PISING	LUPPANGE	WANIO	UGI	BARAKA	摘要
a. 現状(1981年)						
桑収量/ha ton	12	12	10	10	10	A
収繭量/箱 Kg	9	16	12	10	17	
収繭量/ha Kg	85	150	110	130	90	
b. 目標						
桑収量/ha ton	18	18	15	15	15	$B=A \times 1.5$
収繭量/箱 Kg						
演示農家水準	25	25	24	24	27	
参加農家水準	22	22	21	21	24	→a
参加農家の最低線	18	18	16	16	20	
収繭量/ha Kg	360	360	280	280	290	BARAKA $C=B \times a \times 0.8$ その他 $C=B \times a \times 0.9$

注；Cについて、BARAKAは高冷地で飼育日数が長く、箱当り用桑置が他地区より多く要するため80%とした。

第26表 1982年パイロットユニットの掃立計画と実績

パイロットユニット		PISING	LUPPANGE	WANIO	UGI	BARAKA
稚蚕飼育所建設時期		12-1981	11-1981	12-1981	3-1982	8-1982
参加農家数		25	25	30	20	20
1	回 掃立時期計画	15~22-3	15~22-3	15~22-3	15~22-3	-
	" 実施	16-3	16-3	17-3	17-3	-
	飼育農家数	18	13	20	14	-
	掃立箱数	10	10	10	10	-
	配蚕箱数	10	10	10	10	-
2	掃立時期計画	1-6	1-6	2-6	2-6	-
	" 実施	1-6	1-6	2-6	2-6	-
	飼育農家数	25	25	28	20	-
	掃立箱数	30	12	20	30	-
	配蚕箱数	30	12	20	30	-
3	掃立時期計画	30-8	30-8	31-8	31-8	1-9
	" 実施	30-8	30-8	31-8	31-8	2-9
	飼育農家数	19	19	8	20	5
	掃立箱数	20	16	5	30	7
	配蚕箱数	20	16	2	28	3
4	掃立時期計画	13-10	13-10	14-10	14-10	14-10
	" 実施	27-10	-	-	-	-
	飼育農家数	7	-	-	-	-
	掃立箱数	5	-	-	-	-
	配蚕箱数	5	-	-	-	-
5	掃立時期計画	2-12	2-12	3-12	3-12	3-12
	" 実施	14-1	26-1	29-1	28-1	15-1
	飼育農家数					
	掃立箱数	30	30	19	30	7
	配蚕箱数	30				7

- 摘要：1. 第1回の3月では、初回であり、試験的に掃立量を4ヶ所とも10箱とした。
 2. 第2回の飼育から、農民グループの意志で掃立量は決定された。
 3. 第3回の飼育では、乾期の影響、その他の事情で地域差が生じた。
 4. 第4回の飼育では、例年がない乾期の影響などでPisingだけが飼育し、桑収量の減収から掃立量も激減した。また掃立時期もおくれた。

第27表 第1回 3-1982

パイロット ユニット	演示農家名	飼育育 箱数	収繭量 / 1箱		500g 粒数	健 蛹 歩 合	繭層重	繭 重	繭 層 歩 合
			普通繭	総収量					
Pising	M. Tahir	1.0箱	252 ^{Kg}	26.4 ^{Kg}	342ケ	92%	34.4cg	1.52g	22.6%
	Ibrahim	1.0	20.1	22.0	354	94	32.4	1.42	22.8
	Beddu Baluku	1.0	24.2	26.0	295	91	38.3	1.70	22.5
	平 均	-	23.2	24.8	330	92	-	1.55	22.6
	P.U18戸平均	(100)		22.5					
Luppange	Ballu	1.0	23.1	24.6	339	97	32.4	1.52	21.4
	P.U13戸平均	(10.0)		20.4					
Wanio	Aras	1.0	18.9	19.4	362	68	30.1	1.45	20.7
	Marawiah	1.0	14.8	16.0	315	83	36.3	1.63	22.3
	Ruslan	0.5	15.0	15.4	336	79	31.2	1.49	21.0
	平 均	-	16.2	16.9	338	77	-	1.52	21.3
	P.U20戸平均	(10.0)		19.2					
Ugi	Usman. P	1.0	19.7	20.9	346	95	32.0	1.48	21.7
	Balla	1.0	19.6	21.0	333	90	36.9	1.57	23.6
	平 均	-	19.7	21.0	340	93		1.53	22.7
	P.U14戸平均	(10.0)		21.7					

第28表 第2回 6-1982

パイロット ユニット	演示農家名	飼 育 箱 数	収繭量 / 1箱		500g 粒 数	健 蛹 歩 合	繭層重	繭 重	繭 層 歩 合
			普通繭	総収量					
Pising	M. Tahir	2.0箱	31.0 ^{Kg}	32.4 ^{Kg}	302ケ	90%	41.2cg	1.75g	23.6%
	Ibrahim	1.5	23.5	24.9	336	95	34.8	1.48	23.6
	Beddu Baluku	1.25	16.1	17.2	335	95	29.4	1.40	21.0
	平 均	-	23.5	24.8	324	93	-	1.54	22.7
	P.U30戸平均	(30.0)		22.5					
Luppange	Ballu	2.0	30.3	31.5	315	97	40.1	1.67	24.0
	P.U12戸平均	(12.0)		23.5					
Wanio	Marawiah	3.0	19.6	20.2	403	84	28.2	1.29	21.8
	Ruslan	1.0	19.1	19.8	371	86	34.8	1.44	24.2
	平 均	-	19.4	20.0	387	85	-	1.37	23.0
	P.U20戸平均	(20.0)		22.5					
Ugi	Usman. P	1.0	23.3	24.4	330	84	33.9	1.58	21.5
	Balla	1.0	24.0	25.1	332	83	33.4	1.54	21.7
	平 均	-	23.7	24.8	331	84	-	1.56	21.6
	P.U30戸平均	(30.0)		23.5					

第29表 第3～4回養蚕成績

第3回 8-1982

パイロット ユニット	演示農家名	飼育 箱数	収繭量/1箱		500g 粒数	健蛹 歩合	繭層重	繭重	繭層 歩合
			普通繭	総収量					
Pising	M. Tahir	2.0 箱	23.6 ^{Kg}	24.8 ^{Kg}	373 ^ヶ	90 [%]	33.3 ^{cg}	1.45 ^g	23.0 [%]
	Beddu Baluku	1.0	9.7	10.8	520	73	22.1	1.03	21.4
	平均	—	16.7	17.8	447	82	—	1.24	22.2
	PU19戸平均	(20.0)		17.1					
Luppange	Ballu	1.0	10.3	12.5	596	96	19.8	0.89	22.1
	PU19戸平均	(16.0)		8.1					
Wanio	Marawiah	0.25	11.3	12.2	493	17	22.2	1.06	21.0
	PU8戸平均	(2)		9.9					
Ugi	Usman, P	0.5	13.2	15.6	580	28	19.5	0.97	20.2
	Balla	0.5	14.6	15.3	400	90	29.0	1.29	22.6
	平均	—	13.9	15.5	490	59	—	1.13	21.4
	PU20戸平均	(28.0)		14.4					
Baraka	Ambe Mina	0.5	6.9	7.5	577	76	22.7	1.05	21.7
	PU5戸平均	(3)		9.8					

第4回 10-1982

Pising	M. Tahir	15	23.4	25.0	375	88	35.4	1.39	25.5
	PU7戸平均	5.0		21.7					

C. 結果の概要

a. 掃立計画と実績

a) 掃立時期では、第3回までは順調であったが、第4回は例年にない乾期の影響で掃立
てたのは1地区で、しかも計画の時期より遅くなった。

b) 飼育農家数では、第1回は掃立量を制限したので、参加農家数に対して少なかったが、
2回目は参加農家数がほとんど飼育し、第3回と第4回は桑収量の関係で地区によりか
なり減少あるいはしないところがあった。

蚕の飼育数量も同様な傾向である。

b. 養蚕成績

a) 稚蚕飼育と作柄との関係では、収繭量や健蛹歩合からみて、WanioとBarakaは稚蚕
飼育に問題があると推察される。Luppangeの第3回の成績では収繭量が少いが、演示農

家の健蛹歩合と繭重からみて減蚕は余り多くない。

b) 壮蚕飼育の成績では、Pising 地区が安定しており、Wanio 地区が劣る。Wanio と Ugi 地区は、1981年および1982年1月の作柄が非常に悪く、膿病の多発地帯で第1回飼育時にも膿病が発生した。しかし第1回から第2回と好転の傾向が見られる。それにしても、Wanioの演示農家の成績を向上させなくてはならない。Barakaも検討を要する。第3回の飼育成績は、例年にないきびしい乾期の影響で、桑の収量減、葉質の悪化、高温過乾の環境と悪条件の重複があつたにしても極めて不良であつた。新鮮桑の飽食などの飼育技術、桑栽培および飼育時期の選定等今後検討を要する。

全般的に繭重が軽く繭が小粒である。これでは繭糸長が短かく低糸量となる。葉質が良いと思われる第1回、第2回でも言えることで、4～5令期の給桑技術の改善を要する。繭重をつけることで、収繭量の増加が期待できる。各蚕期にわたり繭重が重く、箱当り収繭量が多い演示農家があるが、給桑技術のほか、桑の葉質が良好であつたことは特筆に値する。

養蚕成績を総括すると、繭生産目標の演示農家水準にほぼ達したパイロットユニットは、Pising（第1回、第2回）で、Luppangeもこれに次ぎ、Ugiは第2回で達した。参加農家が参加農家水準に達したのは、PisingとUgi（第1回、第2回）で、第2回にLuppangeとWanioが達した。今後年間の平均での水準達成が望まれる。

C. 演示指導の結果

a) 稚蚕飼育技術では、全般的に演示指導の成果が見られた。一部のパイロット、ユニットでは、1～2令期の整座、払座および給桑技術に改善を要する。

b) 壮蚕飼育技術では、施設の改善、消毒等全般的に演示指導の成果が見られる。蚕期前に新しい消石灰の土間散布を怠り勝である。また貯桑方法に今少し工夫を要する。4令就眠期に早口、遅口と蚕の経過差を設ける指導が低調である。

もっとも留意することは、4～5令期の蚕座面積の適正と新鮮桑の飽食など給桑技術の改善指導である。

c) 上簇、簇中保護、選繭などの技術では、回を重ねるごとに進展が見られる。しかし全般的に上簇時期の良桑給与を忘れ勝である。また竹簇の改善面で、積み重ね式竹簇が依然として使用されているが早急に改良竹簇に更新しなければ上簇技術、繭質の改善がはかれない。選繭をするようにはなつたが、選繭程度を高める必要がある。

D. 残された問題点と将来への提言

a. 現場における問題点を摘出して、解明するとともに更にすぐれた現地適応の演示技術組立てと演示指導に役立つ。

b. まず、パイロットユニットにおける演示農家にも演示技術の波及を急ぐこと。

c. パイロット、ユニットで生産された繭について、解じよ率や糸量など繭質を調査して、

蚕飼育、上簇技術の改善と繭質改善に役立て、演示指導を助長する必要がある。

(西昇一郎 Iyus R.A. Baharuddin A. Bamban Hr. Wariso P.)

(3) 養蚕農家の技術評価

蚕飼育分野

A. 目的

適切な技術評価により、蚕飼育技術の進歩を促え、評価後の技術改善と演示指導の指標にする。

B. 方法

- a. 調査は、別紙(第30、第31表)、稚蚕と壮蚕上簇の技術評価アンケート表により、普及員が行い、一部カウンターパートが再調査を行なった。
- b. 調査時期と場所は、パイロット、ユニットが活動を始めて第2回目の蚕飼育を行った1982年6月~7月に、Pising. Luppange. Wanio. Ugiの4ヶ所について行った。9月に飼育を始めたBarakaはしなかった。
- c. 調査対象は、稚蚕飼育では、パイロットユニット稚蚕飼育所と従来的一般農家グループ稚蚕飼育所について1地区各1ヶ所である。
壮蚕、上簇では、パイロットユニット飼育農家について調査した。
- d. 技術評価の参考資料として、地区別に養蚕成績を調査した。

C. 技術評価の総合

- a. 稚蚕飼育技術(第32、第33表参照)
 - a) パイロット、ユニット稚蚕飼育所では、Wanioが今一步の水準に達しないが他は極めて高い水準にある。このことは、別紙参考資料(第34表)の養蚕成績の作柄にも現われている。Wanioでは、防暑のため植樹したが枯死して蚕室に陽がさし込み室温が高くなる。
地区別一覧表でも、貯桑方法や蚕座面積、給桑技術が不十分である。
 - b) 一般農家グループの稚蚕飼育所では、調査対象をWanio以外は、比較的の水準が高いところを選んだ傾向がある。技術水準は3ヶ所が中位にあり、蚕室、蚕具の洗浄消毒や蚕体消毒が実行されている。しかしこの程度の技術水準では、稚蚕飼育による作柄が懸念される。
- b. 壮蚕、上簇技術
 - a) パイロット、ユニットの演示農家では、技術水準が向上した。第2回蚕飼育の作柄にも反映している。しかし調査項目別にみると、簇器の消毒、簇器の改善、上簇技術の改善などまだ技術水準の低い面が見られる。
 - b) パイロット、ユニットの一般農家では、技術水準は低位で、とくに施設の改善や蚕室、

蚕具の洗浄、消毒など基本的な技術が進んでいないことは問題である。飼育、上族技術についても低く、早急に演示農家の技術を積極的に吸収するように指導を要する。

D. 残された問題と将来への提言

- a. 年に1回、定期的に調査を継続する必要がある。
- b. 調査結果を技術の演示指導や普及に活用することは当然であるが、担当普及員だけでなく、資料を普及所などの組織でも活用する。
- c. 調査対象をパイロット、ユニットだけでなく、一般農家グループについても行う。壮蚕、上族技術の調査では、調査する一般農家数は、パイロットユニットの調査農家数と同数ぐらい行わねば評価の比較ができない。
- d. 調査者は、調査項目の内容をよく認識して、評価資料を信頼度の高いものにする。

(西 昇一郎

Bambang Hr. Wariso P. Iyus R.A. Baharuddin A. Guidance technician)

第30表 技術評価アンケート (稚蚕飼育技術)

7-1982

調査 年 月 日 調査者

調査番号No | ユニット名 | 配蚕農家数 戸 | 掃立 月 日 |

掃立量 箱 | 収繭量 Kg | 収繭量/箱 Kg | 作柄 % |

No	調査項目	チェック ○・△		配点	点数			
		できた	できていない					
1.	消毒しやすく蚕室を改善	できた	できていない	4				
2.	気流の導入(窓の開閉)	良い	悪い	4				
3.	防暑施設(植樹、日覆)	できた	できていない	4				
4.	飼育室専用の①上衣、②はきもの	① ② あり	① ② な	4				
5.	①棚飼い、蚕箔育、②防乾紙育	① ② している	① ② していない	4				
6.	手指、足の消毒設備	あり	なし	8				
7.	蚕室、蚕具の整理、清潔度	良い	悪い	4				
8.	蚕室、蚕具の洗浄、消毒	飼育の前・後	しない	8				
9.	蚕体消毒	する	しない	8				
10.	貯桑の方法、状態	良い	悪い	8				
11.	採桑の計画性(採桑簿)	良い	悪い	4				
12.	給与桑の新鮮度(比較的)	良い	おれが目立つ	4				
13.	①飼育標準表の適用と②秤の使用	① ② している	① ② していない	8				
14.	蚕室の温度、湿度、気流の調節	良い	悪い	4				
15.	給桑量は	適当	少ない多すぎ	4				
16.	蚕座面積は	適当	狭いか広すぎ	4				
17.	整座の状態と蚕の這い上り	良い	悪い	4				
18.	防乾紙除覆の適否	適当	不適	4				
19.	眠中処理(石灰散布、蚕座の乾燥)	良い	悪い	4				
20.	桑付の時期	適当	早すぎ、遅い	4				
技術評価		A	B	C	D	E	合計点	100
該当欄○		80以上	70以上	60以上	50以上	50以下		

※ (1),(2),(3)について該当欄にチェックするか数字を記入する。

(1) 蚕室蚕具の洗浄消毒①飼育の前後各1回②飼育の前か後に1回③時々④洗浄だけ⑤しない⑥消毒剤名:

(2) 稚蚕の配蚕方法	配蚕の時期	運搬用具	運搬者	運搬時刻
	3眠の前	車	普及員(G.T)	朝
	3眠中	オートバイ	稚蚕飼育所チーフ	夕方
	4令起蚕	人力	壮蚕飼育農家	日中

(3) 稚蚕飼育所の施設 ①a稚蚕桑園面積() ha ⑥桑園所有者
 ②貯蚕室は有か無 ③年間の飼育回数()回 ④1回の掃立可能箱数()箱
 ⑤a飼育所の従事者数()人 ⑥雇よう形態は常雇か臨時雇か ⑦飼育型式はa蚕箔
 b箱飼 cその他 ⑧飼育所の床の状態は aコンクリート b土間 c川砂 d板張り

第31表 技術評価アンケート (牡蚕飼育、上簇技術)

7-1982

調査 年 月 日 調査者 ;

調査番号No | 氏 名 | ユニット名 | 掃立 月 日 |

掃立量 箱 | 取繭量 Kg | 取繭量/箱 Kg | 作柄 φ |

No	調 査 項 目	チェック ○・△		配点	点数			
		す る	し ない					
1.	蚕室天井のビニールフィルム張り	す る	し ない	4				
2.	桑桑育棚	2 段	3 段以上	4				
3.	蚕座にプラスチック布を	使 う	使っていない	4				
4.	貯桑室は蚕室の	外	内	4				
5.	①手指の消毒設備、②病蚕つぼ	①あ る ②	①な い ②	4				
6.	蚕室土間に①石灰散布②竹壁に石灰乳	①す る ②	①し ない ②	4				
7.	蚕室の整理、清潔度	きれい	きたない	4				
※ 8.	蚕室、蚕具の①洗浄、②消毒	①飼育の前・後 ②	し ない	8				
9.	蚕体消毒	す る	し ない	4				
10.	貯桑の方法・状態	良 い	悪 い	4				
※ 11.	給桑の技術	良 い	悪 い	8				
12.	蚕座面積は	適 当	狭い、広過ぎ	4				
※ 13.	①眠、②起の取り扱い	①良 い ②	①悪 い ②	4				
※ 14.	飼育中(5令)の経過処理(早口、遅口)	わ ける	わ けない	4				
15.	簇器の①洗浄、②消毒、③日乾	①す る ②③	①し ない ②③	8				
16.	簇器の改善	して いる	して いない	4				
※ 17.	上簇技術の改善	して いる	して いない	8				
※ 18.	簇中保護の改善	して いる	して いない	8				
19.	取繭時期(上簇中心日より)	6 日 目	5 日以前	4				
20.	選繭の良否	良 い	悪 い	4				
技術評価		A	B	C	D	E	合 計 点	100
該当欄○		80以上	70以上	60以上	50以上	50以下		

調査項目 注 8: 蚕室、蚕具の洗浄消毒 ①飼育前後各1回 ②飼育の前か後に1回 ③時々する ④洗浄だけ ⑤しない

11. 給桑の技術 ①給桑回数は1日3回で乾燥時期や不良桑は4回

②給桑量は適量か ③給与桑は新鮮かしおれ?

13. 眠起の取扱い ①桑付は適期か ②眠中は蚕座に石灰を散布するか

14. 飼育中の経過処理 ①4令催眠期に早口と遅口に分けるか

17. 上簇技術の改善 ①熟蚕の収集法は1頭拾い条払い ②上簇法は1頭上げ一斉ふりこみ

③簇器の使用法は改善されているか

18. 簇中保護の改善 ①上簇後の蚕座の搬出はよいか ②気流の導入はよいか

③尿受け処理 ④病蚕処理はよいか

第3.2表 技術水準評価

地区別一覧表

稚蚕飼育技術

調査時期 6~7-1982

No	調査項目	配点	Pising		Luppange		Wanio		Ugl	
			P.unit	一般	P.unit	一般	P.unit	一般	P.unit	一般
1	消毒しやすく蚕室を改善	4	4	4	4	4	4	0	4	4
2	気流の導入(窓の開閉)	4	4	0	4	4	4	0	4	4
3	防暑施設(植樹、日覆)	4	4	4	4	0	0	4	4	4
4	飼育室専用の①上衣②はきもの	4	4	0	2	0	2	0	2	2
5	①棚飼い、蚕箔育②防乾紙育	4	4	4	4	4	4	2	4	2
6	手指、足の消毒設備	8	8	4	8	0	8	0	8	4
7	蚕室、蚕具の整理、清潔度	4	4	4	4	4	4	0	4	0
8	蚕室、蚕具の洗浄、消毒	8	8	8	8	8	8	4	8	4
9	蚕体消毒	8	8	8	8	8	8	0	8	8
10	貯桑の方法、状態	8	8	0	4	8	4	0	8	8
11	採桑の計画性(採桑簿)	4	2	4	2	0	2	0	2	0
12	給与桑の新鮮度	4	4	0	4	0	4	4	2	4
13	①飼育標準表の適用、②秤の使用	8	8	4	8	0	4	0	8	4
14	蚕室の温度、湿度、気流の調節	4	4	0	4	0	4	0	4	0
15	給桑量は適当、少ない、多過ぎ	4	4	4	4	4	4	0	4	0
16	蚕座面積は、適当、狭、広すぎ	4	2	4	2	4	0	0	2	4
17	整座の状態と蚕の這い上り	4	2	4	2	4	0	0	4	4
18	防乾紙除覆の適否	4	2	0	2	0	2	0	2	0
19	眠中処理(石灰散布、蚕座の乾燥)	4	4	4	4	4	4	4	4	4
20	桑付の時期、適当、早すぎ、遅い	4	2	4	2	4	2	0	2	4
合計点数		100	90	64	84	60	72	22	88	64
評価			A	C	A	C	B	E	A	C

第33表 技術評価表

地区名	調査対象	稚蚕飼育		壮蚕、上簇		調査件数	
		評価点数	評価	評価点数	評価	稚蚕飼育所	壮蚕農家
Pising	Pilot Unit	90	A	● 89	A	1	● 3
	一般農家	64	C	▲ 56	D	1	▲ 12
	(平均)	(77)	B	73	B		
Luppange	Pilot Unit	80	A	● 96	A	1	● 1
	一般農家	60	C	▲ 57	D	1	▲ 15
	(平均)	(70)	B	77	B		
Wanio	Pilot Unit	72	B	● 97	A	1	● 2
	一般農家	22	E	▲ 47	E	1	▲ 22
	(平均)	(47)	E	72	B		
Ugi	Pilot Unit	88	A	● 93	A	1	● 2
	一般農家	60	C	▲ 60	C	1	▲ 14
	(平均)	(76)	B				

摘要：1.技術評価 A(80以上)、B(70以上)、C(60以上)、D(50以上)、E(50以下)

2.壮蚕農家調査 ● - Pilot Unitの演示農家 ▲ - Pilot Unitの一般農家

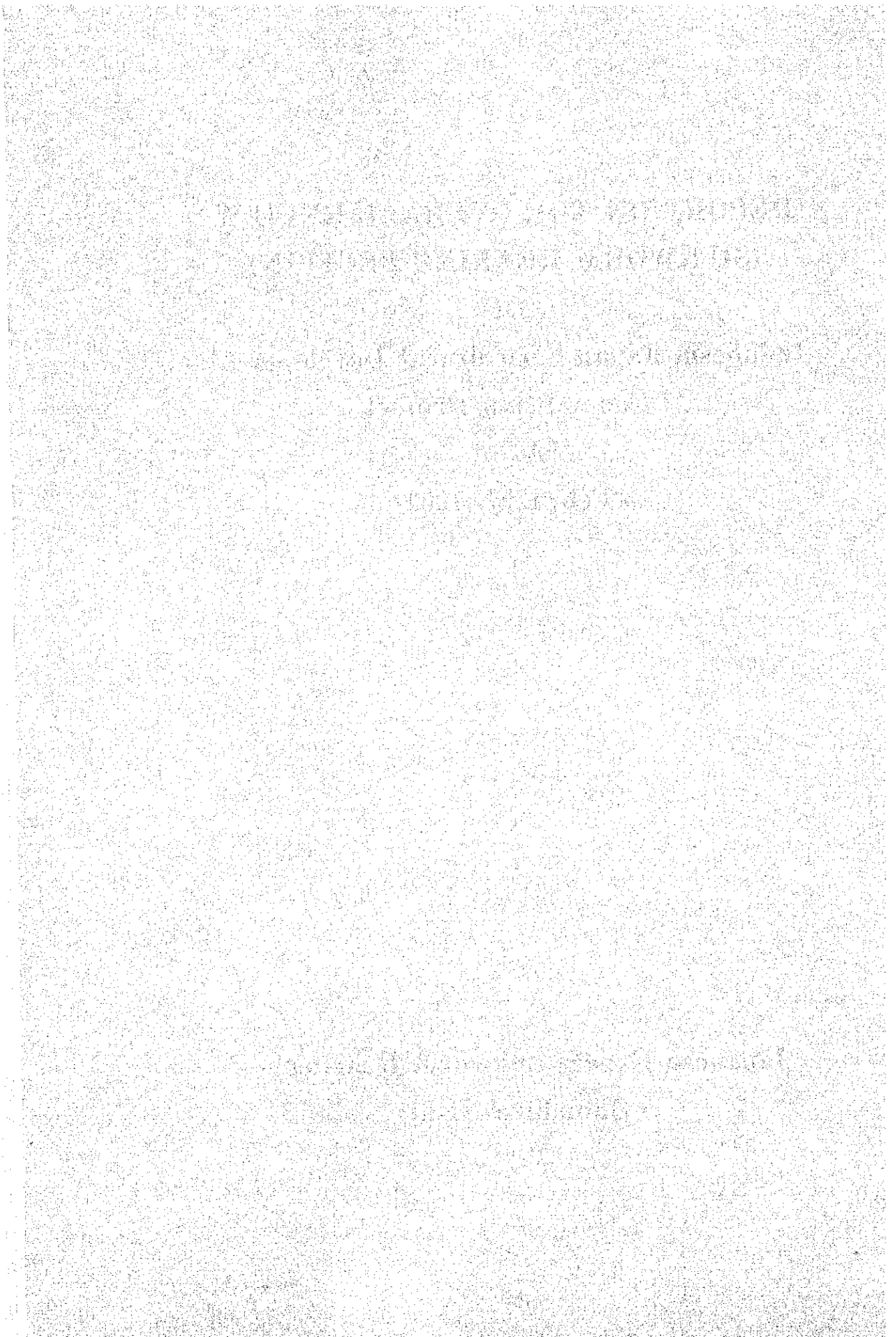
第34表 養蚕成績(参考)

地区名	調査対象	揃立月日	蚕飼育農家数	飼育量箱	収穫量 kg	収穫量/箱 kg	作柄 %
Pising	Pilot Unit	1-6-82	25	30	675.9	22.5	102
	一般農家	31-5-82	5	13	211.3	16.3	74
	計、平均		30	43	887.2	19.4	88
Luppange	Pilot Unit	1-6-82	25	12	282.1	23.5	107
	一般農家	17-6-82		15	150.0	10.0	45
	計、平均			27	432.1	16.8	76
Wanio	Pilot Unit	2-6-82	28	20	450.6	22.5	107
	一般農家	25-7-82	6	4	24.0	6.0	29
	計、平均		34	24	474.6	14.3	68
Ugi	Pilot Unit	2-6-82	20	30	704.7	23.5	112
	一般農家	25-7-82	21	14	252.0	18.0	86
	計、平均		41	44	956.7	20.8	99

摘要：作柄指標は、1箱当り収穫量 Pising・Luppange = 22kg Wanio・Ugi = 21kg

**REPORT ON THE OVERALL REVIEW
(SILKWORM REARING SECTION)
OF
Indonesia-Japan Sericultural Development
Cooperation Project
As of
February, 1983**

**Japanese Expert Silkworm Rearing
Shoichiro Nishi**



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VIII-3 SILKWORM READING

VIII-3-1 Method of young silkworm rearing (Centre).

(1) Characteristics of the tropical region.

Silkworm rearing activities are being performed in this region, under the unique meteorological environment i.e. high temperature, high humidity and excessive dryness.

As in the tropical region, the temperature inside rearing room is considered not too high. However, the combined effect of humidity and temperature, such as high temperature and high humidity in rainy season and high temperature and excessive dryness in dry season, makes silkworm rearing difficult and silkworm susceptible to disease, causing unstable cocoon harvest:

In the most of this region, young silkworm rearing can be carried out anytime throughout a year without any heating. But this, on the other hand, makes the tendency to perform silkworm rearing activities without planning, ignoring the yield or quality of mulberry leaves.

(2) Progress attained and present condition.

Until 1979 local investigations have been conducted concerning farmers' silkworm rearing activities. Positive experiment have also been conducted at the Sub Centre. Meanwhile Japanese techniques were adjusted to local condition in order to improve silkworm rearing technique which has existed before.

At the end of 1979, a Model I young silkworm rearing unit has been completed at Bili-Bili, and further improvement and development of the technique were made, thus bringing about the accomplishment of better and more advanced techniques.

In early 1982 the construction of some of the Pilot Unit's young silkworm rearing unit was also completed. Combination of those improved and developed techniques are hitherto taught and demonstrated to members.

Locally, young silkworm are usually reared in young silkworm rearing units until the third instar. During the molting of third instar, those silkworms are distributed to farmers.

Buildings owned by farmers, used to rear young silkworm, usually have small windows, poor ventilation, lack of sunshine and earthen floor. Such conditions make simplicity the disinfection of the building difficult. Such buildings are still prevailing until today.

Materials to support rearing activity such as seat paper, damp proof paper, disinfectant of body surface of silkworm and other tools for rearing are less used. Rearing methods vary, and the rearing materials such as silkworm seat paper, damp proof paper, body disinfection chemicals and rearing tools, are also insufficiently prepared. Other problem are in methods of leaf preservation, besides the problem of the rearing techniques.

The solution is a steady cocoon production by means of improvement of rearing establishment, and prompt improvement of young silkworm rearing techniques.

(3) Trial experiments to develop techniques for young silkworm rearing.

1) Construction of locally adapted silkworm rearing buildings for trial use.

a) Objectives.

Drawing and model making a design of a young silkworm rearing establishment which is adapted to local condition, in order to be demonstrated and transmitted to farmers.

b) Summary of the process and result of model making.

At the end of 1979, a Model I young silkworm rearing unit was established at the Centre (such as shown in the picture in Experts Report JR 80-55). From 1980 through 1981 three hakitate have been performed in the building (in May and August 1980 and in February 1981). Afterwards several rearing activities were performed to examine the good and bad of the facility.

Young silkworm rearing is performed in this way : At instar I and II silkworm are reared with the use of trays on which a piece of damp proof paper, is laid and base, and covered with damp proof paper too. Leaves are chopped and fed three times a day. At instar III the damp proof paper is only used as cover. Leaves are fed with mulberry shoot, given three times a day.

As a result, each rearing period produced reelable cocoon weighing about 30 kg per box, such as shown in this report table 8-3-3. Consequently the model establishment may be adopted in this region, and it became the basis for the establishment of the Pilot Unit's young silkworm rearing building (picture is shown in Experts Report JR 82-55). In April 1981 the design model was revised, and from November 1981 through August 1982 five young silkworm rearing buildings have been established, respectively at Luppange, Pising, Ugi, Wanio and Baraka.

In November 1981 the young silkworm rearing unit at the Pilot Unit of Luppange was for the first time used for training of guidance technician, who were going to assigned as a guidance technician of five Pilot Units take care of it, and for the test of silkworm rearing techniques. In March 1982 demonstration of actual young silkworm rearing were held at four Pilot Unit buildings (except Baraka), and silkworm distribution to farmers was also demonstrated. Thus far the result attained are quite good (for Baraka those demonstrations were not performed until September 1982).

In June 1982, at the completion of the silkworm rearing unit, a reconstruction was made of the young silkworm rearing buildings, i.e. a new window was made at the upper part of the side wall in order to permit more sun light. For the one in Luppange especially, the nipa roof was replaced by asbestos.

c) Techniques developed.

Establishment of Model I young silkworm rearing building at the Centre.

Based on the local rearing unit and observation of actual conditions, the main measures for the prevention of silkworm diseases in the environment of rearing place are taken; the following matters deserve consideration:

a. Hitherto single roomed rearing units are found everywhere.

Therefore in the future rearing units should be established which are equipped with a leaf preserving room, leaf chopping room, equipment storage room, and at the entrance and exit doors there should be foot and hand disinfection places.

- b. Earth floored rooms are now found everywhere, and in the future the room should be concreted.
- c. Walls are hitherto made of woven bamboo, and in the future walls should be made of concrete for the bottom part and of wood for the upper.
- d. Ceilings are mostly made of woven bamboo, and they have to be replaced by plywood.
- e. Young silkworm rearing rooms hitherto have few small windows, while there should be more windows of larger sizes. On the upper bottom parts of the wall, wooden ventilations should be made which can be opened and closed. In between the wooden windows and large size window there should be closed glass panes, in order to permit light into the room.
- f. Walls of the rearing room and the leaf preserving room should be coated with lime.
- g. A washing pool should be established outside the room to wash rearing tools.

In addition to all those mentioned above, a mulberry field for young silkworm rearing should be established near the rearing room, and the building should be in the vicinity of a clean water source.

(Iyus R.A., Bambang Hr., J. Nakamura, S. Nishi)

- 2) Model making of locally adapted trays and racks for young silkworm rearing.

- a) Objectives.

Established young silkworm rearing houses have used self made wooden and bamboo racks. Jaundice and particularly Aspergillus spores, may enter those tools easily. Disinfection of those tools is difficult, so the germ can remain in them. Therefore, in few of silkworm disease control, it is attempted to make the model of iron made racks and trays locally, and make use of it for demonstration, and will be introduced to the farmers.

b) Summary of the process and result of model making.

It was attempted in late 1979 to make iron racks and trays locally, and use them in the Model I young silkworm rearing rooms (see picture in Experts Report JR 80-55).

Then in January 1982 a revision was made, i.e. adding the stories of rack, and the iron tubing to which the rack was fastened through a screw was welded. After improvements were made in certain parts, racks were produced in a large number in Ujung Pandang. In March 1982 five racks and 80 trays were tried for use in one of the Pilot Unit's young silkworm rearing establishments.

c) Technical improvement.

Local production of iron racks and trays.

a. In early 1980 racks and trays were made with some essential improvements:

- (a) Racks and trays were made of iron tubing and iron wires.
- (b) The rack was 180 cm long, 70 cm wide, 160 cm tall, distance between storeys was 20 cm. Each set consisted of 8 storeys.
- (c) The rack poles used were 1.25 inch in size, while the tubing to put the trays on was 0.625 inch in size. The tubing where the trays were put was screwed to the poles.
- (d) The trays measured 110 cm long and 80 cm wide.
- (e) The edges of the trays were lined with 0.625 inch tubings, and its rearing bed was made of undulated wire, arranged like nets.
- (f) The racks and trays were painted.

b. In 1982 racks and trays are made which are improvement of the ones mentioned under a.

- (a) The rack poles are replaced by iron rectangles, and the tubing where trays are put are welded to the iron rectangles. At the sides of the rack, iron rectangles are set diagonally, in order to strengthen the rack.
- (b) The rack storeys are increased to 10, at distances of 16.5 cm. between them. The rack becomes 180 cm tall.

In making the rack and trays at the smiths, they are also rust-proofed and afterwards painted. In times when there is no rearing activity the racks and trays are repainted where the paint has faded.

(Iyus R.A., Bambang Hr., J. Nakamura, S. Nishi).

3) Observation of silkworm rearing at locally adapted young silkworm rearing buildings.

This observation was made in 1980 at the Centre, in the constructed Model I young silkworm rearing building. Demonstration at the Pilot Unit is written in another part.

a) Objectives

This observation aims to test the result of the use of Model I young silkworm rearing building, which has been constructed at the Centre, and the use of the iron racks and trays.

b) Method and results of observation.

a. Silkworm rearing method.

Young silkworm rearing is performed in this way: Instar I and II silkworms are reared in trays, laid only damp proof paper and covered with the same material. Leaves are chopped before fed, which is three times a day. At instar III damp proof paper is only to cover and fed with mulberry shoot, feeding is done three times a day. Instar IV and V silkworm fed with mulberry shoot, three times a day.

b. Method and results of observation

Instar I through III were observed in this building, and these silkworm were used for the experiment on rearing with mulberry shoots and other experiment at their grown silkworm stages. Some of the results of observation are described below (for further details please refer to Experts Report JR 80-55).

Results of observation may be seen in the following tables.

Table 8-3-1 Experiment of grown silkworm rearing with mulberry shoots
(reference materials) January 1980.

Experi- mental unit.	Quanti- ty of silk- worms used.	Percentage of missing larvae.		Percentage of reela- ble cocoon.	Cocoon yield per a box	Number of co- coons per 500 grams	Cocoon weight
		Y.S.	G.S.				
	box	%	%	%	kg.		gram
(A)	0.5	5	5	93	31.0	276	1.81
(B)	0.5	5	10	87	28.9	278	1.80

Remarks:

1. (A) = Indoor one story shoot rearing.
(B) = Indoor one story shoot rearing.
2. Silkworm race used : F₁ hybrid of KINSHU x SHOWA, imported from Japan.
3. Rearing tools used :
(A). Using of iron racks and trays which are imported from Japan.
(B). Using of locally conditioned iron racks and trays.
4. Y.S. = Young silkworm.
G.S. = Grown silkworm.

Table 8-3-2 Experiment of open air shoot rearing (reference materials)
February 1980.

Experi- mental unit	Number of silkworm to be reared.	Percentage of miss- ing larvae	Percentage of reela- ble cocoon.	Cocoon yield per box.	Number of cocoons per 500 grams	Cocoon weight
	box	%	%	kg		gram
(A)	1.0	8	97	30.4	271	1.80
(B)	1.0	9	98	29.7	274	1.80
(C)	0.5	8	95	27.8	282	1.80

Remarks:

1. (A) = Indoor one story shoot rearing.
(B) = Indoor one story shoot rearing.
(C) = Outdoor two stories shoot rearing.
2. Silkworm raced used at the observation F₂ breeds of KINSHU x SHOWA F₁ hybrid (second generation of F₁ hybrid).
3. Rearing tools used:
 - (A). Using of iron racks and trays, imported from Japan.
 - (B). Locally conditioned iron racks and trays.

Table 8-3-3 Result of silkworm rearing at the second training for guidance technicians June - July 1981

Rearing person nel.	Amount of silkworms to be reared.	Cocoon yield per box	Percentage of missing larvae.	Cocoon weight	Percentage of cocoon shell weight	Number of cocoon per 500 grams
	box	kg	%	gram	%	
A	0.55	31.5	5.6	1.85	20.9	278
B	0.48	34.7	6.1	1.93	21.5	262

Remarks:

1. Silkworm race reared: $BN_2 \times BC_{102}$
2. Percentage of missing larvae from the beginning of silkworm rearing until cocooning.

Table 8-3-4 Result of silkworm rearing at the third training for guidance technicians October - November 1981.

Rearing person nel.	Amount of silkworms to be reared.	Cocoon yield per box	Percentage of missing larvae	Cocoon weight	Percentage of cocoon shell weight	Number of cocoon per 500 grams
	box	kg	%	gram	%	
A	0.48	27.2	17.9	1.78	21.7	275
B	0.44	27.4	19.0	1.79	21.6	287
C	0.40	29.9	11.8	1.78	22.1	274
D	0.48	27.6	15.5	1.78	21.9	289

Remarks : Silkworm race reared : $BN_2 \times BC_{102}$

c) Summary of results.

Tables 8-3-1 to 8-3-4 show that one box of silkworm produces about 30 kg cocoon. Results of this experiment are results of young silkworm rearing both in the rainy and in the dry season. Consequently the local adaptability of the building as well as the tools for young silkworm rearing was proved. There is no problem in the use of racks and trays in rearing, but the distance between storeys are too wide, and 8 storeys of trays are deemed insufficient. Distances may be reduced and the number of trays in a set may be as many as 10 (racks revised in the shape and arrangement have been made in 1982 for use at the Pilot Unit).

(Iyus R.A., Bambang Hr., J. Nakamura, S. Nishi)

4) Observation of silkworm rearing by exchange of reared silkworm between the Sub Centre and farmers.

a) Objectives

Around the Sub Centre there are sericultural farmer groups rearing young silkworm from stadium I through instar III, while grown silkworms (instar IV and V) are reared with mulberry shoot at a rearing place below the raised housefloor of the farmers. However, the cocoon production per box is low, due to the severe damage caused by silkworm disease. Therefore, the exchange silkworm rearing experiments were performed between Sub Centre and farmers groups, e.g. young silkworm reared at Sub Centre and grown silkworm at farmers groups; or young silkworm reared at farmers group and grown silkworm at Sub Centre (see following explanation).

The objective of this rearing is to know the cause for the low cocoon production per box, and as means of comparison for technical improvement.

b) Method and summary of results.

Further details may be seen in Experts report JR 80-55.

a. Method of observation.

(a) Observation was carried out in October 1979.

(b) Silkworm races used at the observation were F₂ breeds of KINSHU x SHOWA (second generation of F₁ hybrid).

(c) Type of observation.

Code	Silkworm rearing place	Method of silkworm rearing	
		Young silkworm	Grown silkworm
A	Young and grown silkworms at the Sub Centre.	Reared in trays covered with damp-proof paper, leaves chopped.	Reared in trays with mulberry shoot.
B	Young silkworm at Sub Centre Grown silkworm at farmers.	Reared in trays covered with damp-proof paper, leaves chopped.	Reared in One-story rack, with mulberry shoot.
C	Young silkworm at farmers rearing unit, Grown silkworm at Sub Centre.	Reared in two-storeyed racks with damp-proof paper. Instar III with mulberry shoot covered with moist cloth.	Reared in trays with mulberry shoot.

Remarks:

1. Number of egg reared from each unit 0.5 box;
2. Number of grown silkworm reared at the observation 400 larvae (worms).

b. Result of observation.

Table 8-3-5 Results of observation.

Unit	Percentage of missing larvae.	Percentage of cocooning		Number of cocoon per 500 grams	Cocoon weight	Cocoon yield per a box
		Reelable cocoon	double cocoon			
	%	%	%		gram	kg
A	9.13	90.3	3.3	301	1.66	23.5
B	13.70	87.6	3.5	401	1.25	16.6
C	15.30	88.3	4.1	350	1.43	18.8

b) Method and summary of results

a. Method and results of observation: Refer to table 8-3-6 and table 8-3-7.

Table 8-3-6 Leaf wither ratio of Japanese and Indonesian damp proof paper.

Experimental unit	Percentage of leaf wither				Time of observation and weather.
	After 4 hours	After 6 hours	After 8 hours	After 24 hours	
	%	%	%	%	
1. Use of damp proof paper as cover and base.	6.6	9.0	12.9	26.5	May 6, 1981 at 10.00 a.m. temp. 28°C hum. 85%
2. Use of local damp proof paper as cover and base	17.7	30.2	34.8	63.9	May 6, 1981 at 2.00 p.m. temp. 31°C hum. 72%
3. Use of folded local damp proof paper as cover and base.	18.0	25.1	34.3	65.3	May 6, 1981 at 4.00 p.m. temp. 30°C hum. 75%
4. Use of seat paper only.	21.9	32.3	37.8	64.7	May 7, 1981 at 10.00 a.m. temp. 28°C hum. 85%

Table 8-3-7 Utilization method and leaf wither ratio of Indonesian damp proof paper.

Experimental unit	Percentage of leaf wither				Time of observation and weather
	After 4 hours	After 6 hours	After 8 hours	After 24 hours	
1. Use of damp proof paper as cover and base.	30.7	40.2	46.7	62.3	May 12, 1981 temp. 28°C hum. 77%
2. Use of damp proof paper as cover and base.	29.5	40.6	48.7	62.6	May 12, 1981 temp. 30°C hum. 72%
3. Some like No.2, but on the upper side covered with seat paper and sprayed with water.	29.9	40.4	47.3	63.6	May 12, 1981 temp. 28°C hum. 77%
4. Same like No.2, but folded paper put in the edge.	27.0	34.9	43.5	63.6	May 13, 1981 temp. 28°C hum. 77%

b. Summary of results

Table 8-3-6 show that local damp proof paper gives poorer results than Japanese damp proof paper. There is a big difference in the percentage of leaf weight loss as the times go by. There is not much difference if locally damp proof paper is used.

Various treatments with the use of locally damp proof paper such as in Table 8-3-7 do not give the expected result. There is essential between the use of Japanese damp proof paper and locally damp proof paper even if they seem similar.

The use of locally damp proof paper as cover is overconfident, and it would be better if humidity in the room can be regulated and feeding in the dry season may be added in order to prevent leaves from withering.

(Iyus R.A., S. Nishi).

6) Practice in the use of "ani-ani" in harvesting mulberry leaves for young silkworms

a) Objectives.

People in Southeast Asia have since long used "ani-ani" to cut paddy. In rearing young silkworms people tend to use plant scissor to harvest leaves. Actually these scissors are used to prune mulberry trees. It is thus tried to use "ani-ani" in picking green shoot for silkworm of stadium I through instar III.

b) Summary of results

a. Characteristics and effect of techniques.

Local farmers are accustomed to the use of this tool, and they can use this tool skillfully. "Ani-ani" can only be used when leaf-stems are still soft and not woody. As young silkworms need leaves at the age of 30-40 days, when stems are soft, "ani-ani" may be used. At the Pilot Unit and at the Centre "ani-ani" has been used without trouble.

b. Background for the use of this tool, and the suggestion upon utilization of it.

Although plant-scissors are used in picking leaves for young silkworms, sericultural farmers cannot afford to buy the good quality tool as it is too expensive. Even one that costs Rp 2500,- to Rp 3000,- are of poor quality.

"Ani-ani" costs about Rp 250,- a piece, and it is easily available anywhere. When the blade has dulled, it may be replaced with a new one. It should be attempted to find "ani-ani" blade of good quality.

(Iyus R.A., S. Nishi).

7) The practice of silkworm body disinfection with Ca-hypochlorite as disinfecting agent during young silkworm period.

a) Objectives

Silkworm body disinfection has hitherto been performed with the application of pafsol; but as it is not easily available, and as

local Aspergillus spores are immune against formaline, Cahypochlorite is used to replace pafsol, and this has been practised by the pest and disease section. It has been tried at the project, and its effect on reared silkworms is studied.

b). Method and summary of results

a. Method

(a) The chemical applied is a mixture of Ca-hypochlorite and lime, at a relation of 1 Ca-hypochlorite: 19 lime. Dosage of application to silkworms is as follow:

1 gm. per 0.1 m² for instar I silkworms,

2 gm. per 0.1 m² for instar II silkworms,

3 gm. per 0.1 m² for instar III silkworms,

bestrown through a plastic sieve. The chemical is bestrown on the surface of the silkworm rearing tray.

(b) The bestrewing of the disinfecting agent is done at the time of hakitate, before the first feeding at instar II and at instar III before first feeding, and at time of net-spreading before molting.

(c) This observation was not carried out with a dissemination of a germ, but it was merely a practice in the use of Ca-hypochlorite mixture, and an observation to study silkworm growth, condition at harvest time and cocoon quality.

b. Summary of results

Data of this observation are described in further reports.

(a) Results

In 1981 silkworm rearing was performed five times both at the Centre and Sub Centre. In 1982, at every rearing period, the disinfecting agent mentioned above was applied to silkworm bodies. There is no evidence of the muscardine disease which usually prevails, and other diseases are slightly evident. Condition at cocoon harvest time is steady, silkworm growth and cocoon quality are unaffected by the drug. In correspondence to this condition, from March 1982 on young silkworm rearing at the Pilot Unit introduces the use of the above mentioned chemical.

(b) Matters deserving attention

Disinfection of newly hatched silkworm at hakitate is done with the use of a gauze-layered sieve to prevent the agent from pouring too much. After the disinfection done at hakitate and at instar II & III after molting, silkworms should be fed immediately. At instar III, as leaves are eaten up, silkworm bodies are again disinfected, and afterwards a net is spread out. Disinfecting agent should possibly be prevented from being eaten by silkworm, and wet leaves should not be fed. The lime used for mixing should be good, dry and sifted first before use. Then the lime is mixed thoroughly with Ca-hypochlorite. Two days after the mixture is made, its effectivity will decrease, so the mixture should preferably be made shortly before use.

(Iyus R.A., Baharuddin A., S. Nishi).

(4) Technique developed

The developed technique for young silkworm rearing is described detailfully in the Manual of Sericulture within the report No. VIII-7-1-(6), i.e. on the demonstration of silkworm rearing technique.

Development and improvement of the technique are described in the following articles.

- 1) Silkworm rearing technique for instar I through instar III.
- 2) Standard table for silkworm rearing (table 8-3-11.12).
- 3) Improvement of farmers young silkworm rearing units and improvement of silkworm rearing.
- 4) Model making of young silkworm rearing units adapted to local condition, and observation of silkworm rearing.
 - a). Establishment of Model I young silkworm rearing building at the Centre.
 - b). Establishment of a young silkworm rearing building at the Centre.
 - c). Model construction and local production of racks and trays.
- 5) The practice of using Ca-hypochlorite as disinfecting agent to young silkworm bodies.

- 6) Observation of the effects of local damp proof paper as cover to prevent leaf withering, and countermeasures techniques.
 - 7) The practice of using "ani-ani" in leaf harvesting for young silkworm.
- (5) Unsolved problems and suggestion for the future.
- 1) The exact time to conduct hakitate in each region.
 - 2) It is still difficult to decide how many boxes of young silkworm to be raised, due to ever-increasing farmers demand.
 - 3) The problem of damp proof paper unavailable in Indonesia, whether Indonesia will produce it herself, and where to obtain it otherwise.
 - 4) Techniques accepted at the Pilot Unit and farmers' demonstration should be immediately transmitted to farmer groups in order to be widespread and never to be eliminated.

VIII-3-2 Method of grown silkworm rearing (Centre)

(1) Characteristics of the tropics

Including some parts of the zone that lies in highlands, silkworm rearing can be performed throughout the year, even without the help of a heating system. Storm and hurricanes do not occur either. Parasitic Tachina fly, which is found in several countries of Southeast Asia, does not exist in Indonesia, giving some advantage conditions, since grown silkworms may be reared in simple buildings. However, in the rainy season, temperature and humidity are high, while in the dry season temperature is high and too dry. These circumstances make diseases develop and contaminate. In the dry season, leaf quality worsens, leaves fed to the worm wither quickly, the high temperature accelerates the growth of silkworms, thus shortening feeding period. Such a case makes cocoon production and cocoon quality decline. Control over this environmental condition is a difficult problem.

(2) Progress attained and present condition

Until 1979, researches have been conducted on the actual condition of farmers' silkworm rearing activities in the region, and applied experiments have been carried out at the Sub Centre to adjust advanced Japanese rearing techniques to farmers' condition, then rearing techniques of the farmers were improved based on these locally adapted Japanese originated techniques. In addition, improvement have also been made of the present silkworm rearing technique.

In late 1979 a young silkworm rearing building and a outdoor "JOSŌ" rearing (shoot rearing) house were completed. New techniques started to be tried and developed in order to improve into better and more advanced techniques.

In early 1982 all the techniques of rearing having been compiled, they started to be applied and taught to extension officers in order to be spread to farmers, particularly those who are members of the pilot Unit.

In this region, farmers generally rear silkworms under the pillars of their houses, silkworm rearing places apart from the bottom of houses are rarely found. Racks used for rearing consist of 2 to 4

times a day. Due to the design of the silkworm rearing place, disinfection of the rearing room can not be done completely. In addition, farmers have not developed the desire to control silkworm diseases, resulting the frequent prevalence of jaundice and Aspergillus disease. This results in unstable cocoon production.

Silkworm rearing may be performed throughout the year, owing to the favorable meteorological environment. Besides, they used to rear silkworm of polyvoltine breed that could be raised at any time. Because of this former habit, farmer tend to perform rearing activities without definite rearing plan.

(3) Trial experiments to develop techniques for grown silkworm rearing.

1) Trial construction of a rearing house (open air shoot rearing) and a rearing examination.

a) Objectives

With the main aims of bigger rearing capacity with smallest construction cost, model house is constructed for the study on local adaptability, considering the protection of silkworms from excessive heat and dryness, the moderate air flow and easier construction by farmers.

b) Performance and summary of the result of experiment

a. In October 1979 a silkworm rearing house model I was constructed at the Centre, and its use has been tried since January 1980 (Experts Report JR 80-55). In this rearing house in May 1981, an experimental rearing was performed.

Several problems encountered were:

(a). The strong wind blow, and

(b). The leaves quickly withered. Consequently the house was improved by using woven bamboo for surrounding walls.

In June 1982, another rearing house was constructed, of which 3 designs were drawn.

(a). One for instar IV silkworm rearing (2 boxes).

(b). One for grown silkworm rearing (1 box or 1.5 box) and one for 1.5 box (model II) was the one newly made (see fig. 8-3-1).

In June and August 1982, it was attempted to rear silkworms in a small number in the house, and it is expected that a larger number can be reared in the future.

b. Result of observation

Result of observation is shown in Table 8-3-8 and table 8-3-9.

Table 8-3-8 Data of silkworm rearing, May 1981.

Experi- men- tal unit	Amount of silkworm to be reared	Cocoon yield per box	Percentage of missing larvae	Cocoon weight	Percentage of cocoon shell weight	Number of co- coon per 500 gram
	box	kg	%	gram	%	
Indoor shoot rearing	0.5	29.9	8.0	1.83	20.9	289
Outdoor shoot rearing	0.15	19.6	10.9	1.81	20.4	289

Table 8-3-9 Data of silkworm rearing, June 1981

Experi- men- tal unit	Amount of silkworm to be reared	Cocoon yield per a box	Percentage of missing larvae	Cocoon weight	Percentage of cocoon shell weight	Number of cocoon per 500 gram
	box	kg	%	gram	%	
Indoor shoot rearing (A)	0.55	31.5	5.6	1.85	20.9	278
Indoor shoot rearing (B)	0.48	34.7	6.1	1.93	21.5	262
Outdoor shoot rearing	0.44	29.9	13.3	1.79	21.1	280

c. Summary results

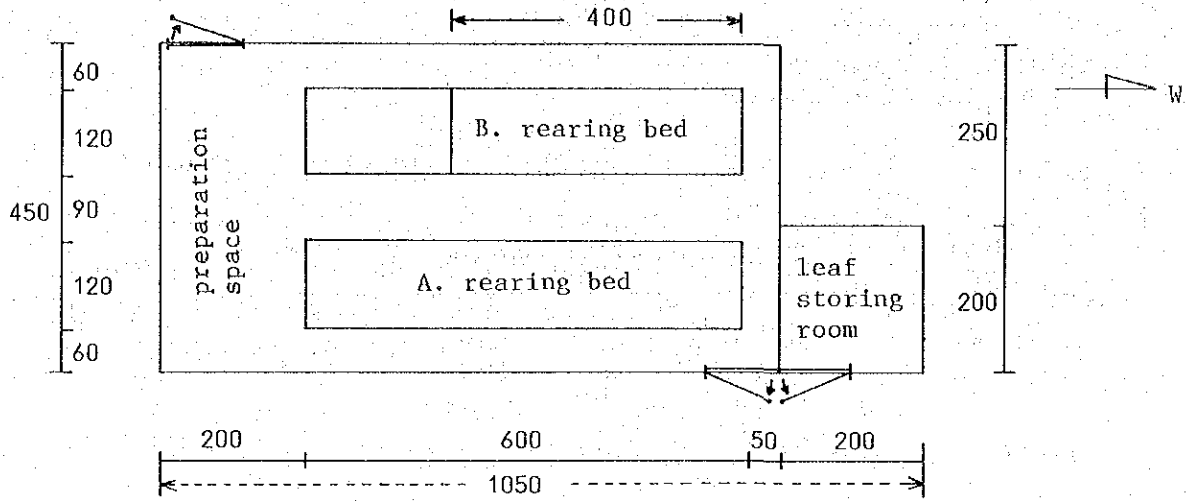
- (a) Data of the results of rearing in May 1981 hardly showed any difference between the two treatments.

Data of the results of rearing in June showed some difference among the three treatments. In the rearing house the percentage of

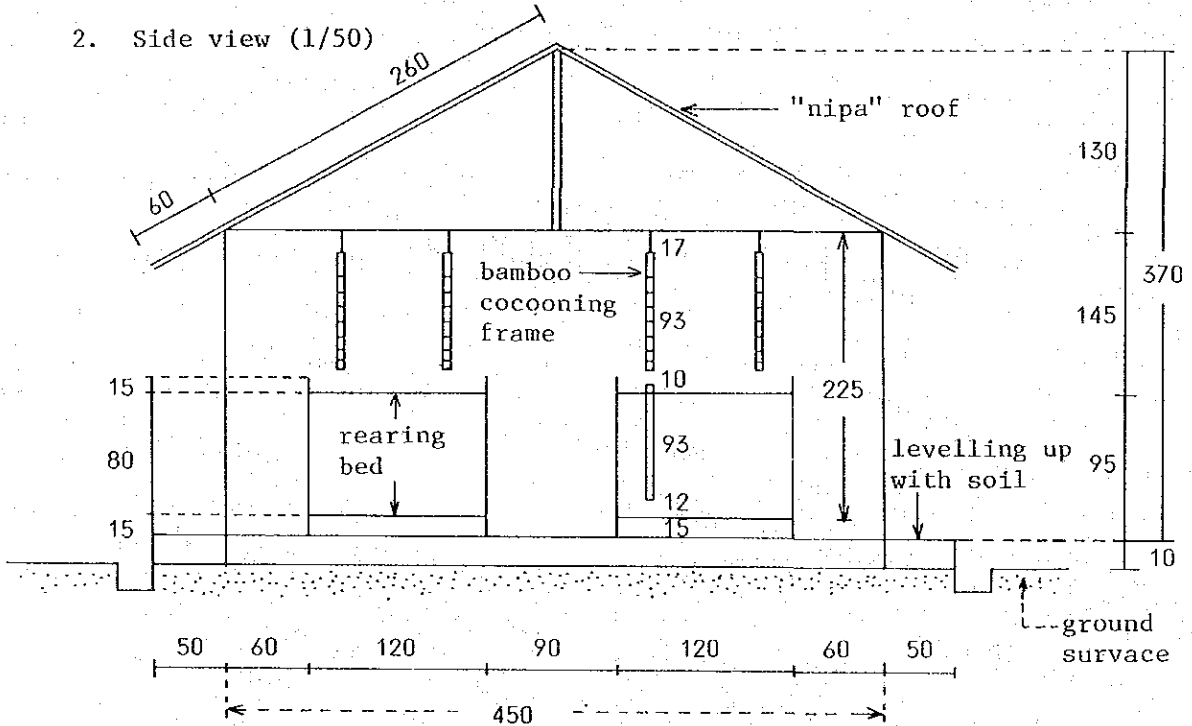
Figure 8-3-1 Construction of open-air shoot rearing house (1.5 boxes).

1. Flat view (1/100)

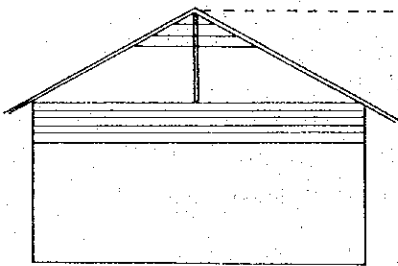
A : 1.5 boxes : 6 m x 2 racks x 2 storeys
 B : 1 box : 4 m x 2 racks x 2 storeys



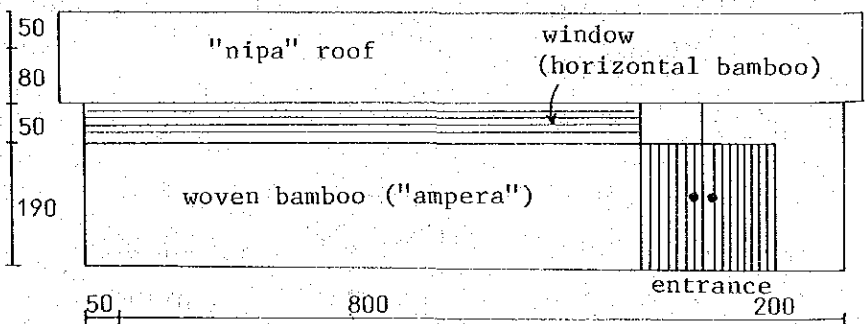
2. Side view (1/50)



3. Eastern view (1/100)



4. Front view (1/100)



silkworm loss was the highest and the cocoon production and quality were somewhat lower than those of the other two treatments. But the result was quite good comparing to the local standard. In the dry season, where temperature is high and humidity very low, countermeasure taken to prevent leaf withering and poor leaf quality is to feed silkworms 4 times a day.

- (b) Narrow & low-roofed silkworm rearing houses are easy to make, but the condition of rearing will be affected by high temperature and low humidity. In a narrow house, only one rearing rack can be placed, making the rearing capacity smaller and resulting economically inefficient. Therefore a model II rearing house was constructed, where two bamboo cocooning frame that have been improved could be hung simultaneously, the roof was heightened and the room widened, in order to accommodate two racks of respectively two storeys.

In farmers' neighbourhood where there are many houses, wind does not blow so hard that a simple bamboo wall to surround the silkworm rearing place will be able to stand it. In regions where the wind blows hard, however walls should preferably be made of woven bamboo and only the upper part of the wall may consist of bamboo bars to serve as ventilation and to permit daylight.

Bamboo materials should be coated with lime emulsion, the earthen floor should also be sprinkled with lime. To avoid direct sunlight, a countermeasure may be taken i.e. making a light screen or planting shelter trees. There is no good method for rat eradication, but it calls for patience in repeatedly applying rodenticides (i.e. racumin) before starting silkworm rearing, as a preventive measure.

(Irus R.A., Bambang Hr., S. Nishi, J. Nakamura)

- 2) Effect of the use of mixed Ca-hypochlorite and lime and that of mixed Ca-hypochlorite and water on grown silkworm reared.

- a) Objective

The use of lime at the silkworm rearing place serves to isolate pathogen of silkworm disease; besides that lime has an absorbing effect on gases poisonous for silkworms in rearing bed. In late 1980 the use of pafsol as a disinfecting agent on silkworm bodies was

proposed to be replaced by a mixture of Ca-hypochlorite with water at a ratio of 1 : 1000 (1 gm. of Ca-hypochlorite in 1 litre of water) by Dr. Inoue and others; its effect on silkworm growth and the quality of cocoon produced is studied thereby.

b) Method and result of observation

a. Method of experiment and data of observation. Data on the result of rearing are shown in table 8-3-10.

Table 8-3-10 Data of silkworm rearing

Experimental unit	Percentage of missing larvae from 4th instar until cooing	Percentage of reela-ble cocoon	Weight of cocoon harvest from 10,000 larvae counted at the 4th instar	Number of co-oon per liter	Cocoon weight	Percentage of cocoon shell weight
	%	%	kg		gram	%
Control	12.6	98	15.9	83	1.88	21.7
Spreading of lime	9.2	97	16.5	83	1.88	21.8
Spraying of silkworm bodies by a mixture of Ca-hypochlo-rite with water	9.0	98	16.6	82	1.90	21.6

Remarks.

1. Observation was done at the 4th and 5th instar larvae.
2. Silkworm race: BN₂ x BC₁₀₂.
3. Each experimental unit has a three times of replication, which is a time of its used 2000 larvae.
4. Spraying of silkworm bodies by a mixture of Ca-hypochlorite with water (1 gm. of Ca-hypochlorite in 1 litre of water) was done one time a day, 1 or 2 litres per a box of silkworm reared.

b. Summary results

According to the analysis of variance, there was no difference of significance in the percentage of lost silkworms and the cocoon production. No difference was observed on cocoon quality between different treatment too.

No dissemination of disease germs was carried out in this experiment; only the physiological effect was emphasized by the observation. There was no adverse effect of the lime bestrewing on the rearing bed at the beginning of molting or grown silkworm before feeding and disinfection of silkworm bodies with the use of mixture of 1 gm. Ca-hypochlorite & 1 litre of water. In accordance with the above mentioned condition, the use of Ca-hypochlorite in water was in our opinion good for the prevention of Aspergillus diseases etc.

(Iyus R.A., Bambang Hr., S. Nishi)

3) Micro-meteorological observation in the silkworm rearing room (observation of temperature and humidity in the young and grown silkworm rearing rooms).

a) Objectives

The instrument for automatic control temperature and humidity control is not available yet locally. Environmental condition is naturally influenced by the tropical climate. Therefore a micro-climatic observation is required in a silkworm rearing room as a guide to decide the rearing season and as an aid in improving silkworm rearing technique.

b) Method and summary results

a. Method of observation

A preliminary observation was conducted at the Centre in December 1980. The observation started from January 1, 1981 to be carried on further. This observation is being conducted at present in Soppeng region (Sub Centre) too. This meteorological observation is to be continued annually and in each region from now on. The observation employs weekly roll self-recording thermometer, hygrometers.

b. Summary results

Data of the results of observation are shown in figures 8-3-2 to 8-3-5. The curves of temperature and humidity for 1981 and 1982 look similar, both in the rainy and the dry seasons. In those two years a seasonal variation of temperature and humidity may occur. From August 1982 until some time later there was a condition where temperature was very high and humidity was low, and in September during one month the average humidity was very low, i.e. 50%. Around September was the peak of the dry season, where temperature was high and humidity was very low. In this season there was a low amount of harvestable mulberry, and leaf quality worsened too; humidity was further extremely low so the leaves fed to silkworms withered easily. In our opinion, under such circumstances it is not good to perform silkworm rearing activities. It is expected that, with the aid of collected data, it will be able to decide the right season for silkworm rearing activities.

(Wariso P., S. Nishi)

(4) Techniques developed

Techniques of grown silkworm rearing that have been developed may be seen detailfully in "A Guidance to Sericulture" and in report No. 8-7-1-(6), i.e. about the demonstration of silkworm rearing techniques. Subjects on the developed and improved techniques are as follow:

- 1) Technique for instar IV and V silkworm rearing.
- 2) Standard table for silkworm rearing (table 8-3-11 : rainy season and table 8-3-12 ; dry season).
- 3) Improvement of the place for grown silkworm rearing at the usual place of the farmers.
- 4) Trial construction of a grown silkworm rearing house and observation of silkworm rearing.
- 5) Practice of using Ca-hypochlorite for silkworm body disinfection, and using lime in grown silkworm rearing.

Figure 8-3-2 Temperature and humidity inside of the young silkworm rearing building 1981.

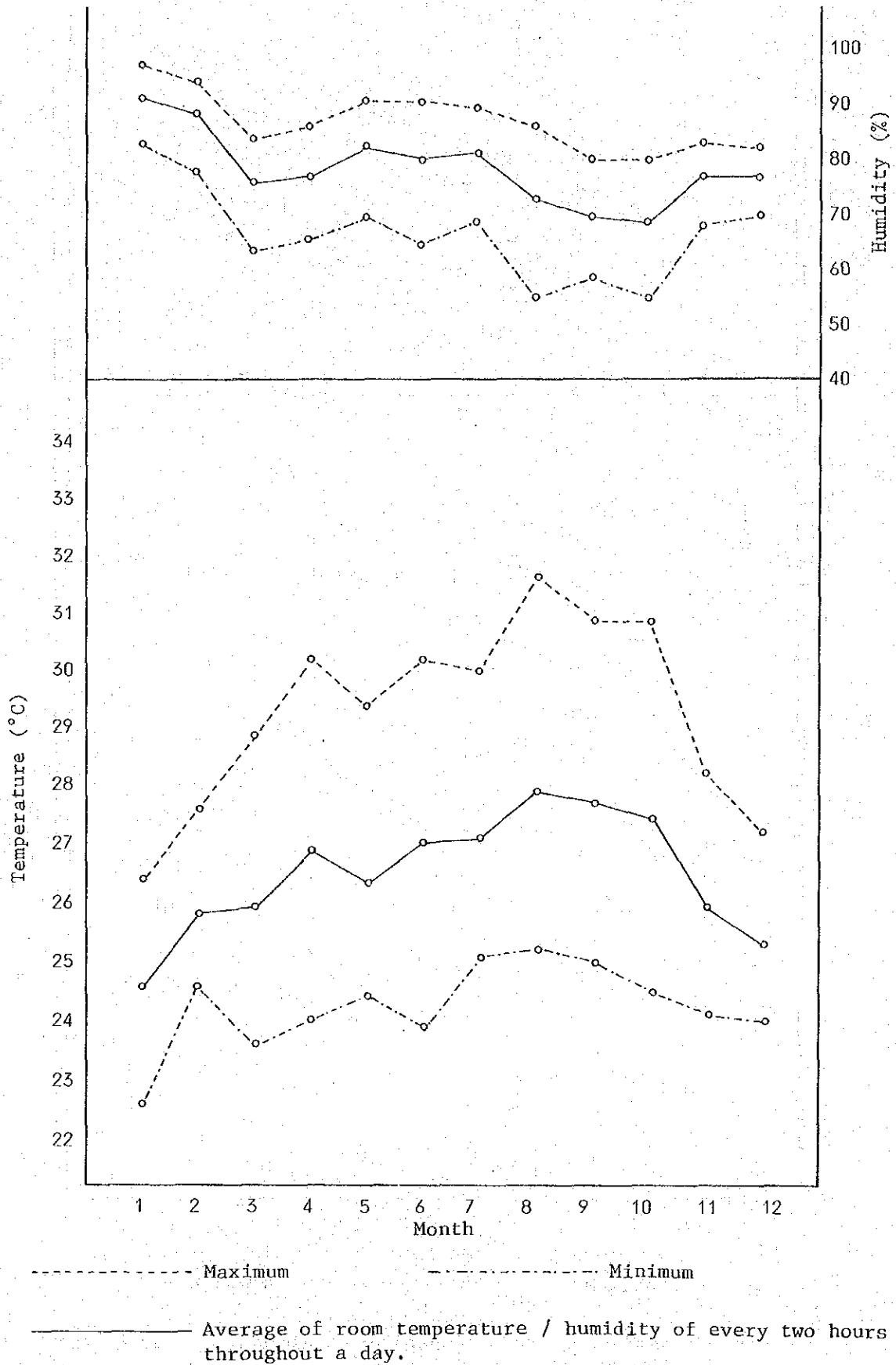


Figure 8-3-3 Temperature and humidity inside of the young silkworm rearing building 1982

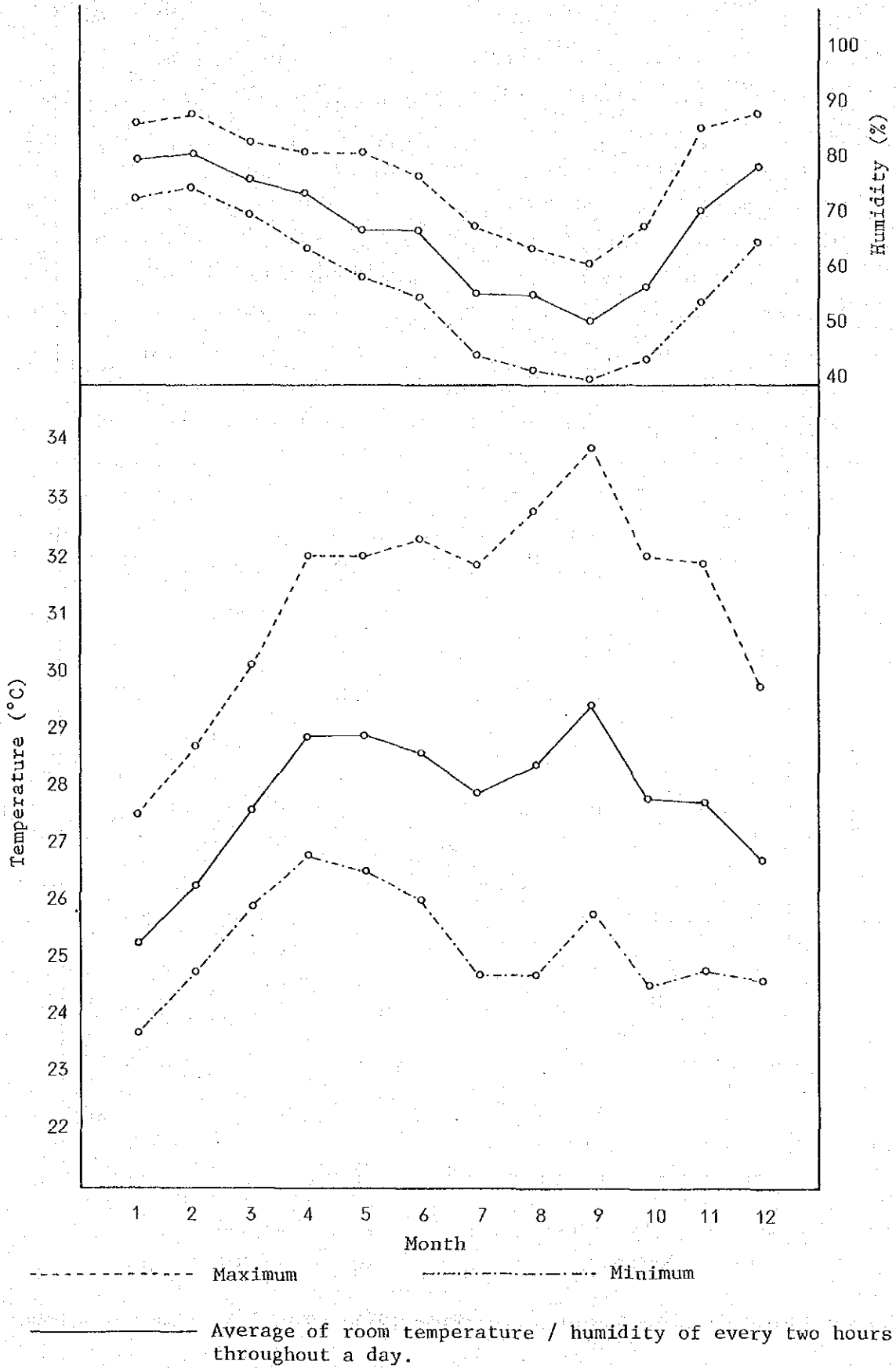


Figure 8-3-4 Temperature and humidity inside of the grown silkworm rearing building 1981

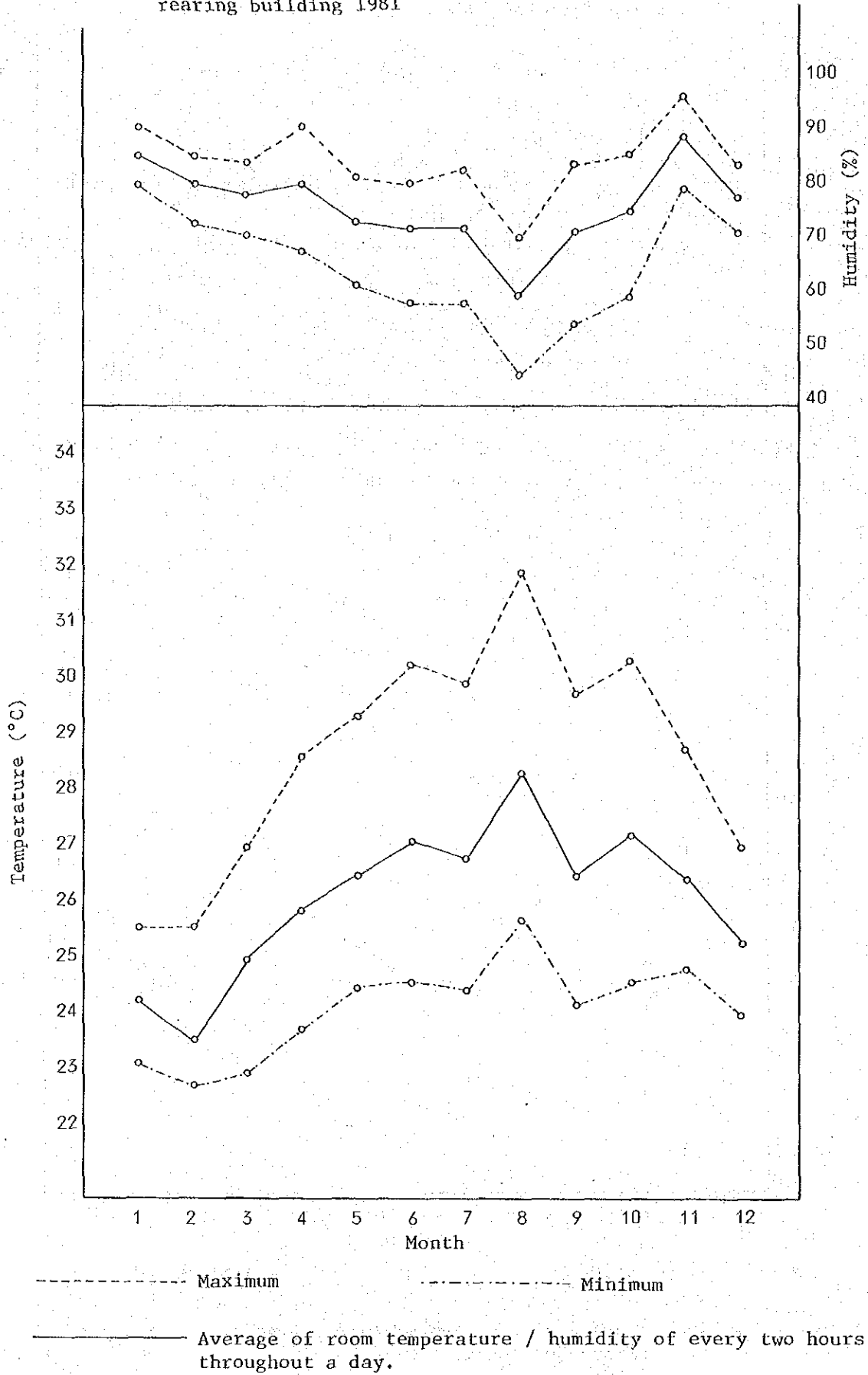
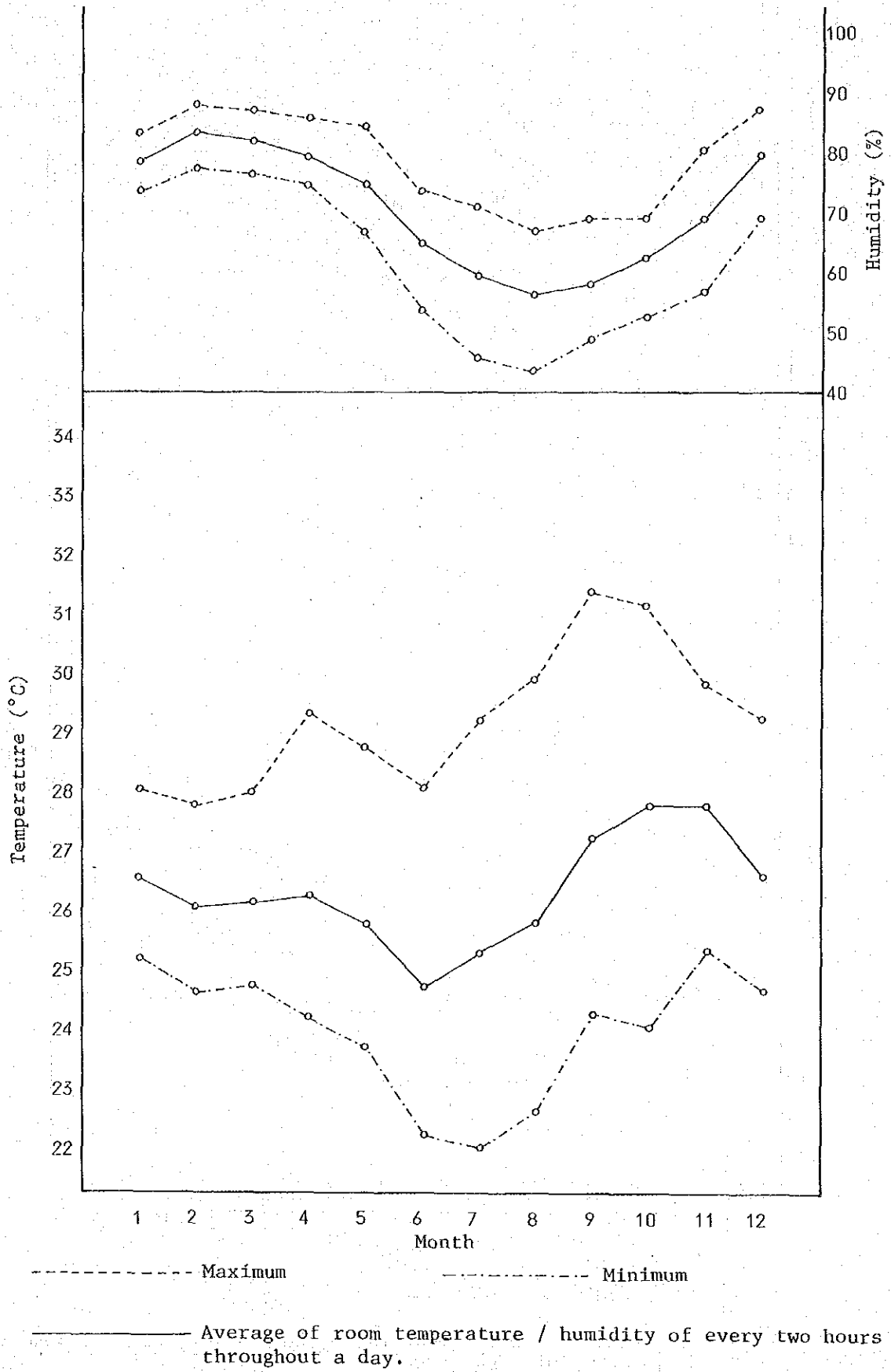


Figure 8-3-5 Temperature and humidity inside of the grown silkworm rearing building 1982



- 6) Micro-meteorological observation in the silkworm rearing room and the method of application.
- (5) Problems still existing and suggestions for the future.
 - 1) Establishment of rearing season in accordance with leaf harvesting system and meteorological condition.
 - 2) Experiment of bigger size rearing at grown silkworm rearing house (outdoor shoot rearing house), its improvement and its demonstration in the localities.
 - 3) Continuity of micro-meteorological observation in the silkworm rearing room and its application to silkworm rearing techniques.

Table 8-3-11 Standard table for silkworm rearing in the rainy season
for one egg case

Instar	Day	Feeding of silkworms				Rearing bed space m ²	remarks
		no.	time of feeding	per feeding gm	daily total gm		
I	(1)	1	09:00	50	240	0.07	<ul style="list-style-type: none"> ◦ Disinfection of silkworm body, first feeding with chopped leaves. ◦ Bed arrangement at 11 a.m.
		2	12:00	60			
		3	17:00	130			
	(2)	4	07:00	100	480	0.20	<ul style="list-style-type: none"> ◦ Bed enlargement in space of 50 cm x 40 cm ◦ Bed enlargement 65 cm x 55 cm
		5	12:00	130			
		6	17:00	250			
	(3)	7	07:00	200	700	0.54	<ul style="list-style-type: none"> ◦ Bed enlargement 77 cm x 70 cm
		8	12:00	200			
		9	17:00	300			
	(4)	10	07:00	260	380	0.63	<ul style="list-style-type: none"> ◦ Divided into two equal parts, with space of 65 cm x 50 cm a tray ◦ Sprinkle with lime
		11	12:00	120			
			17:00	-			
II	(5)	1	12:00	300	1,200	0.72	<ul style="list-style-type: none"> ◦ Disinfection of silkworm body, net setting, first feeding ◦ Bed cleaning and enlargement
		2	15:00	300			
		3	18:00	600			
	(6)	4	07:00	600	2,400	1.10	<ul style="list-style-type: none"> ◦ Bed enlargement 80 cm x 70 cm a tray ◦ Bed enlargement 85cm x 75 cm a tray
		5	12:00	600			
		6	17:00	1,200			
	(7)	7	07:00	800	1,200	2.16	<ul style="list-style-type: none"> ◦ Divided into 2 equal parts ◦ Sprinkle with lime
		8	12:00	400			
III	(8)			kg	kg	m ²	
		1	12:00	1.4	5.4	<ul style="list-style-type: none"> ◦ Disinfection of silkworm, net setting, first feeding 	
	2	17:00	4.0				
	(9)	3	07:00	3.0	13.0	3.20	<ul style="list-style-type: none"> ◦ Bed cleaning, divided into two equal parts ◦ Bed enlargement 67 cm x 60 cm a tray
		4	12:00	4.0			
5		17:00	6.0				

	(10)	6	07:00	5.0	12.2	3.40	◦ Bed enlargement, 70 cm x 60 cm a tray
		7	12:00	4.0			
		8	17:00	3.2			
	(11)	9	08:00	1.6	1.6	3.60	◦ Last feeding of third instar ◦ Bed enlargement
			12:00	-			
			17:00	-			
	(12)		07:00				◦ Distribution to the grown silkworm rearing house
		1	15:00	16	16	5.40	◦ Disinfection of silkworm, netting, first feeding
		(13)	2	07:00	8	40	8.10
	3	12:00	8				
	4	17:00	24				
IV	(14)	5	07:00	10	44		◦ Disinfection of silkworm body, net setting ◦ Bed cleaning
		6	12:00	10			
		7	17:00	24			
	(15)	8	07:00	4	6	10	◦ Bed enlargement, sprinkle with lime
		9	13:00	2			
			17:00	-			
	(16)		07:00	-			
			12:00	-			
	(17)	1	07:00	6	36		◦ Disinfection of silkworm body, net setting, first feeding
		2	12:00	10			
		3	17:00	20			
	(18)	4	07:00	20	96	14	◦ Bed cleaning and enlarge- ment
		5	12:00	26			
		6	17:00	50			
V	(19)	7	07:00	30	126	16-18	◦ Disinfection of silkworm body ◦ Bed enlargement, net setting
		8	12:00	30			
		9	17:00	66			
	(20)	10	07:00	40	160		◦ Bed cleaning
		11	12:00	40			
		12	17:00	80			

(21)	13	07:00	40	160		◦ Disinfection of silkworm body	
	14	12:00	40				
	15	17:00	80				◦ Net setting
(22)	16	07:00	35	125		◦ First mature silkworms picked up one by one	
	17	12:00	30				◦ Bed cleaning
	18	17:00	60				
(23)	19	08:00	15	20		◦ Last feeding before mounting	
	20	11:00	5				

Remarks:

Duration of feeding period and amount of mulberry leaves supplied.

Instar	Duration of feeding period						Amount of mulberry leaves supplied kg
	feeding		molting		total		
	days	hrs.	days	hrs.	days	hrs.	
1st	3	3	1	0	4	3	1.8
2nd	2	0	1	0	3	0	4.8
3rd	2	20	1	7	4	3	32.2
4th	2	22	1	18	4	16	106.0
5th	6	4	-	-	6	4	723.0
Total	17	1	5	1	22	2	867.8

Table 8-3-12 Standard table for silkworm rearing in the dry season
for one egg case

Instar	Day	Feeding of silkworm			Rearing bed space	Remarks		
		no.	time of feeding	per feeding			Daily total	
				grams	grams	m ²		
I	(1)	1	09:00	50			◦ Disinfection of silkworm body, first feeding with chopped leaves ◦ Bed arrangement at 11 a.m.	
		2	12:00	60	230	0.07		
		3	17:00	120		0.14		
	(2)	4	07:00	100			0.20	◦ Bed space 50 cm x 40 cm ◦ Bed enlargement in space of 65 cm x 55 cm
		5	12:00	120	470			
		6	17:00	250			0.36	
	(3)	7	07:00	200				◦ Bed enlargement 77 cm x 70 cm ◦ Divided into two equal parts, with space of 65 cm x 50 cm a tray
		8	12:00	300	700			
		9	17:00	200				
(4)		07:00	-				◦ Sprinkle with lime	
		12:00	-			0.63		
II		1	17:00	400	400		◦ Disinfection of silkworm, netting, first feeding	
	(5)	2	07:00	300			◦ Bed cleaning and enlargement ◦ Bed enlargement, netting 80 cm x 70 cm a tray	
		3	12:00	300	1,500			0.72
		4	17:00	900				1.10
	(6)	5	07:00	600				◦ Bed enlargement 85 cm x 75 cm a tray ◦ Bed cleaning, divided into two equal parts
		6	12:00	600	1,400			
		7	17:00	200			1.30	
(7)		07:00	kg	kg			◦ Bed enlargement, sprinkle with lime	
III		1	13:00	1.4	5.4	2.16	◦ Disinfection of silkworm body, net setting, first feeding	
		2	17:00	4.0				
	(8)	3	07:00	2.0				◦ Bed cleaning and divided into two equal parts ◦ Bed space 67 cm x 60 cm a tray
		4	12:00	2.4	10.4			
		5	17:00	6.0			3.20	
	(9)	6	07:00	5.0				◦ Bed enlargement 70 cm x 60 cm a tray ◦ Last feeding of third instar
		7	12:00	4.0	11.0			
		8	17:00	2.0				

IV	(10)		07:00	-		3.60	◦ Distribution to the grown silkworm rearing house
			12:00	-			
		1	17:00	12	12	5.40	◦ Disinfection of silkworm, netting, first feeding
	(11)	2	07:00	8			
		3	12:00	8	40	8.10	◦ Bed cleaning and enlargement
		4	17:00	24			
	(12)	5	07:00	10			
		6	12:00	10	46		◦ Disinfection of silkworm body, net setting
		7	17:00	26			
	(13)	8	07:00	6			
		9	12:00	4	12		◦ Bed cleaning before molting
		10	17:00	2			◦ Last feeding of 4th instar
	(14)		07:00	-			
			12:00	-		10	◦ Bed enlargement and sprinkle with lime
			17:00	-			
V	(15)		07:00	-			
		1	12:00	6	30		◦ Disinfection of silkworm body, net setting, first feeding
		2	17:00	24			
	(16)	3	07:00	16		14	◦ Bed cleaning and enlargement
		4	12:00	16	77		
		5	17:00	35			
	(17)	6	07:00	25			◦ Disinfection of silkworm body
		7	12:00	25	110	16-18	◦ Bed enlargement and net setting
		8	17:00	60			
	(18)	9	07:00	40			◦ Bed cleaning
		10	12:00	30	150		
		11	17:00	70			
(19)	12	07:00	40				
	13	12:00	40	160		◦ Disinfection of silkworm body	
	14	17:00	80				
(20)	15	07:00	30				
	16	12:00	30	120		◦ First mature silkworms picked up one by one	
	17	17:00	60			◦ Bed cleaning	

(21)	18	08:00	10			
	19	10:00	5	15		◦ Last feeding before mounting
			-			

Remarks :

Duration of feeding period and amount of mulberry leaves supplied.

Instar	Duration of feeding period						Amount of mulberry leaves supplied kg
	feeding		molting		total		
	days	hrs.	days	hrs.	days	hrs.	
1st	2	8	1	0	3	8	1.4
2nd	2	0	0	20	2	20	3.3
3rd	2	4	1	0	3	4	26.8
4th	3	0	1	19	4	19	110.0
5th	5	22	-	-	5	22	662.0
Total	15	10	4	15	20	1	803.5

VIII-3-3 The technique of silkworm mounting and cocoon quality improvement
(Centre)

(1) Characteristics of the tropics

High temperature is more favourable for silkworms to climb up to the cocooning frame and cocooning than low temperature during mounting.

But peculiar climate of high temperature and high humidity of rainy season, and high temperature of dry season deteriorate the mounting environment, leading to poor cocoon quality.

(2) Progress attained and present condition

Development and improvement of silkworm mounting techniques and study on the cocoon quality are behind the schedule. Since 1981 it has been advanced as to the improvement and model making of cocoon instruments and the improvement of the mounting technique. Techniques on silkworm mounting have been established in 1982. Cocoon quality was investigated for the first time in 1981, on the cocoon produced in five areas of South Sulawesi. At the Centre (Bili-Bili), in 1982, facilities and machines were installed that serves to study cocoon quality.

The technique of silkworm mounting in the districts is hitherto not advanced yet. The cocooning instruments are mostly hanging type bamboo frames, though some hanging type double bamboo frames, and piling type bamboo frames are also seen. The original shape of the bamboo cocooning frame is deemed to be not good, and additionally, there is no proper treatment of silkworms about to cocoon. It lead to a poor cocoon quality, particularly reelability percentage and raw silk percentage are low. In addition, cocoon harvesting is too early, and cocoon sorting is not performed.

(3) Trial experiment to develop techniques on the mounting and improvement of cocoon quality.

1) Practical use and improvement of the bamboo cocooning frame.

a) Objectives

Bamboo is suitable as the material used for cocooning instrument in this region. Shaped in a rectangle or square and hung up. In consideration of the rearing method and the shape of rearing place, the hanging type cocooning frame with rectangular or square shape is convenient.

For the improvement of cocoon quality together with the betterment of silkworm mounting techniques, improvement and model making of bamboo cocooning frame and its practical utilization are aimed.

b) Progress of the experiment and summary of the result.

a. Progress of the experiment

(a) Present condition of silkworm mounting by bamboo cocooning frame in the districts.

Cocooning instruments found in the districts are large and heavy, thus making it difficult to handle. In this cocooning instrument many dirty and abnormal cocoons are resulted. Cocooning silkworms gather themselves at the top of the instrument, and there is a low percentage of mounted silkworms as well as that of cocooning silkworms.

(b) The policy of the improvement and model making of bamboo cocooning frame.

For the efficient silkworm mounting and cocooning, the cocooning frame should be turned upside down artificially by using the instinctive climbing habit of silkworms. To meet this requirement, lightening of cocooning frame is important so as to make the handling of cocooning frame easier.

(c) Progress of the experiment and model

To reduce the weight and size of the existing instrument, reduction in the distance between horizontal bamboo, width of horizontal bamboo should be considered, together with the reduction in the thickness of bamboo used. During model making, using the model, following studies were conducted in order to know the limit of space in which matured silkworms are not disturbed and can make normal cocoons.

As the result of the studies, designs of new bamboo cocooning frame became as follows;

- distance between horizontal bamboos = 2.8 cm ;
- width of horizontal bamboos = 2.8 cm to 3.0 cm ;
- thickness of the top, middle and bottom parts of horizontal bamboos which act as reinforcement range between 0.5 cm and 0.6 cm ;
- Other horizontal bamboos are 0.3 cm to 0.4 cm thick. A bamboo cocooning frame with such measurements has been made. Based on the relation between the size of the cocooning instrument and the number of silkworms to be cocooned such as shown in table 8-3-14 No. 5, the bamboo cocooning frame is rather large.

For the relation above, please refer to table 8-3-13 and table 8-3-14.

Table 8-3-13 Relation between the space among horizontal bamboos and length and width of cocoons.

Type of cocooning frame.	Location within model type bamboo cocooning frame (4 types)						Rotary cocooning frame	
	2.0 - 2.4 cm		2.5 - 2.9 cm		3.0 - 3.5 cm		3.0 cm	
Distance between horizontal bamboo	L (cm)	W (cm)	L (cm)	W (cm)	L (cm)	W (cm)	L (cm)	W (cm)
Maximum	3.6	1.9	3.6	2.1	3.5	2.1	3.4	2.0
Minimum	3.1	1.7	3.3	1.8	3.2	1.8	3.1	1.8
Average	3.3	1.8	3.5	1.9	3.4	1.9	3.2	1.9

Remarks:

1. L = Cocoon length W = Cocoon width
2. Cocoon size (length and width) was measured by caliper.
Number of cocoon measured = 10.
3. Dimension of square part of rotary cocooning frame is 3cm x 3 cm x 4.5 cm.

Table 8-3-14 Model made bamboo cocooning frame (typical goods of model making, different in size and structure).

Type of cocooning frame	weight (kg)	Number of effective stairs	Dimension of cocooning frame	
			height (cm)	long (cm)
Ordinary bamboo cocooning frame	6.8	28-29	110	110
Number of cocooning frame				
1.	2.8	20	78	70
2.	2.2	20	78	70
3.	1.9	24	82	74
4.	1.9	26	83	81
5.	2.1	28	83	90

Type of cocooning frame	Distance between horizontal bamboo (cm)	Horizontal bamboo width (cm)	Horizontal bamboo thickness (cm)	
			Upper side centre and under side	others
Ordinary bamboo cocooning frame	2.0-4.5		1	1
Number of cocooning frame				
1.	3.0-3.5	3.0	1.0	0.5-0.8
2.	2.7	3.0	0.7	0.5-0.7
3.	2.5-3.0	2.8	0.5	0.4-0.5
4.	2.8-3.0	2.8	0.4	0.3-0.4
5.	2.8	3.0	0.5	0.3

b. Summary results

One third as heavy as, and 70% as large as existing cocooning frame, thus lighter and smaller. A frame such a measurement at farmers place may be used by hanging it in two layers. The number of silkworms that can be cocooned in one bamboo cocooning frame is 500 heads (maximum capacity x 90%) requiring 32-35 units of frames per one box of silkworms. This model 5 bamboo cocooning frame is a standardized bamboo cocooning frame that may be applied to farmers (table 8-3-14). (Iyus R.A., Bambang Hr., Wariso P., Baharuddin A., S. Nishi).

2) Jobarai (shaking larvae from shoots), collection of matured silkworms and transfer to the bamboo cocooning frame).

A. Method of "jobarai" (shaking larvae from shoots) and mature silkworm collection.

a) Objectives

The prevailing habit in this local is to pick matured (ready to cocoon) silkworms one by one, and directly inserting them into the bamboo cocooning frame. The high temperature at the rearing place in this region makes a simultaneous appearance of mature silkworms, as long as silkworms are reared properly. Picking silkworms one by one is a troublesome job, and many worms are overmatured thereby. Overmatured worm bodies are shortened and they will produce thin cocoons. Hence to cocoon mature silkworms appropriately and to facilitate the silkworm cocooning job, an observation of jobarai is made.

b) Method and summary of results

(a) Young silkworms until instar III are reared at the young silkworm rearing unit. Before entering instar V (instar IV molting), about 15-20% as late molting silkworms are separated as later group. This method is performed in this way; when about 80-85% of the silkworms entered molting, lime is bestrow on rearing bed. On top of this bestrow base, mulberry shoots are put in single layer. Delayed silkworms will climb on a fresh leaf. When all the delayed silkworms have climbed, all the leaf stems above lime are taken up at the same time and moved to another place. As explained above, silkworms are divided into early group and delayed group by mean of the number of feeding days at the fourth molting, and successive rearing activities are done separately till mounting. Separation of delayed silkworms before entering instar V is intended to homogenize mature silkworms and to facility jobarai.

(b) Early matured silkworms are taken and mounted. When about 80% of the silkworms have matured, they will be collected by way of jobarai (simultaneously). Jobarai is performed as follow; prior to jobarai, the silkworm rearing place is single layered with fresh mulberry shoots. The longer the stem, the more efficient it will be. Wet leaves should no be given. Jobarai can not be performed merely

once, so as soon as the silkworms are shaken of the stems, the latter are put in the rearing place again in order to yield opportunity to other silkworms to climb. When some silkworms have climbed the leaf stems, another jobarai is performed. In case of any silkworms not matured yet, they are separated and fed in order to be matured soon.

- (c) In performing jobarai, a plastic sheet and a net should be spread on the floor to soften it. In case no plastic sheet or net is available, banana leaves may substitute for it, spread in 4 layers, on top of which a plastic sheet measuring 1.8 x 2.0 m. is spread. This layering of plastic sheet / banana leaves aims provide a comfortable place for matured silkworms to fall on. Compared with one-by-one cocooning, jobarai is much more efficient.
- (d) Jobarai technique has been performed at the Centre, the Sub Centre and the sericultural farmers place, with a good result. But when many silkworms are infected by diseases carried by Jaundice, Aspergillus etc., jobarai should rather not be performed.

B. Method of the simultaneous transfer of matured silkworms to bamboo cocooning frame.

a) Objectives

The common way of silkworm mounting performed by farmers is by picking the matured silkworms up one by one and placing them onto the horizontal bamboo of bamboo cocooning frame. Such a way of mounting will slacken the work, leading to many overmatured larvae. To cope with above explained situation, simultaneous transfer method of matured silkworms is studied in this experiment so as to seek the way of rational mounting.

b) Method and summary of results

(a) Method (refer to figure 8-3-6)

- If possible, light intensity in the cocooning room should be little darkened to about 20 lux (like the condition below a table). In farmers rearing place which are below the raised house floor, it is generally dark enough and already adequate for cocooning.

- The bamboo cocooning frame is laid on top of a sheet paper or newspaper underlayer.
- Matured larvae in a sufficient number are transferred by hand into the bamboo cocooning frame evenly. The appropriate number of mounting silkworms to fit the cocooning instrument is as follow; the width of the bamboo cocooning frame / 4.5 cm x number of interlath spaces x 90%.
- When silkworms have been inserted into the bamboo cocooning frame, the cocooning frame is darkened with the over of paper or newspaper.
- It is left in this condition for one or two hours and then the cocooning frame is hung up.

(b) Data of results

Data of the results of observation are shown in table 8-3-15.

Table 8-3-15 Method of the simultaneous transfer of matured silkworm to bamboo cocooning frame.
Relation between the covering or discovering of cocooning frame with seat paper, and percentage of left silkworms.

Observation	Distinction	Percentage of left silkworms on the paper cover (1)	Percentage of left silkworms unger bamboo cocooning frame after it was hung (2)	(1)+(2)
		%	%	%
Single set bamboo cocooning frame wrapped with vinyl string	Covered	1.4	5.0	6.4
Single set bamboo cocooning frame	Covered	6.6	12.2	18.8
Single set bamboo cocooning frame	Not covered	-	23.6	23.6
Bamboo cocooning frame	Covered	4.8	6.9	11.7

Remarks:

1. Observation was done in September 1981.
2. Number of mature silkworms mounted in the cocooning frame is 500, respectively for No. 1, 2 and No. 3. For No.4 is 1,000 silkworms.
3. About 2 hours after transferred matured silkworms on to the cocooning frame, it was investigated.

(c) Summary of results

Transfer of matured silkworms into cocooning frame is easy, and number of silkworms left under bamboo cocooning frame is very small if bamboo cocooning frame is covered by some materials such as silkworm seat paper.

Especially if outside of bamboo cocooning frame is strapped with vinyl string, neither many silkworms cling to the paper cover nor being left on the rearing bed, thus unnecessitating supplementary mounting by hand.

Silkworms clinging to the string of the bamboo cocooning frame present no problem, as they will automatically enter the bamboo cocooning frame.

(Iyus R.A., S. Nishi)

3) The effective method in using the bamboo cocooning frame

A. The method of turning the bamboo cocooning frame upside down.

a) Objectives

Bamboo cocooning frame commonly used by local farmers are usually large and heavy, set doubly or singularly. After the instrument is hung up, it is usually left in this condition. In this way the silkworm about to cocoon are collected at the top of the cocooning instrument, while the middle and the bottom parts are less filled, hence a low efficiency of the tool.

In double-set bamboo cocooning frame, diseased or dead silkworms inside are difficult to be removed. Many dirty cocoons are found due to silkworm urine. Consequently, by using a single bamboo cocooning

frame and reducing the above-mentioned disadvantages, silkworms are spread evenly in the cocooning instrument, and to raise the percentage of cocooning silkworms, a trial has been made to turn the position of the cocooning instrument upside down by hand.

b) Method and summary of results

- a. Method and data of results (only one is written to serve as sample; for more explanation, refer to the Annual Report of 1981).

The experiment of turning the bamboo cocooning frame upside down.

Method of experiment

No.	Experimental unit	Number of silk-worm used		Number of cocooning frame	Treatment
		Little unit	Total		
1.	Rotary cocooning frame (control)		1600	1	Treatment roaming silkworms after 15 hours.
2.	Bamboo single, treatment of roaming silkworms	400	800	2	Treatment roaming silkworms after 15 hours
3.	Bamboo single, without treatment	400	800	2	Hanging only
4.	Bamboo single, turning	400	800	2	Hung up, then turning the frame upside down after 6 hours.
5.	Bamboo double without treatment	800	1600	4	Hanging only

Remarks:

1. Time of observation: July 1981
2. No.2 to No.5 consist of two replication.
3. Silkworm race BN₂ x BC₁₀₂
4. Bamboo is bamboo cocooning frame.

The sample is shown in the table on observation of the upside down turning of the cocooning instrument continued with data on the result of observation in table 8-3-16.

Table 8-3-16 Observation of cocooning condition

Experi- mental unit	Percentage of cocoon- ing silkworms			Number of cocooning silkworms in each stair of the horizontal bamboo				
	A	B	Average	Average number			Max/Min number	
	(%)	(%)	(%)	A	B	Average	Max	Min
1.	-	-	94.1	-	-	-	-	-
2.	75.5	77.3	76.4	10.8	11.0	10.9	36	3
3.	85.0	79.0	82.0	12.1	11.3	11.7	43	5
4.	90.0	92.0	91.0	12.9	13.1	13.0	27	8
5.	90.1	88.8	89.5	12.9	12.7	12.8	39	6

b. Summary of results

In treatment No.4 there is a high percentage of cocooning silkworms after treatment No. 1. The number of cocooning silkworms in every interlath space under treatment No. 4 is the highest as compared with other treatments, and there is quite a homogeneous spread of cocooning silkworms.

In treatment No. 5, the percentage of cocooning silkworms is lower as compared with that in treatment No. 4. But there is quite a big difference between the maximum and the minimum numbers of cocooning silkworms at each interlath space. Many cocooning silkworms gather at the top of the cocooning instrument, and many dirty and abnormal cocoons occur. Dead silkworms found in the slit between the double cocooning bamboos are difficult to be taken, and clean cocoons get dirty, thus facilitating the widespreading of germs left in the instrument. It is feared that germs will be widely spread later on, as dead silkworms present a source of germs. The high percentage of cocooning silkworms in treatment No. 5 may be due to the space between the two cocooning bamboos piled up, which enables silkworms to cocoon. It is also supported by the proper place for silkworms to start cocooning.

Conclusions that may be taken from the description above are: The upside-down turning of the cocooning instrument by hand yields a good result. The time interval for the upside-down turning is as follow; first of all 4 hours after the instrument is hung up and second is 8 hours after the instrument is hung. Such a time interval may be used as a standard. Matured silkworms have a instinctive climbing habit during 10 hours after matured. Consequently, upside-down turning of the cocooning frame after 10 hours is deemed to have less effect.

B. Method to strap the outside of bamboo cocooning frame by vinyl string

a) Objectives

A model type bamboo cocooning frame which is purposely made smaller and lighter, can be also used without other treatment if frame are turned upside-down after hanging, and cocooning percentage can be increased with this method.

In addition to above explained method, in this experiment, effect of mounting and cocooning is studied by strapping outside of cocooning frame with vinyl strings vertical lines to the bamboo cocooning frame which has mainly horizontal lines originally expecting to give the convenient space to silkworms.

b) Method and summary of results

a. Method and data of results (only one is described as sample).

For more detail, refer the Annual Report of 1981.

Effect of strapping to the outside of bamboo cocooning frame by using vinyl string.

(a) Method of observation

Date of observation: September 2, 1981

No.	Experimental units	Number of silkworms used.	Treatment
1.	Rotary cocooning frame (control)	1600	Hung up without treatment
2.	Small bamboo cocooning frame, turning strapped	300	Turning after 5 hours and after 13 hours
3.	Small bamboo cocooning frame, turning no strap	300	- do -
4.	Small bamboo cocooning frame	300	Hung up without treatment
5.	Large bamboo cocooning frame, turning strapped	400	Turning after 3 hours and after 9 hours
6.	Large bamboo cocooning frame, turning no strap	400	- do -
7.	Bamboo cocooning frame	400	Hung up without treatment

Remarks:

1. Time of observation: September 1981
2. Silkworm race : BN₂ x BC₁₀
3. Experimental units or treatments, turning = the turning the bamboo cocooning frame upside down.
4. Method of strapping : Vinyl strings wrapped parallelly and vertically on the outside of bamboo cocooning frame are 3 cm. apart from each other. At cocoon harvesting time the strap is united and cocoons are harvested by hand.

Table 8-3-17 Observation of cocoon condition

No.	Percentage of cocooning silkworm	Percentage of roaming silkworm	Number of cocoon in each stair of horizontal bamboo		
			Maximum	Minimum	Average
1	90	-	-	-	-
2	93	3	18	12	14.0
3	76	11	17	6	11.4
4	68	19	27	1	10.2
5	89	2	20	11	14.9
6	77	4	20	9	12.8
7	73	12	29	3	12.1

Table 8-3-18 Cocoon harvest and observation of cocoon quality.

No.	Percentage of cocooning silkworm			Weight of cocoon shell	Weight of cocoon	Percentage of cocoon shell	Number of cocoon per a litre
	Good cocoon	Sorting cocoon	Double cocoon				
	%	%	%	cg.	gr.	%	
1	96	2	1	31.2	1.41	22.1	95
2	72	11	13	29.2	1.38	21.2	90
3	71	11	16	32.6	1.51	21.6	97
4	67	21	10	28.1	1.35	20.8	93
5	68	3	26	32.9	1.48	22.4	93
6	77	6	14	32.1	1.46	22.0	97
7	74	7	17	31.0	1.38	22.5	97

- (a) The string strapped bamboo cocooning frame shows a high percentage of cocooning silkworms and a more uniform spreading at each space. Additionally, according to observation, fewer silkworms roam around and they cocoon earlier.

According to observation, when the cocooning instrument is not upturned, even if it is strapped, the percentage of cocooning silkworms gather at the top and they are not spread uniformly. So the methods of strapping with vinyl string and turning of the cocooning frame should be applied together.

- (b) There is a disadvantage in stringed bamboo cocooning frame, i.e. the high percentage of double cocoons. In bamboo cocooning frame hung up without treatment (number 4), a high percentage occurs of dirty and abnormal cocoons. The data above show a tendency that cocoon quality is unaffected by treatments.

Seeing the value of its use, it can be concluded that the bamboo cocooning frame with vinyl string is efficient, though higher percentage of double cocoons is the disadvantage of this technique. Further observations need to be made in order to lessen this percentage.

(Iyus R.A., Baharuddin A., S. Nishi)

- c. Observation for the reduction of the occurrence of double cocoons in the bamboo cocooning frame.

- (a) Objectives

The use of bamboo cocooning frame can increase effectively the percentage of cocooning silkworms; however, there is a defect in the occurrence of a high percentage of double cocoons. In this relation, an observation is made on the relationship between the percentage of double cocoons and the construction of bamboo cocooning frame, the number of mounting silkworms in each instrument, the treatment on silkworms roaming around after the instrument is hung up, etc. Result of the observation are then used as matters to reduce the occurrence of double cocoons.

b) Method and summary of results

a. Method and data of result (only one is described as sample)

Relation between the occurrence of double cocoons and the structure of bamboo cocooning frame, etc.

Method of observation.

Code	Little unit	Number of silkworms mounted	Construction of the cocooning frame			Time of turning the frame to the upside down.	
			Number of effective stair of horizontal bamboo	Distances of the cord wrappings	Distances between horizontal bamboo		
				cm	cm		
A	a ₁	400	25	3.0	3.0	I.	2 hours
						II.	8 hours
	a ₂	400	25	3.0	3.0	I.	2 hours
						II.	8 hours
B	b ₁	400	25	4.0	3.0	I.	2 hours
						II.	8 hours
	b ₂	400	25	4.0	3.0	I.	2 hours
						II.	8 hours
C	c ₁	500	28	3.0	2.7	I.	4 hours
						II.	8 hours
	c ₂	500	28	3.0	2.7	I.	4 hours
						II.	8 hours
D	d ₁	500	28	3.0	3.0	I.	4 hours
						II.	8 hours
	d ₂	500	28	3.0	3.0	I.	4 hours
						II.	8 hours

Remarks:

1. Time of observation : July 1982
2. Silkworm race : BN x BC
3. Number of silkworm mounted was 90% of the from total capacity respectively at the frame A, B, C and D.
4. After 10 hours the roaming silkworm in each cocooning frame was taken and then transfered to the plastic cocooning frame.

Table 8-3-19 Data of experiment

Code	Percentage of silk-worm mounted	Number of silkworm mounted in each stair of horizontal bamboo			Percentage of cocoon yield			Cocoon weight
		Max.	Min.	Average	Reela-ble cocoon	Double cocoon	Bad cocoon	
	%				%	%	%	gram
A	90	19	10	14.4	87	11	2	1.34
B	87	19	11	13.5	87	9	4	1.33
C	86	20	10	15.4	87	10	3	1.31
D	82	19	10	14.6	91	5	4	1.33

b. Summary of results

In addition to the above experiment, investigation is made including the experiment with variable treatment on roaming silkworms after hanging using the maximum number of silkworms that can be accomodated by cocooning frame.

The conclusion is that observations on improved bamboo cocooning frame have been conducted, but the change in the construction of the instrument has little effect on the percentage of double cocoons.

The percentage of double cocoons may be reduced in this manner; silkworms which are about to mounting are inserted at the amount of 90% of the full capacity, and roaming silkworms treated about 10 hours after hanging bamboo cocooning frame. These countermeasures are generally anticipated to avoid the decline in cocoon quality.

(Bambang Hr., Wariso P., S. Nishi)

- 4) The method of natural mounting with the use of the bamboo cocooning frame.

a) Objectives

Farmers in general pick matured silkworms one by one by the hand, and placing them on to the horizontal bamboo of bamboo cocooning frame.

This method is bothersome and moreover, the high temperature in this region tends to lead to overmatured silkworms. In connection to the circumstances, an observation is made on the method of natural silkworm mounting by using bamboo cocooning frame, in order to eliminate the specific place for silkworm cocooning and at the same time to make silkworm collection easier.

b) Method and summary of results

a. Method of observation (refer to figure 8-3-6).

- (a) For condition of natural silkworm mounting, silkworm growth has to be homogenized. Before molting in instar IV, a separation is made of slow-growing and rapid-growing silkworms, and the two groups are separated from the start of the fifth instar until cocooning time.
- (b) The bamboo cocooning frame used should be light weight and wrapped with vinyl string at distance of 3 cm between the cord wrappings.
- (c) First matured silkworms will emerge in the afternoon before mounting day. About that time the place should be cleaned, and levelled flat as much as possible.
- (d) The size of the rearing bed should be narrowed to the size of bamboo cocooning frame or dense rearing method should be taken; only overmatured larvae are to be picked up by hand. Then the silkworms are fed once or twice with unchopped leaves without stems. When it is estimated that more than 80% of worm have emerged, the bamboo cocooning frame is placed at level on top of the silkworm rearing bed.
- (e) The top of the bamboo cocooning frame is then covered by a sheet of newspaper to darken the inside of the bamboo cocooning frame.
- (f) One or two hours after setting, mounting condition of silkworms into the bamboo cocooning frame should be observed, and hung up if mounting is satisfactory.
- (g) Silkworms left in the rearing bed are picked up, and mounted at another place, while immature ones are collected somewhere and fed once again. The rearing bed of the silkworms are then cleaned.

Table 8-3-20 Self mounting percentage, cocoon harvest and observation of cocoon quality.

Experi- mental unit	Self mount- ing percen- tage	Percen- tage of left silkworms on the bed	Percen- tage of reelable cocoon	Weight of cocoon shell	Cocoon weight	Percen- tage of cocoon shell	Number of cocoon per a 500 grams
	%	%	%	cg	gram	%	
1	-	-	96	40.9	1.85	22.1	275
2	-	-	86	39.0	1.82	21.4	285
3	74	26	86	39.9	1.84	21.7	276

Remarks

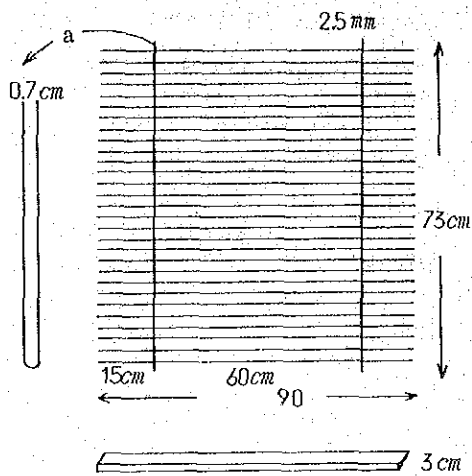
1. Experimental unit 1: rotary cocooning frame, matured silkworms transferred to the it.
 - 2: bamboo cocooning frame, matured silkworms transferred to the it.
 - 3: bamboo cocooning frame, natural mounting
2. Time of observation: July 1982
3. Silkworm race : BN x BC
4. Number of improved bamboo cocooning frame in the natural mounting method: 3
5. Self mounting percentage = A ratio of a number of worms mounted in a self-mounting to a total number of worms on a bed.

b. Summary of results

There is quite a fair percentage of mounted silkworms with natural mounting by using bamboo cocooning frame, and only few silkworms are left at the rearing bed, thus labor saving.

Cocoon in the rearing bed are hardly found: there is a good percentage of reeling cocoon at the bamboo cocooning frame. Cocoon quality differs slightly among the three kinds of treatment. In this region, mulberry shoots are small and straight, therefore it is easy to make the silkworm rearing bed flat. Moreover, the high

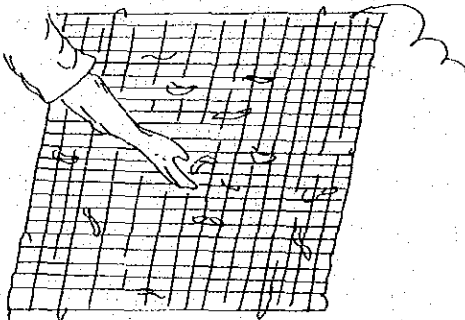
Fig. 8-3-6 Improvement of bamboo cocooning frame and its effective usage.



Structure of bamboo cocooning frame:

1. Number of horizontal bamboo are 29 stairs.
2. Distance between horizontal bamboo is 2.8 cm.
3. Thickness of horizontal bamboo (a,b,c) is 0.5 cm, thickness of other horizontal bamboo is 0.3cm.
4. Width of horizontal bamboo is 3 cm.

Method of the transfer of matured silkworms:



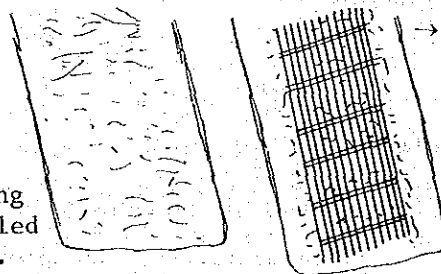
1. Vinyl strings wrapped parallelly & vertically on the outside of bamboo cocooning frame are 3 cm. apart from each other.
2. The frame should be turned upside-down twice at 4 hrs. & 8 hrs. after hanging.

Method of natural mounting with the use of the bamboo cocooning frame:

Silkworm rearing bed:

1. The size of rearing bed should be narrowed to the size of bamboo cocooning frame or dense rearing method should be taken.
2. Either side of rearing bed should be sprinkled with lime or sawdust.
3. The silkworms are fed once or twice with unchopped leaves.

Setting bamboo cocooning frame on the silkworm rearing bed:



1. The bamboo cocooning frame placed at level on top of the silkworm rearing bed.
2. The top of bamboo cocooning frame then covered by a sheet of newspaper.
3. The frame should be hung up after 1 to 2 hours.

temperature provides a good condition for the performance of natural mounting. Further observation is still required for its application in the field.

(Iyus R.A., Wariso P., S. Nishi)

5) Observation of the relationship between the time of mounting and the time of moths emerging in hybrid silkworms

a) Objectives

This experiment aims to study the number of days after mounting when hybrid silkworm moths emerge from the cocoon both in the rainy season and the dry season, and take necessary steps to improve the killing of pupae, drying and sales cocoons.

b) Method and summary of results

a. Method and data results

Cocoons taken for the observation are those mounted on the same day. One hundred cocoons are taken and kept in a rearing room without cutting. Those cocoons are observed each day, moths emerging condition. Additionally, temperature, humidity, maximum and minimum temperatures are also observed, every days till last day of moths emerging from mounting day. For the results of observation refer to table 8-3-21 and figure 8-3-7.

b. Summary of results

Taken from the time silkworms start mounting, moths begin to emerge on the 13th day; the peak of moths emergence is around the 15th day, and the last emergence is on the 19th day. In June and September (dryseason), in spite of the relatively not too high temperature as compared with that during the rainy season, moths have a tendency to emerge earlier. It may be due to the low humidity (according to a report by Ushigome, at a humidity of 60% moths emerge one day earlier as compared with that in a condition of 90% humidity at the same temperature).

Conclusion; Two days before the earliest emergence of moths, i.e. the 11th day from the start of cocooning (mounting), pupae

should be killed by drying the cocoons. In other words, cocoon are dried within 5-6 days after cocoon harvest ; the harvesting of cocoon is performed the 6th day starting from the day when the largest number of silkworms are mounting. It is deemed safe enough. If cocoons are to be dried by another party, it is expected that cocoons be taken at the latest 4 days after cocoon harvest. This observation is still to be carried on for another year, in order to know the relationship between humidity and emergence of moths.

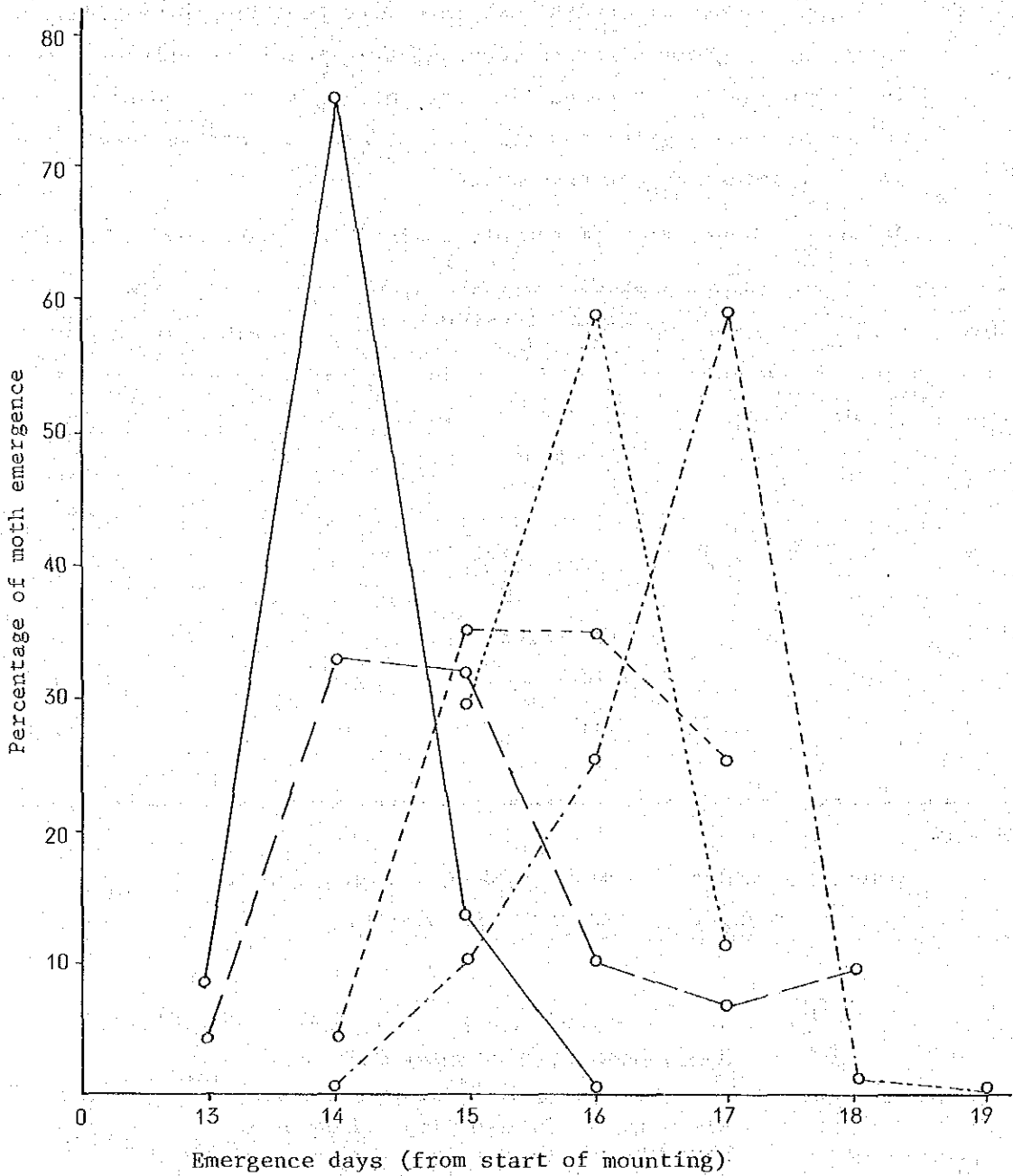
(Wariso P., Bambang Hr., Baharuddin A., S. Nishi)

Table 8-3-21 Relation between the time of mounting and the time of moth emergence.

Place	Time of observation	Silkworm race	Average temperature	Average humidity	Maximum temperature	Minimum temperature
			°C	%	°C	°C
Bili-Bili	Nov.1981	BNxBC	26.9	87	27.0	25.3
Bili-Bili	Feb.1982	BNxBC	26.3	82	28.3	24.3
Soppeng	Apr.1982	BNxBC	27.3	82	28.8	25.7
Bili-Bili	Jun.1982	BNxBC	24.3	66	27.8	21.9
Bili-Bili	Sept.1982	BCxBN	27.0	59	31.6	23.8

Place	Percentage of moth emergence								Total (%)
	Mounting days								
	13.	14.	15.	16.	17.	18.	19.	20.	
Bili-Bili	-	-	29	58	13	-	-	-	100
Bili-Bili	-	4	35	35	26	-	-	-	100
Soppeng	-	1	11	26	58	3	1	-	100
Bili-Bili	4	36	34	10	6	10	-	-	100
Bili-Bili	7	75	17	1	-	-	-	-	100
Average	2	23	25	26	21	3	-	-	100

Figure 8-3-7 Relation between the time of mounting and the time of moth emergence



..... Bili-Bili, Nov. 1981
 ----- Bili-Bili, Feb. 1982
 - . - . - . Soppeng, April 1982

----- Bili-Bili, June 1982
 _____ Bili-Bili, Sept. 1982

6) Cocoon quality improvement

a) Objectives

Improvement of conditional stability in silkworm rearing, the technique of grown silkworm rearing, technique for silkworm mounting including the treatment and care during silkworm mounting, the method of cocoon selection etc. are efforts to improve cocoon quality and to increase cocoon production.

b) Method of observation (more detail are shown in the report 82-33).

Plot	Production time	Place of cocoon production	Number of sample
A	July, 1981	Centre	2
		Enrekang	2
		Wajo	2
B	September, 1981	Centre, Sub Centre	4
		Soppeng A	1
		Soppeng B	4
		Sidrap	2
		Wajo	3
		Enrekang	2

Remarks:

1. Number of cocoon observed is 200 grams each sample.
2. Speed of reeling : 100 metre per minute.

c) Result

Table 8-3-22 Data of experiment unit A.

Place of cocoon production	Raw silk percentage	Reelability percentage	Length of cocoon filament	Size
	%	%	metre	d
Centre	18.69	80	1.137	2.46
Centre	18.66	77	1.129	2.46
Enrekang	17.10	64	-	-
Enrekang	19.25	61	-	-
Wajo	11.50	37	-	-
Wajo	12.70	40	-	-

Table 8-3-23. Data of experiment unit B

Place of cocoon production	Raw silk percentage	Reeability percentage	Length of cocoon filament	Size
	%	%	metre	d
Centre	16.85	74	965	2.45
Centre	16.90	81	981	2.30
Sub Centre	16.77	64	931	2.39
Sub Centre	17.00	54	948	2.46
Soppeng A	12.45	32	821	2.02
Soppeng B	14.25	44	921	2.10
Soppeng B	12.10	22	815	2.00
Soppeng B	14.75	47	834	2.34
Soppeng B	11.15	37	717	2.23
Sidrap	11.18	39	720	2.19
Sidrap	11.25	39	686	2.12
Wajo	12.48	36	745	2.36
Wajo	14.10	59	939	2.05
Wajo	14.80	53	804	2.50
Enrekang	14.77	54	726	2.23
Enrekang	14.30	50	727	2.45
Maximum	14.80	59	939	2.50
Minimum	11.15	22	686	2.00
Average	13.13	43	788	2.22

Remarks: Data from Centre and Sub Centre were not included in the maximum, minimum and average calculations above.

d) Summary of results

Cocoon production from the Centre and the districts in September is generally worse than that in July.

Observation of cocoons in the regions show a low result, particularly reeability percentage is very low ; raw silk percentage is about 13%. On the base of the data above, silkworm rearing performed at the same time under the same climatic condition shows a significant difference in cocoon quality between the ones produced

by farmers.

The data above shows a difference in cocoon quality between different region. But even in Enrekang alone there is a difference of cocoon production between July and September. Consequently, when the stability of rearing condition in the region is improved, and the techniques for silkworm rearing and silkworm cocooning are also improved, it will enable the production of good quality cocoons. In the dry season, even with low humidity, reelability percentage is very low. It may be due among other things to the use of doubled bamboo cocooning frame, the use of heaped bamboo cocooning frame, and use of a cloth (or "sarong") to cover the bamboo cocooning frame to avoid silkworm roaming, leading to lack of ventilation, hence a locally higher humidity. Therefore bamboo cocooning frame ought to be improved e.g. by strapping etc., and silkworm mounting technique ought to be improved.

(Iyus R.S., Baharuddin A., S. Tomonari,
S. Nishi)

7) Observation of cocoon quality

a) Objectives

To make a sketch of the room inside the building for cocoon quality testing at the Centre in the Project of Sericultural Development, to improve room arrangement, to decide the location of machinery and cocoon testing instruments, to give guidance on the method of cocoon quality observation.

b) Progress achieved

More detailed description may be found in the report JR 81-05.

a. The short-term expert Mr. H. Tsuboi performed the following activities from September through November 1980.

- (a) Setting up a basic plan for cocoon quality observation at the Centre.
- (b) Making a design of room lay-out inside the building for cocoon quality testing.
- (c) Making a list of required machinery for testing.

- b. From May to June 1982, on the base of the outline, the structure of the building is altered and improved.
- c. From September to November 1982 two short-term experts Mr. K. Yuhara and K. Akahane install testing machinery required, and give instructions on the operation of the cocoon quality testing equipment.

(H. Tsuboi, K. Yuhara, K. Akahane, S. Nishi, K. Tominaga,
Iyus R.A.)

(4) Technique that have been developed.

Techniques for silkworm mounting which have been developed are shown in this Report No. 8-7-2-(6), i.e. concerning the demonstration of silkworm rearing technique.

Techniques developed and improved are such as described in the following subjects.

- 1) Silkworm mounting technique.
- 2) Practical use and improvement of the bamboo cocooning frame.
- 3) Method of jobarai, shaking larvae from shoots, collection of matured silkworm and transfer to the bamboo cocooning frame.
- 4) The effective method in using the bamboo cocooning frame.
 - a) The method of turning the bamboo cocooning frame upside down.
 - b) Method to strap the outside of bamboo cocooning frame by using vinyl string.
 - c) Observation for the reduction of the occurrence of double cocoons in the bamboo cocooning frame.
- 5) The method of natural mounting with the use of the bamboo cocooning frame.
- 6) Relation between the time of mounting and the time of moths emergence and consequently the time of killing pupae and drying cocoons.
- 7) Observation and improvement of cocoon quality.

(5) Unsolved problems and suggestions for the future.

- 1) Cocoon quality improvement.
- 2) How to speed up cocoon quality testing.

VIII-3-4 Direct introduction of silkworm rearing technique (Sub Centre)

(1) Background

In Kabupaten Soppeng at a site close to the Sub Centre, an observation was made in 1978 of silkworm rearing activities at the third and ninth rearing units and at a few sericultural farmers' places.

Due to the delay in the construction of the place for demonstration, that is the Pilot Unit. Experiments for the development of locally adaptable silkworm rearing techniques were conducted at the Centre, while introducing Japanese originated techniques of silkworm rearing directly. In 1980, techniques applicable to farmers have been established, tried and demonstrated to the third unit farmers' group in Soppeng.

(2) The third unit farmers' group in Kabupaten Soppeng was used for investigation and demonstration in the context of silkworm rearing technique improvement.

a) Objectives

To introduce directly some silkworm rearing techniques from Japan which are adaptable to the condition at sericultural farmers' places, and to select the technique applicable to the farmer concerned. This technical improvement will be usable in the future, both in the regions and at the Pilot Unit, and be widespread to farmers through demonstrations.

b) Method

First priority was given to pest & disease control and technical improvement.

- a. Construction of young silkworm rearing buildings.
- b. Construction of grown silkworm rearing place at the farmers'
- c. Before hakitate:
 - (a) Completion of building and equipment.
 - (b) Cleaning the rearing place.
 - (c) Room and tool disinfection

- d. Young and grown silkworm rearing method
- c) Summary of results

Technical improvement applied to the third unit showed that cocoon production before 1978 with the use of F2 breed was 8.6 kg per box. After the improvements in 1980, average cocoon production from two farmers increased to 19.3 kg per box. It owed to improvements in pest & disease control, which led to a better condition of the rearing place. If these steps could be carried on continuously, plus technical improvement, cocoon production will go on increasing. Nevertheless, since many silkworms were still found dead inside the cocoons, improvement of the rearing technique and improvement of the silkworm rearing place below the house floor are still required.

(3) Techniques developed

- a) Improvement of the young silkworm rearing building and tools.
 - a. The ceiling is replaced by ply'woods.
 - b. All the walls of the rearing room are coated with lime.
 - c. Windows are established on the upper and the bottom parts of the rearing room walls for ventillation.
 - d. Equipment for handwashing, footwashing and clothes changing and sandals, should be provided in the preparatory room.
 - e. The racks and trays are made of iron, and silkworm rearing equipment are supplemented, such as plastic baskets to keep leaves, containers for leaves to be fed etc.
- b) Improvement of grown silkworm rearing place and tools at the farmers' place.
 - a. The floor of the rearing room is bestrown with lime at 1 - 2 cm's thickness.
 - b. The rearing room's bamboo walls are coated with lime.
 - c. Plastic sheet is spread at the ceiling of the rearing room.
 - d. Leaf storage is established outside the rearing place, hence apart.
 - e. A hand-wash stand should be provided at the entrance of rearing room.
- c) These are performed before hakitate.
 - a. Preparation of buildings and equipment.
 - b. Cleaning of the rearing place.
 - c. Room and equipment disinfection.

Additionally, improvement of the place and tools for young silkworm rearing and also for grown silkworm rearing below the house floor should also be performed, including cleaning and disinfection, both inside and outside the rearing room.

- d) Improvement of young silkworm rearing technique.
 - a. Racks and trays, covered with a sheet of paper, feeding 3 times a day on chopped leaves.
 - b. Body disinfection on newly hatched larvae and newly exuviated silkworms at each instar.
 - c. Deciding the place to heap silkworm wastes and dirt, not inside or around the silkworm rearing room.
 - e) Improvement of grown silkworm rearing technique.
 - a. Dimension of rearing bed and amount of feeding mulberry leaves are adjusted based on the standard table for silkworm rearing. However, in case of high temperature, these matters should be adjusted with the duration of the feeding period of silkworms.
 - b. Deciding the regular place to heap silkworm wastes and dirt.
- (4) Unsolved problems and suggestions for the future.
- 1) Searching for the appropriate drug for the disinfection of the place and tools for grown silkworm rearing below the house's raised floor.
 - 2) To avoid the disturbances made by small outside animals like rats, birds, ants, snake etc. while performing the trial rearing at the Centre (open-air shoot rearing house).
 - 3) To study the technical system for silkworm rearing in which 4th instar silkworm are reared in the independent rearing house, and only 5th instar silkworms are reared below the raised house floor.

(Iyus R.A., Bambang Hr., J. Nakamura)

VIII-6-1 Training of Indonesian Technical Staffs

2) Silkworm rearing

A. Practical training on the techniques

a) Objectives

Technique for silkworm rearing and a training on practical techniques are required for the development of silkworm rearing in Indonesia.

b) Method

A trial silkworm rearing is performed at the Centre to improve those techniques. Results of the experiment are tried again at the Sub Centre, and afterwards applied to farmers' places. The latter serves as the object of technical guidance, technical application and as a practising place for the counterparts.

c) Results of achievement

All counterparts have studied practical techniques and have grasped them well.

B. Planning and performance of the experiment and the compilation of the results of experiment.

a) Objectives

To develop sericulture in Indonesia it need the ability for planning and performance of the experiments on silkworm rearing, and compilation of the results.

b) Method

Experts have given the methods of planning, performance and result compilation in the developmental experiment that deals with silkworm rearing.

c) Results of achievement

There are matters still unmastered so well, but the ability is quite good.

C. The ability to development of new techniques and to give technical guidance.

a) Objectives

To develop sericulture in Indonesia an ability is needed new techniques and to give technical training to a-sistant counterparts, extension workers and farmers.

b) Method

Technical development in ATA-72 Project is urgently needed in the context of technical establishment. In this case the expert takes the leading part. To improve the ability for technical establishment, however, counterparts have taken the lead since mid-1981, because the experts have given the planning of experiments and the method of conception for technical development. Further on, several course were given to extension workers and farmers, and daily guidance to assistant counterparts, all of which will upgrade the counterparts' ability to extend guidance.

c) Results of achievement

Both the ability to establish techniques and the planning is not sufficient yet. The ability for guidance has sufficed, but there is a tendency to give more theory and less practical training.

D. Problems unsolved and suggestions for the future.

a) A higher technical training course is still necessary

b) In planning, performance and in compiling experimental results, it is attempted to apply new bright ideas. Analysis of the ability to consider data, and the ability to describe clearly, are essential.

c) The ability to forecast what kind of techniques are necessary in near future and the ability to create techniques, from experience, from problems coming from the districts and from adjusted problems still need training.

(2) The training for the technical staff at the Centre.

A. Practical training on the technique.

a) Objectives

Training for assistant counterparts is necessary to render them the ability in the preparation for silkworm rearing, arrangement after

the rearing etc.

b) Method

The practical training on the technique is performed with Counterparts' advice. Assistant counterparts participate in the activity of silkworm rearing and in technical demonstrations at the Pilot Unit.

c) Results of achievement

The practical training runs well such as given by counterparts, except for new staff members.

B. Problems unsolved and suggestion for the future

More practical trainings are still to be arranged.

VIII-7-1-(6) Formulation of silkworm rearing techniques for demonstration

(6) Formulation of silkworm rearing techniques for demonstration

1) Objectives

Trial experiment to develop techniques have now been carried out at the Centre, and positive experiment have been performed at the Sub Centre. As the result, silkworm rearing techniques developed and/or improved are formulated, and these formulated techniques are utilized for the guidance of demonstration activities at farmers' groups. After tested, the silkworm rearing techniques were immediately applied to the farmers' districts. Technical guidance has been established for demonstration.

2) Demonstration techniques formulated

The standard plan for silkworm rearing is 6 times a year. Young silkworm from 1st to 3rd instar are reared in a young silkworm rearing unit, while 4th and 5th instar grown silkworm are reared at the farmers' place.

A trial model of young silkworm rearing building was constructed at the Centre. Based in this trial model, the Centre Model I young silkworm rearing building was designed. Since 1981, the young silkworm rearing building Centre Model I were constructed at five Pilot Unit. This young silkworm building Centre Model I is one of the model for young silkworm rearing building. Locally adapted iron racks and trays were also made for the Pilot Unit. For grown silkworm rearing, improvement was made in the rearing place below the raised house floor, and the open air shoot rearing house model was made at the Centre. Techniques of this model will be outlined in the following chapter.

A. Young silkworm rearing

- a) At the first through second instar, silkworms are fed on chopped young leaves; damp proof paper is used as underlayer and as cover; feeding is done 3 times a day.
- b) At 4th instar, silkworms are fed on leaves with mulberry shoot, silkworm rearing bed is covered with damp proof paper, and feeding is done three times a day.

- c) Important matters in young silkworm rearing.
 - a. Washing and disinfection of the rearing room and tools.
 - b. The use standard table for young silkworm rearing.
 - c. Regulation of humidity, and air circulation in the rearing room.
 - d. Leaf preparation, including the method of leaf harvesting and leaf storage.
 - e. Treatment of molting silkworms and silkworm immediately after ecdysis.
 - f. Prevention of missing and burying silkworms in the rearing bed.
 - g. Method of silkworm distribution to farmers.
 - h. Method of silkworm body disinfection.
 - i. Prevention of pests such as rats, ants etc.
 - j. Cleaning of the rearing room and the yard surrounding the rearing room, and disinfection of foot and hand.

- B. Grown silkworm rearing
 - a. One box of silkworms are reared at each time, and rearing is performed 6 times a year.
 - b. The rearing racks used are only two-storeyed.
 - c. Feeding with mulberry shoot, feeding is done three times a day.
 - d. Rearing room and tools are improved.
 - e. Important matters in grown silkworm rearing.
 - (a) Washing and disinfection of the rearing room and tools.
 - (b) The use of standard table for grown silkworm rearing.
 - (c) Method of leaf harvesting and preservation.
 - (d) Treatment of molting silkworms and silkworm immediately after ecdysis.
 - (e) Cleaning of the silkworm rearing bed.
 - (f) Silkworm body disinfection
 - (g) Prevention of pests, such as rats, ants etc.
 - (h) Cleaning of the rearing room and the yard surrounding the rearing room and disinfection of foot and hand.

- C. Improvements of the silkworm mounting technique and cocoon quality.
 - a. Improvement of bamboo cocooning frame
 - b. Preparation for mounting; washing and disinfection of mounting frame and so forth.

- c. Important matters in silkworm mounting techniques.
 - (a) Levelling of the silkworm rearing bed and treatment of early matured silkworms.
 - (b) Additional feeding when silkworms are about to mounting.
 - (c) Mounting the suitable matured silkworms.
 - (d) The method for the collection of matured silkworms by means of "jobarai".
 - (e) Method of the simultaneous transfer of matured silkworms to bamboo cocooning frame.
 - (f) Method to string the outside of bamboo cocooning frame by vinyl string.
 - (g) Treatment after the bamboo cocooning frame is hung up.
 - (h) Treatment during silkworm mounting.

- D. Cocoon harvesting, sorting and marketing
 - a. Determination of cocoon harvesting time and the method of cocoon harvesting.
 - b. The method of cocoon sorting.
 - c. The time for cocoon transportation (number of days after cocooning for transportation).

- 3) Unsolved problems and suggestions for the future
 - a) Collection of problems occurring in the regions, and the improvement & development of suitable technique.
 - b) Collection of data for the formulation of better techniques for demonstration.

(Iyus R.A., Baharuddin A., Bambang Hr., Wariso P., S. Nishi,
J. Nakamura)

VIII-7-2 Guidance Activities for the Demonstration of Sericultural Techniques
at the Farmers Groups

(1) Guidance for the Demonstration at the Pilot Unit

2) Silkworm rearing

a) Objectives

This investigation have been conducted concerning farmers' silkworm rearing method so as to improve farmer's young & grown silkworm rearing method, therefore occurring problems are offered in order to improve rearing techniques in the future.

b) Method.

a. Observation of farmers' silkworm rearing places unit: It was conducted in kabupaten Soppeng around Sub Centre in 1978. The observation was conducted in two young silkworm rearing units No.3, No.9 and three farmers from each unit. The results is written in the Report JR 80-55 in detail.

b. Survey on the actual condition of the young silkworm rearing unit and sericultural farmers : The observation was conducted by short-term experts Mr. Fujii and Mr. S. Tomonari in 1981-1982. Refer to Report JR 82-83 for more detail.

(a) Survey on the member farmers of the Pilot Units: Observed 120 unit members by distributing questionnaires, interviews and by direct observation.

(b) Though there are 129 young silkworm rearing units in total, survey was conducted in the five units where Pilot Units were planned to be established.

(c) Observation of sericultural farmers in all farmers including those who are Pilot Unit members, numbering more than 2000, were given a questionnaire to be filled up. Response was processed by guidance technicians in order to draw conclusions. Each guidance technician selected 20 sericultural farmers from his coverage, collected the questionnaires from them on rearing room disinfection and this result was calculated.

(d) Cocoon quality observation. Sixteen samples of cocoon produced in five Pilot Unit locations in July and September 1981 were taken and compared with the cocoons produced at the Centre and Sub Centre.

- c) Summary of results
- a. Observation of farmers' silkworm rearing condition in 1978.
- (a) Originally used polyvoltine race eggs were totally replaced by imported F₁ eggs, and F₂ eggs produced from imported F₁ eggs. Young silkworm (until third instar) were reared in the young silkworm rearing unit, and occurrence of pebrine disease proved to be reduced. However, young silkworm rearing unit and grown silkworm rearing house had a less favorable construction from the viewpoint of disease prevention, hence the increase of diseases brought about by Aspergillus and other diseases damaging the silkworms.
- (b) Cocoon yield from the rearing of one box with F₂ breed was only the half, or less than the product of F₁ breed.
- (c) The amount of cocoons received by farmers was; the cocoon product obtained minus the price of the silkworm egg and multiplied by one half.
- (d) Young silkworm rearing was performed with the use of rearing trays, and wooden boxes feeding was once a day with shootlet. Due to the poor rearing technique many worms were lost and many irregular silkworms occurred.
- (e) Grown silkworm rearing used two or three storeyed racks, feeding with mulberry shoot three or four times a day. Due to the too dense rearing, the amount of leaves fed was insufficient.
- (f) Heavy bamboo cocooning frame was used for silkworms were put one by one into the instrument, leading to improper results and many dirty cocoons occurred. In short, rearing and mounting techniques at that time were primitive, and therefore technical improvement is called for.
- b. Survey on the actual condition of the young silkworm rearing unit and sericultural farmers of Pilot Unit in 1981-1982 (Survey on the member farmers of Pilot Unit in 1981-1982).
- (a) Grown silkworm rearing took place below the raised house floor, but many people reared silkworms in their houses and also many reared them in separate houses. Grown silkworm rearing places were averagedly 33.3 m² large.

- (b) About 23.5% of the farmers owned leaf storing rooms, though poorly equipped. Farmer carries harvested leaves from the field on his head, wrapped in sarong.
- (c) Rearing racks had averagedly 2.67 storeys; dimension of rearing bed measured averagedly 26.4 m² ; the dimension of rearing bed for a box of silkworms was 21.9 m² large. The rearing bed were mostly layered by a sheet of paper, but some people used a piece of cloth or a tikar mat.
- (d) Hakitate was performed averagedly 5.3 times a year. As many as 6.5 boxes of silkworm eggs were averagedly put to hakitate a year. The average amount of silkworm eggs at each hakitate was 1.23 boxes.
- (e) About 36.4% of farmers have disinfected their grown silkworm rearing rooms, 25.3% disinfected silkworm bodies, 9.1% provided hand-wash facility and 60.6% have cleaned the environment of the rearing house. Disinfecting agent mostly employed was Ca-hypochlorite.
- (f) Average feeding a day was 3.89 times, giving mulberry shoots.
- (g) Single cocooning frame or double cocooning frame were mostly used. Some people piled the cocooning bamboos one upon another. Some farmers washed the bamboo cocooning frame after use, but they rarely performed disinfection.
- (h) Mounting of silkworm was mostly performed by picking matured silkworms one by one. To prevent matured silkworms from escaping, some farmers wrapped the cocooning instrument in a plastic sheet or a cloth. Many farmers carried cocooning silkworm to their home in order to avoid rats.
- (i) Cocoon harvest was performed 4-6 days after silkworms were cocooned, averagedly 4.78 days. Floss was removed by hand, without selection of cocoon by quality. They were immediately transfered to next process.
- (j) Cocoon production per box ranged from 0 to 25.6 kg. Average cocoon yield per box was 12.9 kg, reelable cocoon amounted to 11.2 kg. One hectare of mulberry field produced 115 kg cocoons.
- (k) Cocoon price paid was decided merely from the weight, regardless of the quality.
- (l) Income from sericulture amounted to 50% of the total income of the farmers.

- c. Observation of the ordinary young silkworm rearing unit.
- (a) Young silkworm rearing unit were mostly self owned. Mulberry fields used for young silkworm were also self-managed.
 - (b) Each young silkworm rearing unit was a single-storeyed, earth-floored building, measuring 5-5.6 m in width and 9-10 m in length.
 - (c) Six to eight rearings were performed each year, averagedly 6.6 times, 60 to 150 boxes of silkworm eggs were put to hakitae, averaging 100 boxes. Maximum amount in one rearing was 12 to 30 boxes, averagedly 20.8 boxes.
 - (d) Two of five workers were employed, the average being 3.8 workers. Young silkworm cost was silkworm eggs price plus 1/2 of the cocoon yield of each farmer.
 - (e) Room and tools disinfection was conducted once in each rearing period, but some farmers did not do it.
 - (f) Cocoon yield for a box ranged from 8.6 to 17 kg, averaging 12.8 kg.

d. Observation of sericultural farmers' condition in general.

Farmers numbered from 2411 to 3000. Their fields extended averagedly 63 are. Rearing per year occurred 4.19 times on average, with 4.04 boxes of silkworm eggs or 0.97 box each rearing. Cocoon yield per box was 10.1 kg, each farmer producing 40.8 kg cocoons. Cocoon yield per hectare of mulberry field amounted to 71 kg.

e. Cocoon quality observation

Weight of single cocoon was 1.4 gm in average. There was a high percentage of eliminated cocoons ; also a high percentage of dead silkworms inside cocoons, outside-soiled cocoons and double cocoons. Length of cocoon filaments were short. Reelability percentage was low, being 43% in average, and raw silk percentage was also low, i.e. 13% in average.

d) Unsolved problems and suggestions for the future

Survey on the actual condition of sericultural farmers is expected to be made continuously by guidance technician and the persons concerned. Occurring problems in region were taken to the Centre. The problems were discussed throughly and get solution or carry out experiment if necessary. Solution of the occurring problems

are used in technical improvement simultaneously.

(Iyus R.A., Baharuddin A., J. Nakamura, M. Fujii, S. Tomonari)

VIII-7-2-(2) Survey on the Actual Condition of Sericultural Farmers

2) Silkworm rearing

A. Objectives

In order to speed up the technical transfer to the Pilot Unit young silkworm rearing and the Pilot Unit demonstration farmers, guidance is given for the demonstration method of young and grown silkworm rearing and mounting. Furthermore the transmission of demonstrated technique to farmers around the Pilot Unit is requested.

B. Method and achieved progress

- a. At 5 units of young silkworm rearing and 8 demonstration farmers in Pilot Units, guidance is given for the demonstration of the formulated techniques for silkworm rearing.
- b. The Pilot Unit's young silkworm rearing building Model I established on the base of the trial model of young silkworm rearing building at the Center. After the completion of the young silkworm rearing building at the Pilot Unit of Luppange, guidance for the demonstration of techniques was given in November and December 1982, at the same time training practice for five guidance technician who are in charge of the Pilot Units.
- c. In March 1982 before the first activity of silkworm rearing, a discussion was held at 4 Pilot Unit location by experts, counterparts, Pilot Unit managing guidance technician and personnel concerned with the Pilot Unit activity, about the technical guidebook for demonstration at the Pilot Unit, so the content would be understood.
- d. In the case of guidance for technical demonstration, the expert took the leader's part accompanied by the counterpart in the first performance, giving guidance to guidance technician and farmers. In the second rearing performance the expert merely gave advice and the counterpart acted as leader. From the third rearing on, it is the counterpart himself that guides guidance technician and farmers.
- e. Materials and equipment for the demonstration of silkworm rearing at the young silkworm rearing unit were lent or granted by the project and some were locally made or bought. For the demonstration farmers' activities, improved bamboo cocooning frames and other equipment, which were made locally as much as possible, were lent or granted.

Detail of the materials and equipment for the Pilot Unit activities are described in the book of the Pilot Unit operational plan.

- f. After the accomplishment of the rearing activity at the Pilot Unit, a discussion was held at one place in the Pilot Unit location, attended by representatives of farmers groups in the 5 locations and personnel having to do with Pilot Unit activities. The counterparts and experts gave advice and suggestions and discussed the occurring problems, and showed solution for the future in order to gain good techniques for demonstration.

C. Summary of results

a. The plan for hakitate and its actual result

- (a) The activity went satisfactorily until the third performance. Since the fourth performance, however, due to the long dry season, the activity was performed at one Pilot Unit location only; besides, hakitate was also delayed.
- (b) In the first performance, number of farmers rearing silkworm was restricted by the amount of silkworm reared, hence a small number of them. In the second performance, nearly all members-farmers conducted rearing. In the 3rd and 4th rearing, due to the unusual dry season, mulberry leaf production in several regions decreased. In the 3rd rearing, the amount of rearing decreased as well, while in the 4th rearing only the location conducted it. The number of silkworms reared tended to be the same as the number of farmers rearing them.

b. Results of rearing

- (a) Seeing the relation between young silkworm rearing and crop conditions, it is assumed that in Wanio and Baraka there is a problem in young silkworm rearing. In Luppange, data of the 3rd rearing show a slight decline of amount of cocoon crop, but viewed from the survival rate of pupae and the average cocoon weight, actually not so many silkworms are lost.
- (b) Result of grown silkworm rearing at the location of Pising was steady, while that at Wanio was less good. Crop conditions at the locations of Wanio and Ugi in 1981 and in January 1982 showed a very poor result, many silkworms suffering from a jaundice (nobody).

The disease even occurred in the Pilot Unit during the first rearing activity. The condition was to some extent improved in the second rearing. However, according to the data of demonstration farmers at Wanio, more improvement was required in crop condition. The location in Baraka needed observation as well.

According to data of silkworm rearing, the third rearing has had bad results. It was due to the several dry season which led to a declining mulberry leaf production and quality, a high temperature and excessive dryness. Such a circumstance is unfavorable for silkworm rearing activities. Therefore it necessitates a discussion from on the technique of fresh leaf feeding to let silkworms eat to their satisfaction; the technique of silkworm rearing, that of mulberry cultivation, determination of silkworm rearing time etc.

In general, cocoon weight are light, small, length of cocoon filaments are shortened and raw silk percentage declines. In spite of the good leaf quality such as in the first and second performances, the technique for grown silkworm feeding ought to be improved (instar IV and instar V). By increasing the average cocoon weight, cocoon cropping is expected to increase. In every rearing activity, one demonstration farmers has been obtaining heavy individual cocoon weight and cocoon yield per box. It owes not only to good feeding technique, but also to good mulberry leaf quality, possibly drawing the special attention.

As the result of silkworm rearing activities, only Pising Pilot Unit has so far almost achieved the cocoon production target for demonstration farmers (first & second rearing). Next in succession is the location at Luppange. The Pilot Unit in Ugi has achieved the target in the second performance. The target of production at Pilot Unit farmers' level is achieved by Pilot Unit farmers of Pising and Ugi (first and second rearings), while Luppange and Wanio achieve the target in the second rearing. Therefore the rearing activity throughout the year is expected to achieve the target from now on.

c. Result of the guidance for demonstration

- (a) The guidance for demonstration of the young silkworm rearing technique has shown a good result. In one or two Pilot Units, improvement in bed arrangement, spacing in bed and mulberry feeding techniques during the 1st & 2nd instars, is required.

- (b) The guidance for demonstration of the grown silkworm rearing technique, e.g. improvement of the grown silkworm rearing construction, disinfection etc., has generally shown good results. However, lime bestrewing on the earthen floor before rearing is often neglected. Then farmers are required to exert their ingenuities little more in the storing method of mulberry leaves. Advice and guidance are still required concerning the separation of quick growing and slow growing silkworm at before molting of instar IV.

Improvement is required for the determination of the right dimension of rearing bed at instar IV and V, for fresh mulberry leaf feeding to satisfy silkworm, and other matters concerning silkworm feeding technique.

- (c) Techniques of mounting, silkworm treatment during mounting period, cocoon sorting etc. show some progress after performed several times. Yet fresh mulberry leaf feeding is often forgotten at the time silkworm are about to mounting. In the case of the improvement of bamboo cocooning frame, piling type bamboo cocooning frames are still being used. Unless this piling type bamboo cocooning frame is replaced by improved cocooning frame promptly, technical improvement in cocooning and cocoon quality will not succeed. Although cocoon sorting has been performed at farmers' level, the cocoon sorting needs to be upgraded.

D. Unsolved problems and suggestions for the future

- a. Problems occurring in the regions are selected, solved together in Centre, and adjusted to the local condition to be developed into a better technique which may be usable as guidance for demonstration.
- b. Smooth transfer of demonstration techniques to the ordinary members of Pilot Units.
- c. The Pilot Unit produced cocoons are observed as to their reelability percentage, raw silk percentage etc. in order to improve the techniques of silkworm rearing, silkworm mounting and cocoon quality improvement, which may be employed to promote the guidance for technical demonstration.

(Iyus R.A., Baharuddin A., Bambang Hr., Wariso P., S. Nishi)

Table 8-7-8 Target and present condition of mulberry and cocoon crop at the Pilot Unit

	Pising	Luppange	Wanio	Ugi	Baraka	Results
a. Present condition (1981)						
Amount of mulberry crop per a hectare (tons)	12	12	10	10	10	A
Amount of cocoon crop per a box (kg)	9	16	12	10	17	
Amount of cocoon crop per a hectare (kg)	85	150	110	130	90	
b. Target						
Amount of mulberry crop per a hectare (tons)	18	18	15	15	15	$B = A \times 1.5$
Amount of cocoon crop per a box (kg)						
- Level of demonstration farmers	25	25	24	24	27	
- Level of participating farmers	22	22	21	21	24	a
- Lowest level of participating farmers	18	18	16	16	20	
Amount of cocoon crop per a hectare (kg)	360	260	280	280	290	Baraka = $C = Bx \times 0.8$ another = $C = Bx \times 0.9$

Note: Baraka is in the highland. Duration of feeding period will be longer if silkworm rearing performed in this area, because of cold. It needs more leaves for silkworm feeding. So, amount of cocoon crop per hectare of mulberry field in this area is only 80% of (Bxa).

Table 8-7-9 Plan and actual result of hakitate at the Pilot Unit
1982/1983

Items	Pilot Unit				
	Pising	Luppange	Wanio	Ugi	Baraka
Building established	Dec. 1981	Nov. 1981	Dec. 1981	Mar. 1982	Aug. 1982
Number of participating farmers	25	25	30	20	20
1.	A Mar. 15-22	Mar. 15-22	Mar. 15-22	Mar. 15-22	-
	B Mar. 16	Mar. 16	Mar. 17	Mar. 17	-
	C 18	13	20	14	-
	D 10	10	10	10	-
	E 10	10	10	10	-
2.	A July 1	July 1	July	July	-
	B July 1	July 1	July 2	July 2	-
	C 25	25	28	20	-
	D 30	12	20	30	-
	E 30	12	20	30	-
3.	A Aug. 30	Aug. 30	Aug. 31	Aug. 31	Sept. 1
	B Aug. 30	Aug. 30	Aug. 31	Aug. 31	Sept. 2
	C 19	19	8	20	5
	D 20	16	5	30	7
	E 20	16	2	28	3
4.	A Oct. 13	Oct. 13	Oct. 14	Oct. 14	Oct. 14
	B Oct. 27	-	-	-	-
	C 7	-	-	-	-
	D 5	-	-	-	-
	E 5	-	-	-	-
5.	A Dec. 2	Dec. 2	Dec. 3	Dec. 3	Dec. 3
	B Jan. 14	Jan. 26	Jan. 29	Jan. 28	Jan. 15
	C 30	30	19	30	7
	E 30				

Remarks:

A = Plan of hakitate time

B = Hakitate operation

C = Number of rearing farmers

D = Number of silkworms reared (box)

E = Number of silkworms distributed (box)

Table 8-7-10 Result of sericulture at the Pilot Unit, March 1982

Pilot unit	Demonstration farmers name	Number of silkworm reared	Amount of cocoon crop	Number of cocoon per a 500 grams	Survival rate of pupa	Cocoon weight	Percentage of cocoon shell weight
			box		kg	%	gram
P	M. Tahir	1.0	26.4	342	92	1.52	22.6
	Ibrahim	1.0	22.0	354	94	1.42	22.8
	Beddu. B	1.0	26.0	295	91	1.70	22.5
	Average	-	24.8	330	92	1.55	22.6
	Average of 18 farmers	10.0	22.5				
L	Ballu	1.0	24.6	339	97	1.52	21.4
	Average of 13 farmers	10.0	20.4				
W	Aras	1.0	19.4	362	68	1.45	20.7
	Marawiah	1.0	16.0	315	83	1.63	22.3
	Ruslan	0.5	15.4	336	79	1.49	21.0
	Average	-	16.9	338	77	1.52	21.3
	Average of 20 farmers	10.0	19.2				
U	Usman. P	1.0	20.9	346	95	1.48	21.7
	Balla	1.0	21.0	333	90	1.57	23.6
	Average	-	21.0	340	93	1.53	22.7
	Average of 14 farmers	10.0	21.7				

Remarks: P = Pising
L = Luppange
W = Wanio
U = Ugi

Table 8-7-11 Result of sericulture at the Pilot Unit,
July 1982.

Pilot unit	Demonstration farmers name	Number of silkworm reared	Amount of cocoon crop	Number of cocoon per a 500 grams	Survival rate of pupa	Cocoon weight	Percentage of cocoon shell weight
		box	kg		%	gram	%
P	M. Tahir	2.0	32.4	302	90	1.75	23.6
	Ibrahim	1.5	24.9	336	95	1.48	23.6
	Beddu.B	1.25	17.2	335	95	1.40	21.0
	Average	-	24.8	324	93	1.54	22.7
	Average of 18 farmers	30.0	22.5				
L	Ballu	2.0	31.5	315	97	1.67	24.0
	Average of 12 farmers	12.0	23.5				
W	Aras	-	-	-	-	-	-
	Marawiah	3.0	20.2	403	84	1.29	21.8
	Ruslan	1.0	19.8	371	86	1.44	24.2
	Average	-	20.0	387	85	1.37	23.8
	Average of 20 farmers	20.0	22.5				
U	Usman.P	1.0	24.4	330	84	1.58	21.5
	Balla	1.0	25.1	332	83	1.54	21.7
	Average	-	24.8	331	84	1.56	21.6
	Average of 30 farmers	30.0	23.5				

Remarks: P = Pising
L = Luppange
W = Wanio
U = Ugi

Table 8-7-12 Result of sericulture at the Pilot Unit, August 1982

Pilot unit	Demonstration farmers name	Number of silkworm reared	Amount of cocoon crop	Number of cocoon per a 500 grams	Survival rate of pupa	Cocoon weight	Percentage of cocoon shell weight
		box	kg		%	gram	%
P	M. Tahir	2.0	24.8	373	90	1.45	23.2
	Beddu. B	1.0	10.8	520	73	1.03	21.4
	Average	-	17.8	447	82	1.24	22.2
	Average of 19 farmers	20.0	17.1				
L	Ballu	1.0	12.5	596	96	0.89	22.1
	Average of 19 farmers	16.0	8.1				
W	Marawiah	0.25	12.2	493	17	1.06	21.0
	Average of 8 farmers	2.0	9.9				
U	Usman. P	0.5	15.6	580	28	0.97	20.2
	Balla	0.5	15.3	400	90	1.29	22.6
	Average	-	15.5	490	59	1.13	21.4
	Average of 20 farmers	28.0	14.4				
B	Ambe Mina	0.5	7.5	577	76	1.05	21.7
	Average of 5 farmers	3.0	9.8				

Result of sericulture at the Pilot Unit, October, 1982.

P	M. Tahir	1.5	25.0	375	88	1.39	25.5
	Average of 7 farmers	5.0	21.7				

Remarks: P = Pising, L = Luppange, W = Wanio, U = Ugi and B = Baraka

VIII-7-2-(3) Assessment of Techniques of Sericultural Farmers

2) Silkworm rearing.

A. Objectives

Through a proper technical assessment, the progress or development of silkworm rearing technique can be known. Results of evaluation can be applied as indexes for technical improvement and guidance for demonstration.

B. Method

- a. Observation is made by guidance technician by making a questionnaire on the techniques of young silkworm and grown silkworm and mounting (as described in table 8-7-14 and table 8-7-15). Some parts of the result obtained were observed again by the counterparts.
- b. Observation was performed at the start of the second rearing in June/July 1982 at the Pilot Unit locations in Pising, Luppange, Wanio and Ugi. Assessment was not made at the Pilot Unit located in Baraka which started silkworm rearing in September 1982.
- c. One of the object of observation was the young silkworm rearing unit; one Pilot Unit and one Non Pilot Unit were observed in each location. The other object was grown silkworm rearing and mounting, observation was made at the place of Pilot Unit member farmers.
- d. As reference materials for the questionnaire on technical assessment, results of silkworm rearing activities were observed in each location.

C. Summary of the technical assessment

- a. The young silkworm rearing technique (shown in table 8-7-16 and table 8-7-17).
 - (a) The young silkworm rearing techniques at the Pilot Unit in Wanio have not reached the satisfactory levels, while other Pilot Units reached very high levels. Such a condition is seen in the reference materials, in table 8-7-18 concerning the result of rearing. Trees were planted as shelter at the location in Wanio but they died. Sunshine penetrated the rearing building, bringing about an increase in temperature. Concerning leaf preservation, the dimension of rearing bed and the mulberry leaf feeding technique were poor in Wanio.

- (b) The young silkworm rearing units of non Pilot Unit farmers chosen for observation were tended to have been chosen from among better conditioned farmers except in Wanio.

Technical levels of these three non Pilot Units are considered to be at the middle levels, and are practicing the washing & disinfection of rearing rooms & rearing tools and body disinfection of silkworm. However, the cocoon cropping is still varried with their technical levels.

- b. The techniques for grown silkworm rearing and silkworm mounting.

- (a) Technical condition at the Pilot Unit's demonstration farmers improv improved. This condition was reflected by the result of second silkworm rearing. However, when scrutinized one by one, e.g. disinfection of the cocooning frames, improvement of the cocooning frame, improvement of the mounting technique etc., the technical level was is still in low level.

- (b) Farmers who were ordinary Pilot Unit members and not the demonstration farmers were in low technical level, particularly concerning the condition of the rearing unit establishment, disinfection and washing of rearing room and tools and so forth which are the principles of silkworm rearing. Result in the technical level of silkworm rearing and silkworm mounting were low. A guidance to demonstrated techniques to these farmers is urgently required herefor, in order to be understood new techniques more deeply by farmers.

D. Unsolved problems and suggestions for the future

- a. Technical assessment should be conducted regularly each year.
- b. Results of this assessment/observation can be utilized by guidance technician, as reference materials for the guidance activities in the demonstration of techniques. Not only guidance technicians but also district office personel may utilize the items.
- c. To know the actual technical level of the farmers of Pilot Unit, it is necessary to compare with it to non Pilot Unit farmers, and the rearing and mounting techniques were observed in both farmers groups.
- d. Personnel conduction the observation should master the things to be observed. Additionally, the reference materials from the questionnaire of assessment should be reliable.

(Bambang Hr., Wariso P., Iyus R.A., Baharuddin A., Guidance technician, S. Nishi)

13	a. Standard for leaf feeling b. Weighing scale	a. Applied b. Employed	a. Not applied b. Not employed	8
14	Observation of temperature, humidity and air circulation in the rearing room	Performed	Not performed	4
15	Amount of leaves	Sufficient	Insufficient/ excessive	4
16	Extent of silkworm rearing bed area when rearing	Sufficient/ suitable	Too narrow/ too extensive	4
17	Silkworm condition and density	Good	Poor	4
18	Performance in damp proof paper covering/ uncovering	Good	Poor	4
19	Treatment at molting (lime bestrewing, enlargement of the silkworm rearing bed area)	Good	Poor	4
20	Method of first feeding at awakening	Good	Too soon/ too late	4

Technical assessment	A	B	C	D	E	Total	100
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Total value	80	70	60	50	50		
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Young silkworm rearing activity

Addition

A. Performance of cleaning and disinfection of the young silkworm rearing room:

1. a. Performed once prior to rearing and once again after rearing.
- b. Performed just once, either before or after rearing.
- c. Performed occasionally.
- d. Only washed.
- e. Never performed.

2. Disinfection chemical use :

B. Young silkworm distribution

Period of distribution	Means of transportation	Carrier	Time
a. Prior to third instar	a. By car	a. Guidance technician	a. Morning
b. Third instar molting	b. By motorcycle	b. Unit chief	b. Afternoon
c. Fourth instar awakening	c. On feet	c. Rearing farmer	c. Noon

C. Means for young silkworm rearing:

1. a. Extent of mulberry plants for young silkworm rearing: ha.
- b. Mulberry field owner :
2. Is a leaf storing room available?
3. How many times is hakitate performed a year?
4. The largest amount of silkworms reared in one period: boxes
5. a. Number of personnel for young silkworm rearing: men
- b. Are the men regular or seasonal labor?
6. Silkworm rearing employs:
 - a. Trays
 - b. Wooden boxes
 - c. Other tools
7. The floor of the rearing room is :
 - a. Plastered
 - b. Earthen
 - c. Graveled
 - d. Timber boards.

Table 8-7-15 Questionnaire for the assessment of the grown silkworm rearing and mounting techniques

Date of observation: _____ Observer's name : _____
 No. : _____ Amount of silkworm reared: _____
 Farmer's name : _____ Cocoon yield : _____
 Unit/Village : _____ Cocoon yield per a box : _____
 Date of hakitata : _____ Cocoon yield percentage : _____

No.	Item observed	Results of observation		Mark/ section
1	Is the Ceiling of the rearing room plastic-sheet covered?	Yes	No	4
2	Number of rack storeys for rearing	2	3 or more	4
3	Is the surface of the rearing rack plastic-sheet covered?	Yes	No	4
4	Situation of the leaf storing place	Outside the room	Inside the room	4
5	a. Hand-washing device	a. Available	a. Not available	4
	b. Waste basket for sick/dead silkworms	b. Available	b. Not available	
6	a. Is the floor lime bestrow?	a. Yes	a. No	4
	b. Is the wall spread with lime?	b. Yes	b. No	
7	Orderliness and cleanliness of the rearing room	Good	Poor	4
8	Cleaning and disinfection of the rearing room	Performed	Not performed	8
9	Silkworm body disinfection	Performed	Not performed	4
10	Technique of leaf preservation	Performed	Not performed	4
11	Technique of leaf feeding	Good	Poor	8
12	Extent of silkworm tray in the racks	Sufficient/suitable	Narrow/too extensive	4

13	Treatment at a. Molting b. Awakening	a. Good b. Good	a. Poor b. Poor	4
14	Separation of overdue silkworms	Performed	Not performed	4
15	Cocooning frame is a. Washed b. Disinfected c. Sundried	a. Yes b. Yes c. Yes	a. No b. No c. No	8
16	Improvement of the cocooning frame	Performed	Not performed	4
17	Improvement of the mounting technique	Performed	Not performed	8
18	Treatment at mounting time	Performed	Not performed	8
19	Cocoon harvesting time (considered from the time or largest number mount- ing)	The sixth day	The 5th day or before	4
20	Cocoon assorting	Performed	Not performed	4

Technical assessment	A	B	C	D	E	Total	100
Total value	80	70	60	50	50		

Additional explanation for grown silkworm rearing

Running number	Explanation
8	<ul style="list-style-type: none">a. Performed before and after rearing.b. Performed just once, either before or after the rearing.c. Performed occasionally.d. Only washed.e. Not performed at all.
11	<ul style="list-style-type: none">a. Daily feeding frequency is respectively twice, 3 times or 4 times.b. Amount of leaf feeding is sufficient, excessive or insufficient.c. Leaves fed are withered or fresh.
13	<ul style="list-style-type: none">a. First feeding after awakening is too early, too late or on time.b. Is the silkworm place lime bestrow or expanded during molting.
14	When most (85%) of the fifth instar silkworms have molted, are overdue silkworms separated?
17	<ul style="list-style-type: none">a. Are matured silkworms taken one by one or by "jobarai" (shaken from the stems).b. Are silkworms put in the cocooning frame one by one or poured.c. In using the cocooning frame, is it upturned or strapped with vinyl cord?
18	<ul style="list-style-type: none">a. After silkworms are mounted, in the tray cleaned?b. Is the mounting room sufficiently ventilated?c. Are silkworm urine and waste in the cocooning frame received with paper or paddy husk?d. Are dead cocoons in the cocooning frame removed or left that way?

Table 8-7-17: Assessment of young silkworm rearing technique
(in each district)

No.	Mark per section	Pising		Luppange		Wanio		Ugi	
		PU	Non PU	PU	Non PU	PU	Non PU	PU	Non PU
1	4	4	4	4	4	4	0	4	4
2	4	4	0	4	4	4	0	4	4
3	4	4	4	4	0	0	4	4	4
4	4	4	0	2	0	2	0	2	2
5	4	4	4	4	4	4	2	4	2
6	8	8	4	8	0	8	0	8	4
7	4	4	4	4	4	4	0	4	0
8	8	8	8	8	8	8	4	8	4
9	8	8	8	8	8	8	0	8	8
10	8	8	0	4	8	4	0	8	8
11	4	2	4	2	0	2	0	2	0
12	4	4	0	4	0	4	4	2	4
13	8	8	4	8	0	4	0	8	4
14	4	4	0	4	0	4	0	4	0
15	4	4	4	4	4	4	0	4	0
16	4	2	4	2	4	0	0	2	4
17	4	2	4	2	4	0	0	4	4
18	4	2	0	2	0	2	0	2	2
19	4	4	4	4	4	4	4	4	4
20	4	2	4	2	4	2	0	2	4
Total value	100	90	64	84	60	72	22	88	64
Technical assessment		A	C	A	C	B	E	A	C

Remark: Items of observed (No. 1 to 20) see table 8-7-14.
Time of observation: June / July 1982

Table 8-7-17 Assessment of young & grown silkworm rearing and mounting techniques.

Place	Object to observation	Young silkworm rearing		Grown silkworm rearing & mounting		Number of observation object	
		Total value	Evaluation	Total value	Evaluation	Y.S.	G.S.
Pising	PU	90	A	89	A	1	a. 3
	Non PU	64	C	56	D	1	b. 12
	Average	(77)	B	73	B		
Lu-ppange	PU	80	A	96	A	1	a.1
	Non PU	60	C	57	D	1	b.12
	Average	(70)	B	77	B		
Wanio	PU	72	B	97	A	1	a.2
	Non PU	22	E	47	E	1	b.22
	Average	(47)	E	72	B		
Ugi	PU	88	A	93	A	1	a.2
	Non PU	60	C	60	C	1	b.14
	Average	(76)	B	77	B		

Remarks:

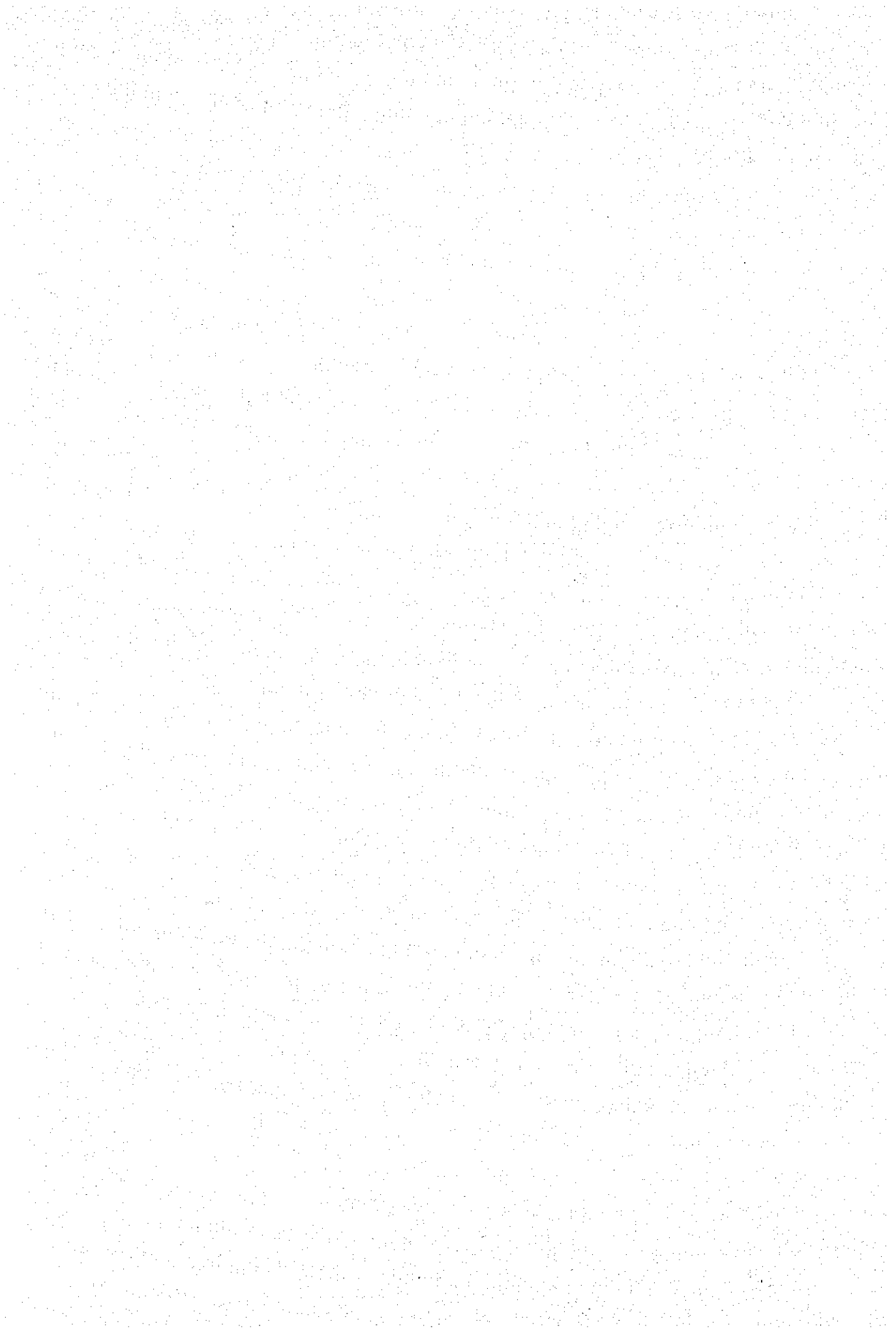
1. Technical assessment A (80) B (70) C (60) D (50) E (50)
2. a. Demonstration farmers
b. Participating farmers
3. Y.S. = Young silkworm rearing
G.S. = Grown silkworm rearing
4. PU = Pilot Unit
Non PU = Non Pilot Unit

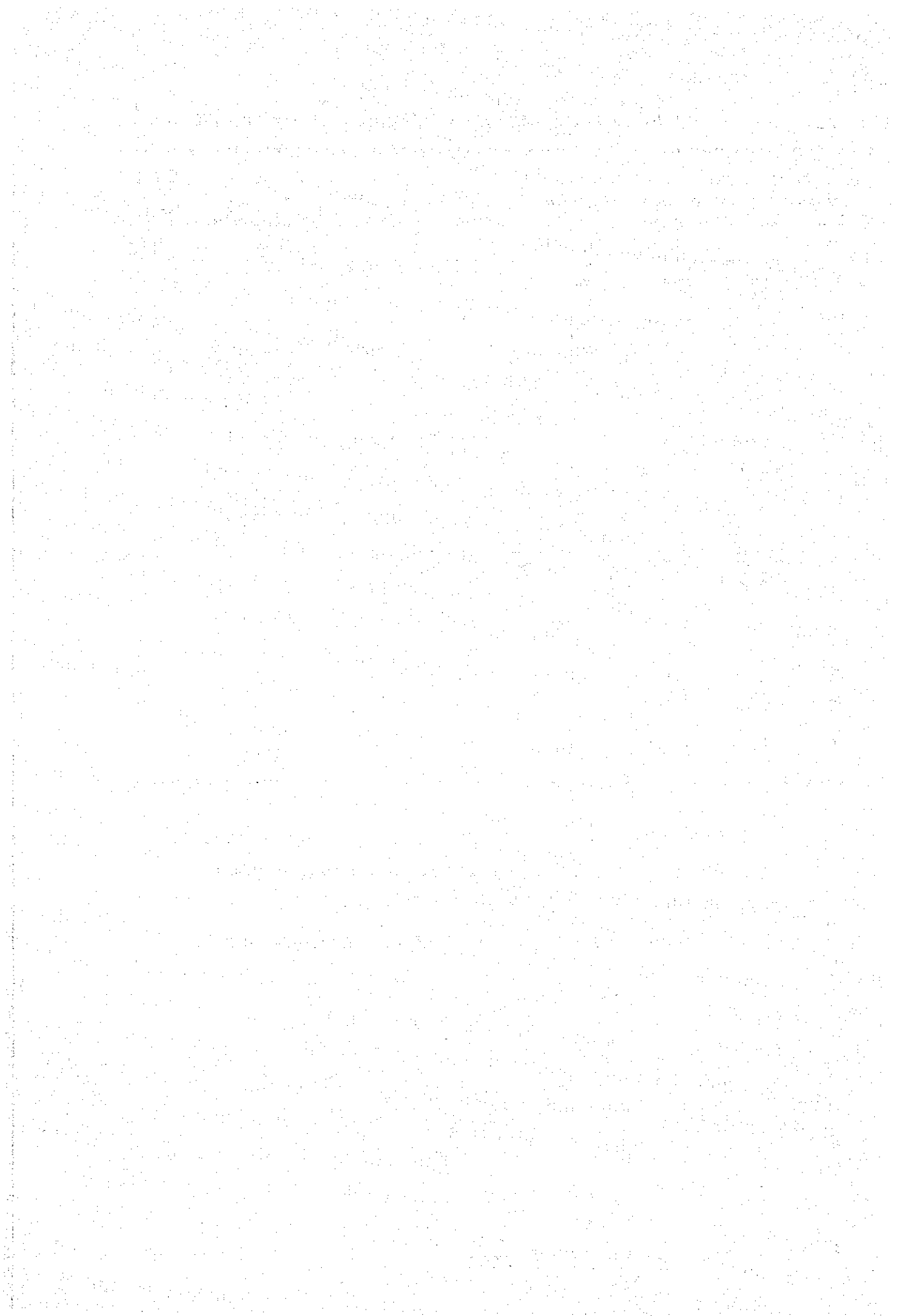
Table 8-7-18 Results of silkworm rearing activity, 1982

Place	Object to observation	Time of hakitata	Number of farmers	Number of silk-	Cocoon crop	Cocoon crop per a box	Cocoon crop condition
				worm reared			
				box	kg	kg	%
Pising	PU	Jun.1	25	30	675.9	22.5	102
	Non PU	May 31	5	13	211.3	16.3	74
	Total and average		30	43	887.2	19.4	88
Luppange	PU	Jun.1	25	12	282.1	23.5	107
	Non PU	Jun.17		15	150.0	10.0	45
	Total and average			27	432.1	16.8	76
Wanio	PU	Jun. 2	28	20	450.6	22.5	107
	Non PU	Jun. 25	6	4	24.0	6.0	29
	Total and average		34	24	474.6	14.3	68
Ugi	PU	Jun. 2	20	30	704.7	23.5	112
	Non PU	Jul.25	21	14	252.0	18.0	86
	Total and average		41	44	956.7	20.8	99

Remarks:

1. Index of cocoon crop at Pising & Luppange: 22 kg per a box
Wanio & Ugi : 21 kg per a box
2. PU = Pilot Unit; Non PU = Non Pilot Unit





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