タイ国立農産工業
バイオテクノロジーセンター計画
長期調査員報告書

平成4年11月

国際協力事業団

序　　文

国際協力事業団は、タイ国政府の要請を受け平成３年３月、タイ国立農産工業バイオテクノロジーセンター計画に関する事前調査を実施しましたが、その調査報告を踏まえ、平成４年９月22日から10月５日まで長期調査員３名を現地に派遣しました。

同調査員は、本プロジェクトの開始に必要な現地調査及びタイ国政府関係者との協議を行いました。

本報告書は、同調査員による調査結果等をとりまとめたものであり、今後、本プロジェクトの実施の検討にあたり広く活用されることを願うものです。

終わりに、この調査にご協力とご支援をいただいた内外の関係各位に対し、心より感謝の意を表します。

平成４年11月

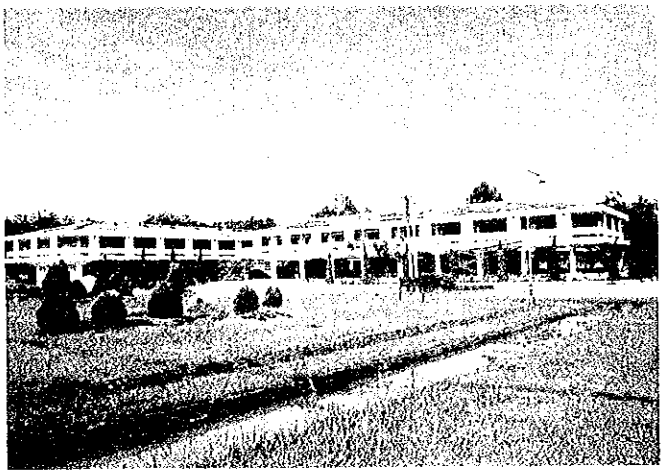
国際協力事業団
農業開発協力部
部長　有川通世

◀ 総理府技術経済協力局（DTEC）表敬・協議

大学省（MOUA）表敬・協議 ▶

◀ チェンマイ大学学長表敬

チェンマイ大学農学部長と協議 ▶



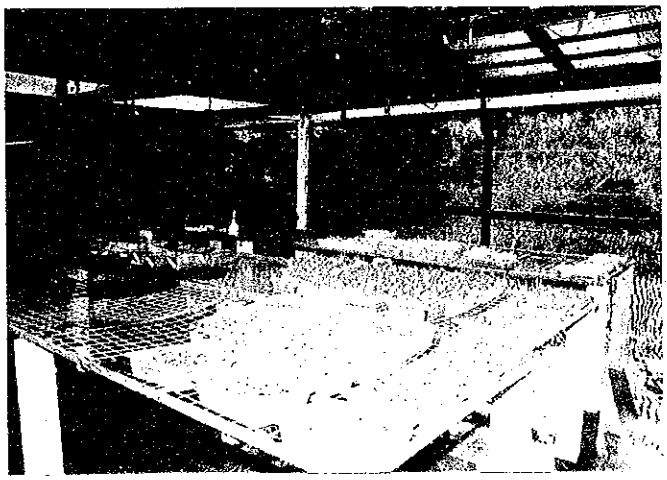
◀ チェンマイ大学農学部

園芸学科実験棟 ▶

◀ USAIDより資金供与を受けた機材

◀ 実験室内の様子（植物病理学科）

実験室内の様子（園芸学科） ▶



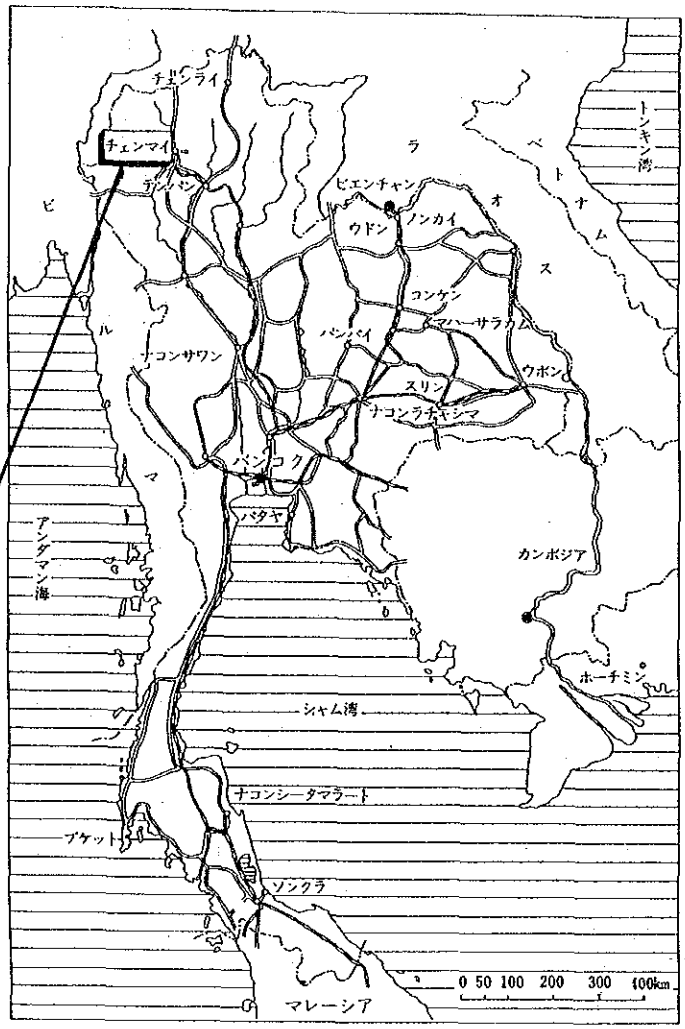
◀ 馴化の様子

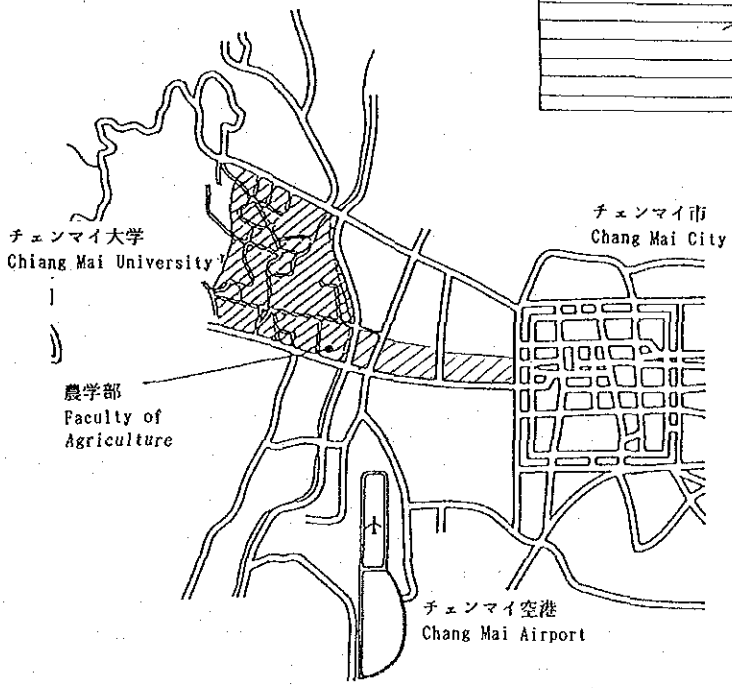
(プロジェクトサイト位置図)

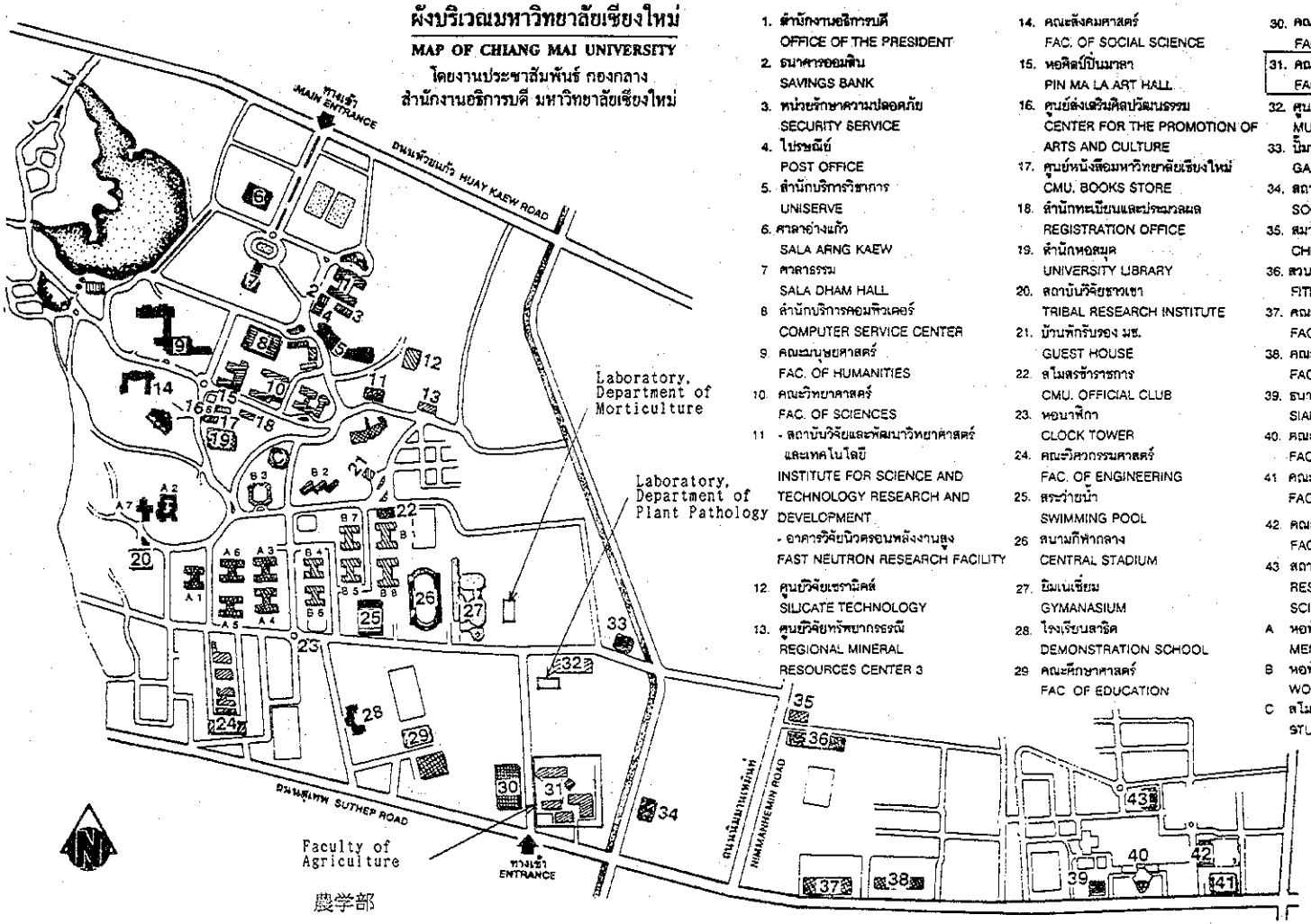
チェンマイ：首都バンコクより北方700km.（空路１時間）
タイ国第２の都市（北部の中心都市）

チェンマイ大学：　チェンマイ中心地より北西4km.

タイ王国







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1. 長期調査員の派遣

1－1　派遣の経緯と目的

1989年、タイ国立遺伝子工学バイオテクノロジーセンター（NCGEB）は、第6次経済社会開発計画（1987～1991）・科学技術開発プログラムの一環として、『タイ国立農産工業バイオテクノロジーセンター計画』を日本側へ正式要請してきた。しかしNCGEB要請は無償資金協力26億円を主体としたものであったため、平成2年度対タイ無償・技協年次協議（1990.6.19）は、近年の経済発展著しい現在のタイ国に対する無償資金協力の対応は困難との判断を下した。

これを受け国際協力事業団（ＪICA）は、NCGEB要請への無償資金協力を前提としないプロジェクト方式技術協力の可能性を探るため、三重大学教授・梅林正道を団長とする事前調査団を1991年3月に派遣したが、タイ側はあくまで無償資金協力を要請したため、同調査団はタイ側との妥協点を見い出すに至らなかった。帰国報告会において外務省・文部省・ＪICA 関係者はNCGEB要請への日本側スキームによる対応は困難との意見で一致した。

一方、平成3年度対タイ無償・技協年次協議（1991.7.31）において、NCGEB要請に対し、「プロ技協のみであれば実施協議調査団を派遣する」旨、言及されている。同言及を受けてチェンマイ大学（CMU）はNCGEBの指導によりNCGEB要請を日本側スキームに沿って改訂した『タイ農産工業バイオテクノロジー研究計画』を、1992年1月に要請してきた。

以上のような経緯のなか、ＣMU要請をNCGEB要請からの継続案件として検討を続け、1992年7月の各省会議に諮り、ＣMU要請に対し下記の方針に基づく長期調査員を平成4年（1992年）9月22日～10月5日の期間、タイ王国へ派遣した。

本調査は長期調査ではあるが、前回の事前調査とは異なる新たな要請を基に行われるため、その調査方針は事前調査的色合いが強い。

＜長期調査員対応方針＞

① 長期調査員は新規要請内容について確認するとともに、プロジェクト方式技術協力実施の可能性を技術面、プロ技協スキームとの整合性の面から検討する。

② プロジェクト方式技術協力実施の可能性が確認された場合は、調査結果に基づきプロジェクト基本計画をタイ側と検討する。

③ 現地調査の結果はレターにとりまとめ、タイ側に提出する。

④ 現地調査の結果は持ち帰りのうえ、日本側関係機関に報告する。

1－2　調査員の構成

担当業務	氏名	所属先
(1) 総括兼培養培地・生育環境研究	梅林　正直	三重大学生物資源学部教授
(2) 植物バイオテクノロジー研究	山本　喜良	香川大学名誉教授
(3) 協力計画兼業務調整	小淵　仲司	国際協力事業団農業開発協力部 農業技術協力課

1－3　調査日程

日順	月　日	曜日	調査日程	宿泊地	調査内容
1	9月22日	火	東京→ バンコク	バンコク	往路　JL717
2	9月23日	水	バンコク	〃	ＪＩＣＡタイ事務所打合せ　日本大使館・ 総理府技術経済協力局表敬訪問
3	9月24日	木	〃	〃	大学省・科学技術環境省表敬訪問・打合せ
4	9月25日	金	バンコク→ チェンマイ	チェンマイ	移動　TG104 チェンマイ大学表敬訪問・打合せ
5	9月26日	土	チェンマイ	〃	チェンマイ大学調査①
6	9月27日	日	〃	〃	調査員内打合せ・資料整理
7	9月28日	月	〃	〃	チェンマイ大学調査②
8	9月29日	火	〃	〃	チェンマイ大学調査③ チェンマイ大学協議
9	9月30日	水	チェンマイ→ バンコク	バンコク	移動　TG105 調査員内打合せ・資料整理
10	10月 1日	木	バンコク	〃	大学省協議
11	10月 2日	金	〃	〃	大学省協議・報告 ＪＩＣＡタイ事務所・日本大使館報告
12	10月 3日	土	〃	〃	調査員内打合せ・資料整理
13	10月 4日	日	〃	〃	調査員レター作成
14	10月 5日	月	バンコク→ 東京	東　京	調査員レター提出 帰路　TG640

1－4　主要面談者

(1)総理府　技術経済協力局(DTEC)
- Mr.Krisda Piampongsant, Director,External Cooperation Division I.
- Ms.Tipsuda Nopmongcol, Chief,Japan Sub-Division.
- Mr.Tomikazu Inagaki, JICA Expert,Technical Cooperation Coordination.

(2)大学省(MOUA)
- Prof.Dr.Wichit Srisa-an, Permanent Secretary.
- Prof.Dr.Kasem Watanachai, Deputy Permanent Secretary. (from Oct.1)
- Ms.Chantavit Sujatanond, Director,Foreign Relations Division.
- Ms.Vandee Ketanitinan, Chief,Asian Cooperation Section,Foreign Relation Division.

(3)科学技術環境省(MOSTE)
- Dr.Sakarindr Bhumiratana, Director,National Center for Genetic Engineering and Biotechnology(NCGEB).
- Dr.Sutat Sriwatanapongse, Deputy Director,NCGEB.
- Dr.Aphirat Arunin, Secretary General,National Research Council of Thailand(NRCT).
- Ms.Prapasri Thanasukarn, Director,Research Project and Coordination Division, NRCT.

(4)チェンマイ大学(CMU)
- Prof.Dr.Kasem Watanachai, President. (until Sep.30)
- Prof.Dr.Choti Theetranont, President. (from Oct.1)
- Associate Prof.Nakorn Nalampang, Dean,Faculty of Agriculture. (until Sep.30)
- Associate Prof.Dr.Pongsak Angkasith, Dean,Faculty of Agriculture. (from Oct.1)
- Associate Prof.Dr.Prasartporn Smitamana, Head,Department of Plant Pathology,Faculty of Agriculture.
- Associate Prof.Dr.Adsorn Krasasechai, Head,Department of Horticulture, Faculty of Agriculture.
- Associate Prof.Dr.Pimchai Apavatjrut, Department of Horticulture, Faculty of Agriculture, (Vice director,Institute for Science and Technology Research and Development).
- Associate Prof.Dr.Kesinee Ramingnong, Department of Horticulture, Faculty of Agriculture.
- Assistant Prof.Dr.Danai Boonyakiat, Department of Horticulture, Faculty of Agriculture.
- Assistant Prof.Dr.Pajchima Smitamana, Department of Plant Pathology, Faculty of Agriculture.
- Assistant Prof.Dr.Sombat Srichuwng, Department of Plant Pathology, Faculty of Agriculture.

2. 要　　約

2－1　概要

本調査は長期調査ではあるが、チェンマイ大学から新しく提出された要請書を基に行われたため、調査項目は事前調査的な色彩もかなり濃いものとなっている。

しかし前回の事前調査とは異なり、プロジェクト方式技術協力における「人造り」に重点を置いた観点から行ったもので、チェンマイ大学における協力実施の可能性について調査を行い、プロジェクト基本計画を検討するとともに、プロジェクトの名称変更についても検討した。

2－2　タイ側新規要請内容（チェンマイ大学要請）

(1) プロジェクト名：「タイ農産工業バイオテクノロジー研究計画」

英　名：Agro-industrial Biotechnology Research Project

(2) プロジェクト要請機関

要請機関：チェンマイ大学

実施機関：チェンマイ大学　農学部・理学部

上位機関：チェンマイ大学

国立遺伝子工学バイオテクノロジーセンター（科学技術環境省）

(3) プロジェクトの上位目標

タイ北部における農産物の高収量化・高品質化を促し、輸出農産物を開発して、農産工業の発展に資する

(4) プロジェクトの目標

① 高付加価値農産物の開発

② 組織培養における環境要因研究

③ 組織培養用低価格培地の開発

④ 天然殺菌殺虫剤

⑤ 大学院課程への支援

(5) プロジェクトの活動

① 作物改良のためのバイオテクノロジー研究

a. 組織培養

b. 遺伝子組換

② 閉鎖栽培下における環境要因の研究

a. データ収集

b. 培地用ゲルの検索

③ 病害虫防除のための有用植物利用研究

a. 民間療法で殺菌殺虫剤に用いられる有用植物の調査・研究

b. 殺菌殺虫成分の同定

(6) 技術移転・普及ターゲットグループ

① タイ北部（チェンマイ・チェンライ・ランポン）農民

② 大学スタッフ・研究者

(7) プロジェクトの期間：5年間（1992年4月～1997年3月）

(8) 日本側協力

① 専門家派遣

長　期：チームリーダー・調整員

短　期：植物病理学・組織培養・突然変異育種・モノクロナール抗体製造・培養環境研究・植物生化学・分析化学・ポストハーベスト病理学

② 研修員受入れ：4～5人／年

③ 機材供与　　：5年間計¥170,000,000-

(9) タイ側措置

① 土地・建物・施設及び機材

② 新規申請の予算措置　：5年間計¥32,900,000-

③ カウンターパート　　：チェンマイ大学　農学部・理学部

：准教授・助教授・講師等27名

④ 管理部門スタッフ　　：3名

⑤ ③④人件費の予算措置：5年間計¥20,195,000-

⑥ その他プロジェクト実施に必要な機械・機材・スペアパーツの供給等

2－3　調査・協議結果

(1) プロジェクトマスタープラン案

プロジェクト名の変更：チェンマイ大学植物バイオテクノロジー研究計画

（英名：Chiang Mai University Plant Biotechnology Research Project）

Ⅰ. 開発目標

チェンマイ大学における植物バイオテクノロジー研究を通じて、タイ北部の農産物を改良し、それらの普及を目指す。

Ⅱ. プロジェクト目標

植物バイオテクノロジー分野におけるチェンマイ大学研究員の資質向上に資する。

Ⅱ. プロジェクト活動

1. 経済作物無菌苗の実用的生産技術と圃場馴化技術の確立。

1) 商品作物無菌苗の実用的生産技術確立のための植物バイオテクノロジー研究

① 植物組織培養技術研究

② 植物細胞工学研究

2) 経済作物無菌苗の実用的圃場馴化技術確立のための培養培地と環境要因研究

① 培養培地研究

② 環境要因研究

③ 圃場における経済作物無菌苗の馴化研究

2. 植物バイオテクノロジー研究分野におけるチェンマイ大学研究員への技術移転

1) 活動 1.に関する指導書の作成

2) 指導書を用いたセミナー・ワークショップ開催による、チェンマイ大学研究員への技術移転

3. 「タイ農産工業バイオテクノロジー研究計画」要請の背景

3－1　国家開発計画における位置付け

新興工業国への発展を目指すタイ国にとって最大の問題は「農工間の所得格差と都市部と農村部並びに地域格差の拡大」であることは種々の経済統計報告によって明らかである。

このため政府は既に「第6次経済社会開発プログラム」において、とくに農産物の品質向上、輸出農産物の開発が重要であり、そのためのバイオテクノロジー技術の強化を最重要視してきた。さらに本年から始まった「第7次経済社会開発計画」にも、この考えが引き継がれている。

このようにバイオテクノロジー技術の発展に結びつく本プロジェクトの研究は国家的要請に応えるものであり、タイ北部の中核都市として同国で第1位優先順位にあるチェンマイ市の大学を拠点とした同プロジェクトの要請が強い。

3－2　チェンマイにおける農業・農産工業

チェンマイ地方はタイ北部の中山間地帯を含み、いわゆる熱帯高地のため南部地方とは異なった立地条件に置かれており、熱帯作物のほか温帯作物も栽培可能である。そのため水稲を中心とした普通作もできるが、種々の果樹、野菜、花の栽培が重要であり、近郊にはバイテク技術を取り入れた蘭などの花卉産業もかなり見られる。さらに、これら農産物の加工関連の企業も多く、蚕糸織物、木材家具、製紙などとともに当地方の重要な産業となっている。

チェンマイ地域の農産工業における民間セクターは、中規模から家内工業に分類され、果樹及び野菜を、缶詰、発酵食品、乾燥及び冷凍食品に加工している。しかし、彼らには研究に力を注ぐ余力はなく、政府研究機関の研究に期待するところが大きい。

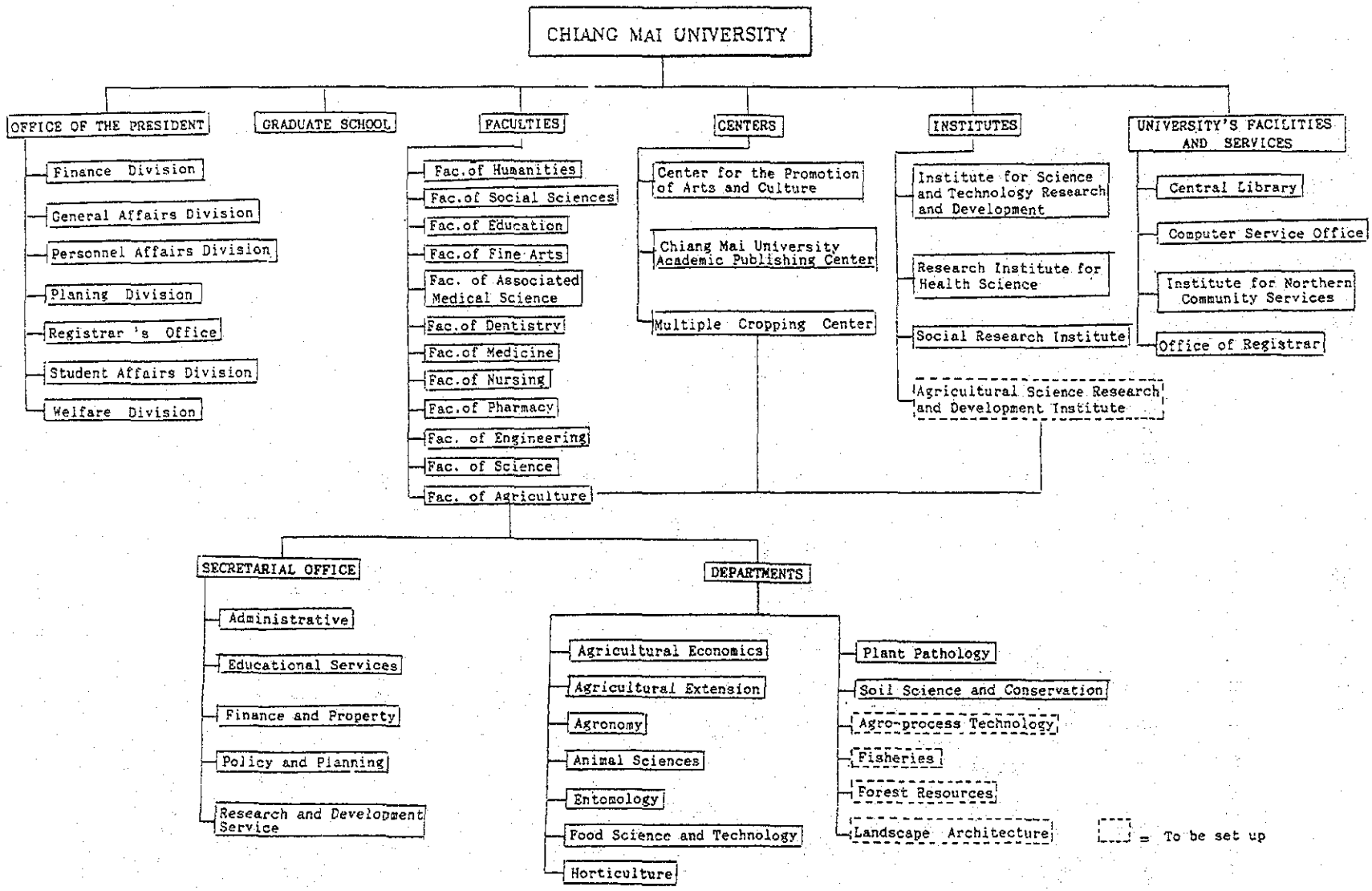
3－3　チェンマイ大学における組織と機構

チェンマイ大学は大学省に直属する国立大学で、チェンマイ市の郊外にあり、1964年に創立された総合大学で、その目的はタイ北部における教育の普及である。

本大学には現在12学部と大学院及び農業科学研究開発研究所を含む3研究所のほか、多毛作研究センターを含む三つのセンターが含まれる。学生数は12,000人で、その教育に関係する教職員は11,000名に達している（図1）。

また農学部は学生数約900名、大学院生113名であり、教官は131名、総合管理職員64名、研究助手40名、常勤職員218名、非常勤職員66名から成っている（表1）。設立は1967年で、その使命は農業専門家の教育、農業及び自然資源に関する基礎的並びに応用的研究と農業技術の普及である。学期は各18週間の2学期と8週間の夏期講座で編成されている。研究講

図1　チェンマイ大学組織図



座は学士コースに農業経済学、食品科学技術学、農業普及学、農学、畜産学、昆虫学、園芸学、植物病理学及び土壌学の９学科と修士コースに食品科学技術学、農業普及学、園芸学、土壌学及び農業システム学が開講されている。第７次教育開発計画（１９９２～１９９６）で学士コースは４学科、修士コースはバイオテクノロジーを含め、６コースが開講予定である（附属資料5.）。

研究体制としては、各学科毎にその専門分野の教育と並行して研究を行っているが、日本の大学にみられるような講座制はなく、教育に携わる教授陣としてその調整役の学科主任がいる。研究費として大学から配分される予算もあるが、多くは国内、国外及び国際機関からの補助金に依存している。

表１　チェンマイ大学農学部の職員数

1）教官数（人）

学　科	Ph.D.	M.S.	B.S.	計
農業経済学	5	5	1	11
農業普及学	4	6	-	10
農学	9	9	2	20
畜産学	6	10	2	18
昆虫学	6	4	-	10
食品科学技術学	6	7	-	13
園芸学	11	8	2	21
植物病理学	6	4	-	10
土壌及び土壌保全学	8	9	1	18
計	60	63	8	131

2）構成別職員数（人）

教　官	131
研究助手	40
総合管理職	64
常勤職員	218
非常勤職員	66
計	519

3－4　チェンマイ大学農学部におけるバイオテクノロジーの研究態勢

農学部の植物バイオテクノロジー分野は16年前に開始された。開始初期は切り花と蘭が研究されたが、1983年以降、外国から若手研究員が植物バイオテクノロジーの新技術を導入し始め、近年では商品作物の病害抵抗性作物作出のため植物組織培養及びプロトプラスト技術が研究員によって開発されている。

しかしながら、研究予算や研究機材が不足しているため、新しい情報や技術が活かされず、研究発展の障害となっている。

表2　チェンマイ大学農学部における予算額

1988	1,200,000.00 Baht
1989	900,000.00 Baht
1990	920,000.00 Baht
1991	650,000.00 Baht
1992	835,295.00 Baht

備考：1）研究費、機材費を含む。1 Baht ≒ 5円
　　2）研究費は年間200,000～500,000 Baht

3－5　チェンマイ大学農学部における技術移転態勢

チェンマイ地域のバイオテクノロジー技術者に対し、農学部の研究員は過去2回（年1回）セミナーを開催している。同セミナーは、細胞培養及びプロトプラストのそれぞれ基礎及び上級コースが設置され、15名を対象に1週間実施された。研修者の割合は農業省、大学が9割、民間が1割である（表3）。

一方、農業技術の普及も実施されている。農業普及学科はもとより、農学科や多毛作研究センターはデモンストレーションプロット持っている。日本の大学と異なるのは、どの学科の研究者も研究者自身が普及のための研修コースを開催でき、直接農民に普及するシステムが存在することである。

表3　セミナー参加者及び講師リスト

1. セミナー参加者

1) 公的機関

Chiang Mai University
Faculty of Agriculture
Faculty of Science
Faculty of Pharmacy

Mae Joe Institute of Agricultural Technology

Chiang Mai Vocational School (Teacher College)

King Mongkut Institute of Agriculture (Lampang)

King Mongkut Institute of Agriculture (Pitsanuloke)

Srinakarintaravirote University (Pitsanuloke)

Ministry of Agriculture
Department of Agriculture

2) 私的機関

Bangkok Seed Co. Ltd.

Food Processing Co. Ltd.

Private Laboratories

2. 講　師

Assoc. Prof. Dr. Prasartporn Smitamana

Asst. Prof. Dr. Pajchima Smitamana

Asst. Dr. Pimchai Apavatcharut

Mrs. Kaewalin Kunasakdakul

Ms. Angsana Akrarapisan

4. プロジェクトの実施態勢

4－1 「タイ農産工業バイオテクノロジー研究計画」に対する大学省及び科学技術環境省の役割

本調査員派遣に係る各省会議（平成4年7月16日）並びに事前打合せ（平成4年9月11日）において、本研究計画の2省庁にまたがる点について検討すべき点のあることが指摘されていた。

そこで調査員は、任地到着後直ちに総理府技術経済協力局（DTEC：Department of Technical and Economic Cooperation）を訪問し、最も重要なこの点についての協議を行った。

その結果、技術経済協力局の示した基本原則、すなわち研究計画の提出された省庁が対応予算に責任を持つということから考えると、チェンマイ大学が提出した本研究計画に対する責任省庁は大学省（MOUA：Ministry of University Affairs）のみであって、チェンマイ大学はローカルコストのための対応予算要求を大学省経由で総理府予算局に対して行うことが正式の手順であるということになった。

したがって、科学技術環境省（MOSTE：Ministry of Science, Technology and Environment）内の国立遺伝子工学バイオテクノロジーセンター（NCGEB：National Center for Genectic Engineering and Biotechnology）並びにタイ学術研究会議（NRCT：National Research Council of Thailand）は、研究費補助金を個々に補完的に助成する役割でしかない。

以上のように本研究計画の責任省庁が大学省一本に明確化された点について、関係各部局に対して確認を求めたところ、何ら異議なく了承された。

また9月30日までチェンマイ大学学長であったDr.Kasem Watanachai教授が10月1日から大学省次官補に任命されたため、本研究計画に対応するタイ側の予算要求に対して極めて有利な状況になるものと推察される。

4－2 予算措置

本研究計画に必要なローカルコストをはじめとするタイ側の予算措置は、チェンマイ大学→大学省→総理府予算局の流れで要求され措置されることを、チェンマイ大学並びに大学省の両者によって同意がなされた。

4－3 研究の状況

本プロジェクトの活動を想定して、とくに農学部における研究施設と本研究に係る研究者の

資質について調査した。

施設設備については、まず本プロジェクトの交渉窓口であるDr. Prasartpornから学部の研究室、実験室、付属施設についての説明を受け、質疑を行い、その後、本プロジェクト研究に関連する植物病理学、園芸学など関係研究室、実験室、圃場、付属施設などを訪ね、実験器具・機械の配置状況のほか、実際に研究・実験中のスタッフからも聴き取りを行った。その結果一応本プロジェクトの研究項目の遂行に必要なクリーンルーム、培養室、培養器具・機械は揃っており、クリーンベンチ、オートクレーブ、遠心分離機、光学顕微鏡、電算機なども備えられ、培養実験室内の整理もできており、また各研究室スタッフの実験操作も円滑に進められていた。培養実験の精度を示すコンタミ率も5%以下であるとのことであった。

しかし、より高度な研究に必要なマイクロマニュピレーターなどは予算要求が出されている段階であり、電子顕微鏡は新規に導入されたが、全学的な使用になっている。また隔離施設は現在P Ⅱまであるが、将来は現施設を拡充してP Ⅲまでにしたいとのことであった。なお実験室の主要機械の一部は昨年まで4年間実施されたＵＳＡＩＤからの資金援助で得られたものである（図2）。

農学部内の電力は220 V、50サイクルであり、水道及びガスは大学独自で供給している。また必要な研究室、実験室、付属施設では空調がなされている。

1993会計年度（1992年10月から1993年9月）から3年以内に農学部内に研究棟が建設される予定であり、バイオテクノロジーの研究施設も含まれている（図3～5）。

次に研究者の資質であるが、本プロジェクトに参加予定の研究者15名はDr. Prasartporn以下、主に植物病理学、園芸学と農学の各学科に属している。これら研究者の資質を判断するため、経歴、最近の業績の提出を求めるとともに、各研究者の研究活動について聴いた。研究活動については期限内にすべての研究者からの提出資料が得られなかったが、植物病理学、園芸学の主要メンバーからの資料について判断した。いずれもヨーロッパ、アメリカ留学者も多く、論文発表も国際誌、国内誌、国際シンポジウム報告、チェンマイ大学学術報告など多岐にわたっている。さらに主要メンバー以外の研究者からも研究活動の状況を聴いたところ、植物バイオテクノロジー研究についての理解と熱意がうかがわれた。

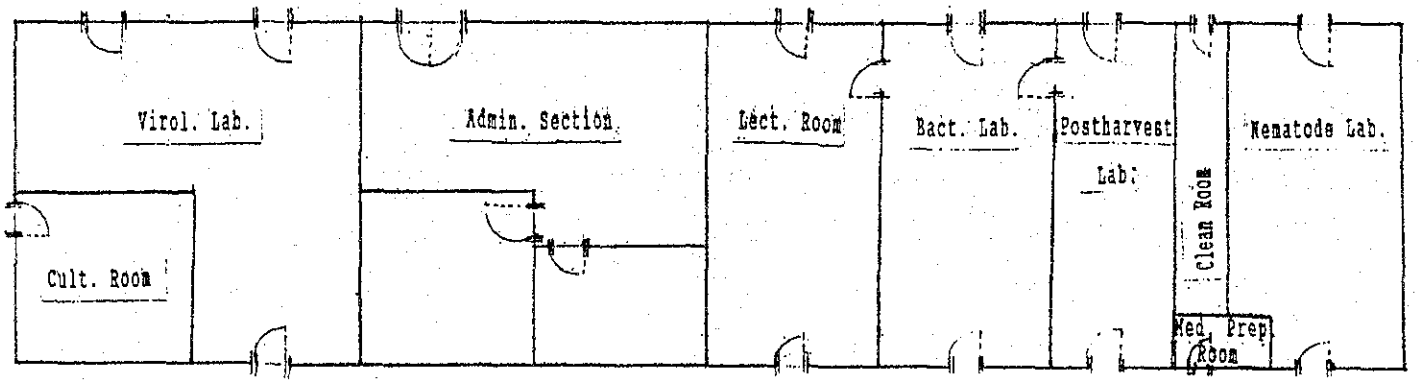
以上の調査結果から、施設面では高度な遺伝子組換実験などは現時点で困難と考えられるが、本プロジェクトの各研究項目を遂行することは基本的に問題ないと思われる。

4－4　人員配置

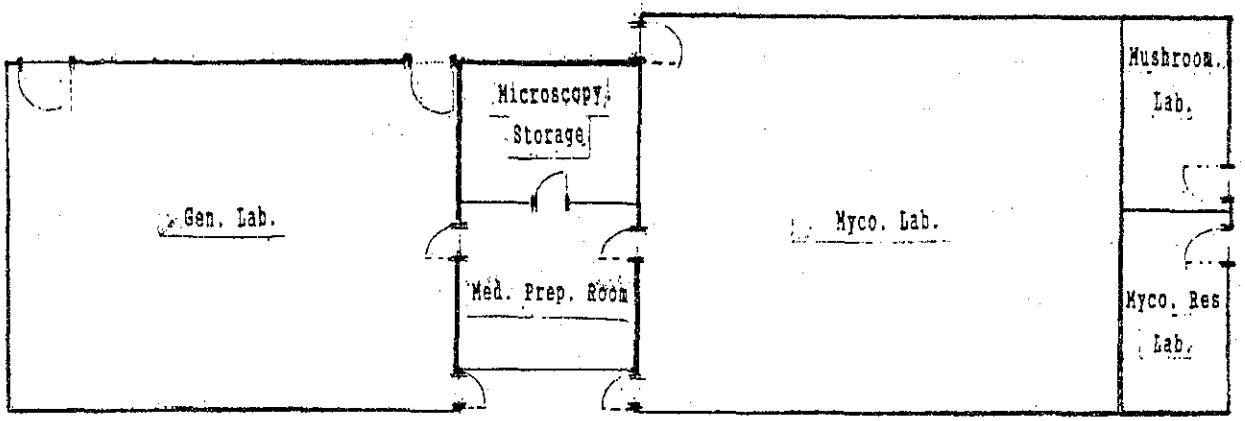
暫定的な人員配置についてタイ側から下記のような提案があり、実施協議調査に向けて、今後、検討される予定である（表４）。

Project Manager	チェンマイ大学　学長
Project Coordinater	チェンマイ大学　農学部　副学部長（研究担当）
Project Leader	Dr. Prasartporn Smitamana
組織培養関係	４名
細胞工学関係	５名
培養培地関係	３名
環境要因関係	３名
圃場馴化関係	３名

図２　植物病理学研究室の配置図（1992年10月現在）



Second Floor



First Floor

(1:200)

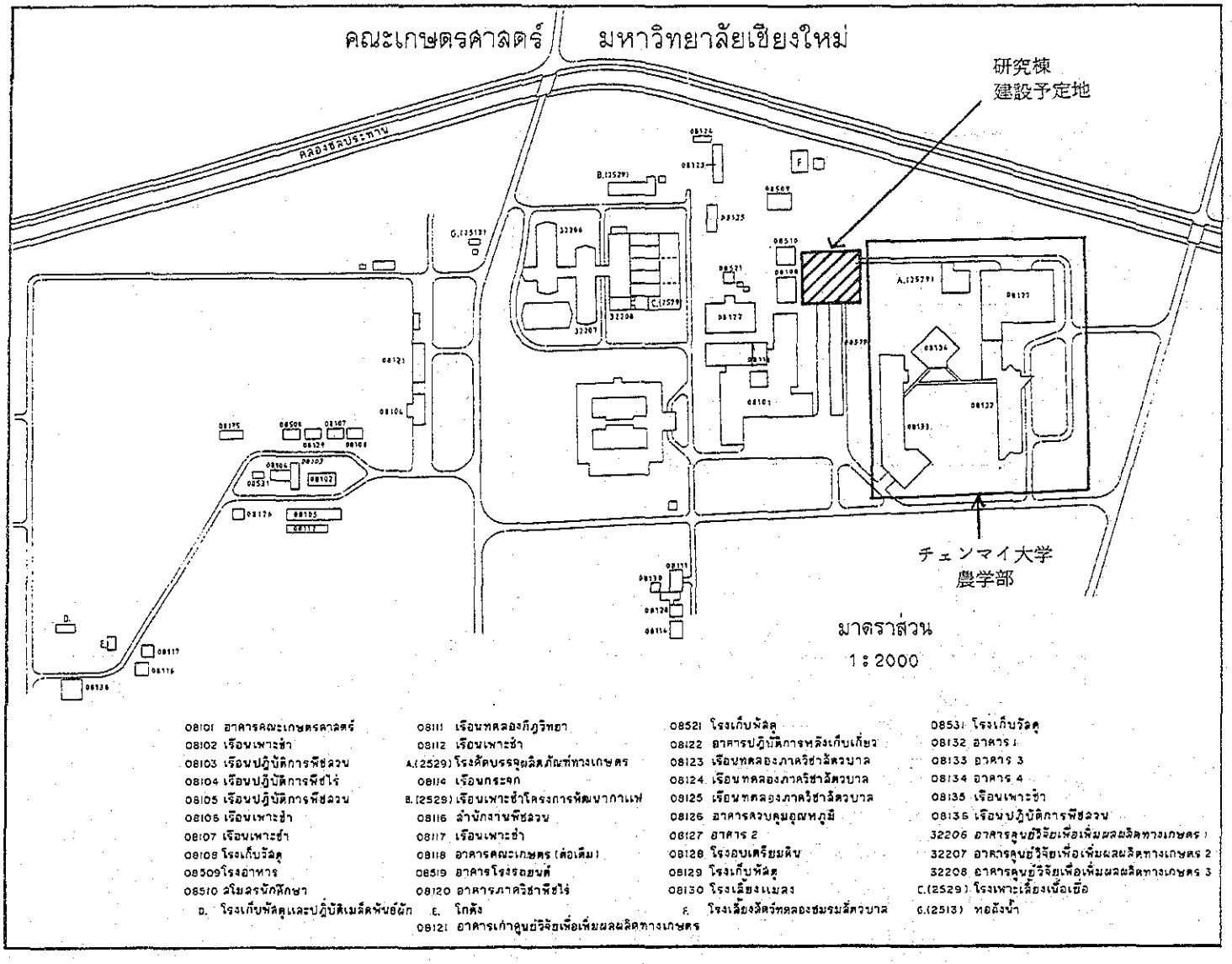


図３　新研究棟建設予定地

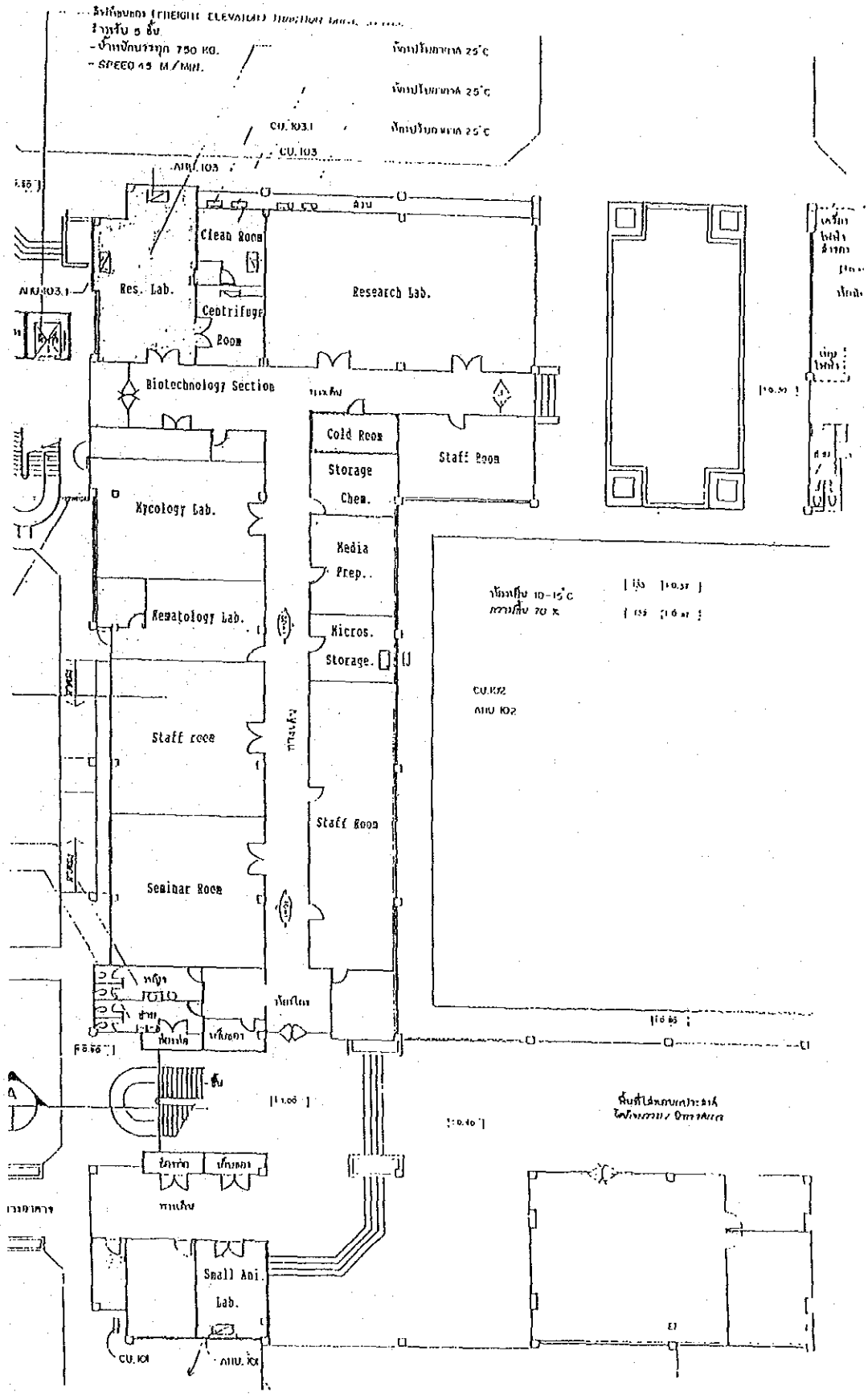


図4　新研究棟見取り図（1階）　1995年9月完成予定

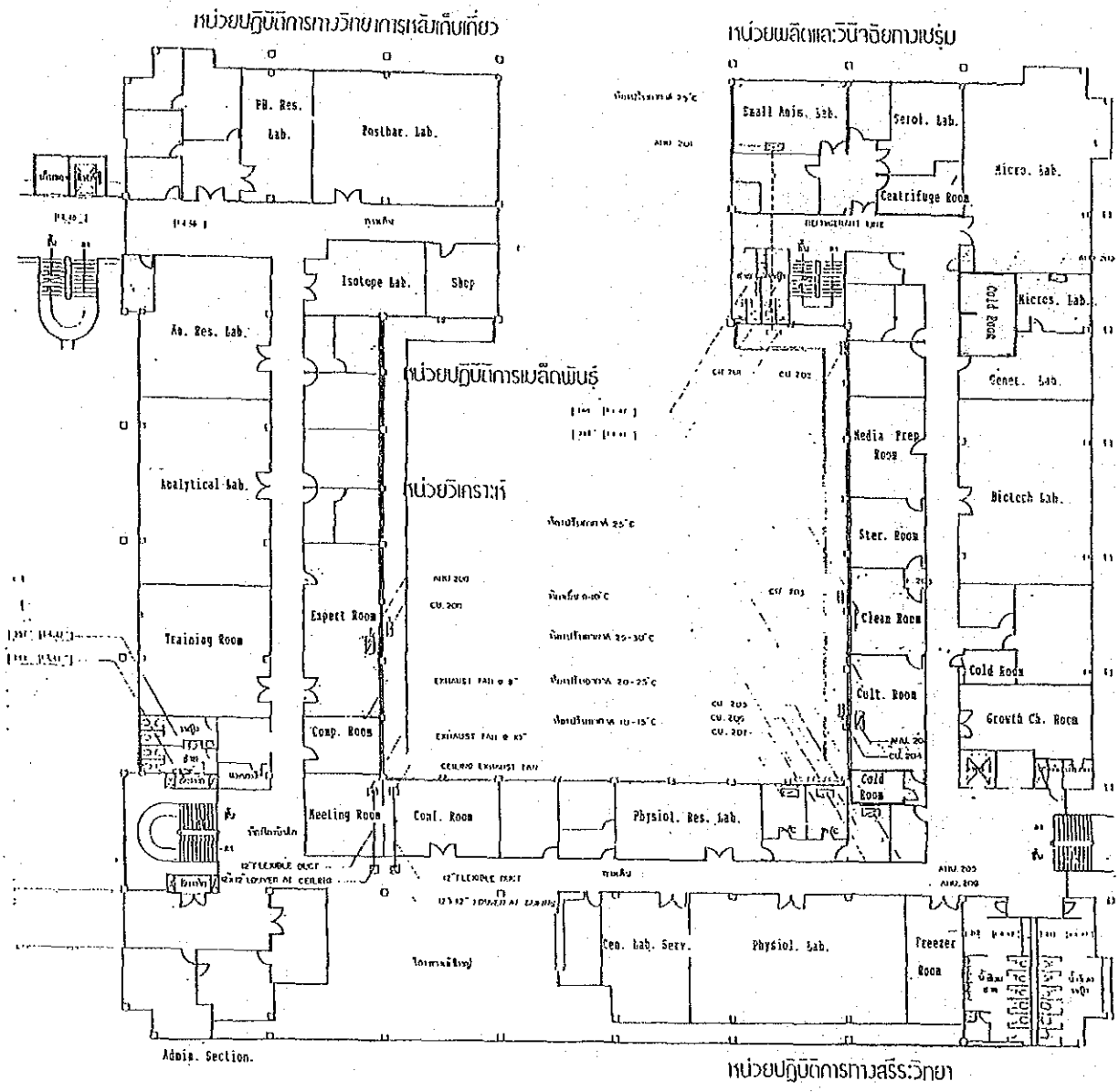


図５　新研究棟見取り図（２階）　1995年９月完成予定

表 4　分野別人員配置（予定）

Ⅰ. Plant Tissue Culture Technology	
	Ⅰ.1 Plant Tissue Culture Technology Dr. Pacjchima Smitamana Mr. Pongyuth Nuanboonruang (M.S.) Mr. Theeraphon Phornsawatchai (M.S.) 1 New staff which will join the faculty in 1993 (M.S.)
	Ⅰ.2 Protoplast Technology Dr. Prasartporn Smitamana Mr. Chaiwat To-anan (M.S.) Mrs. Kaewalin Kunasakdakul (M.S.) Ms. Angsana Akrarapisan (M.S.) (Studying for Ph.D in Japan, expect to be back in 1993) Mr. Theeraphon Phornsawatchai (M.S.)
Ⅱ. Culture Medium and Environment	
	Ⅱ.1 Culture Medium Dr. Prasartporn Smitamana Ms. Orapin Chiangpew (B.S.) 1 New staff which will join the faculty in 1994 (M.S.)
	Ⅱ.2 Environmental Effects Dr. Adisorn Krasaechai Ms. Kesinee Ramingwong (M.S.) Ms. Apatcha Wongsermsatit (M.S.)
	Ⅱ.3 Acclimatization Dr. Danai Boonyakist Dr. Pitta Suarmsiri Dr. Sombat Srichuwong

5. 協力内容の検討

5－1　協力課題

プロジェクト方式技術協力の主眼である「人造り」に重点を置いて検討した結果、遺伝子工学研究、天然薬用植物研究はカットすることになり、以下のように整理された。

1. 商品作物無菌苗の実用的生産技術と圃場馴化技術の確立
   1) 商品作物無菌苗の実用的生産技術確立のための植物バイオテクノロジー研究
      ① 植物組織培養技術研究
      ② 植物細胞工学研究
   2) 商品作物無菌苗の実用的圃場馴化技術確立のための培養培地と環境要因研究
      ① 培養培地研究
      ② 環境要因研究
      ③ 圃場における商品作物無菌苗の馴化研究
2. 植物バイオテクノロジー研究分野におけるチェンマイ大学研究者への技術移転
   1) 活動1.に関する指導書の作成
   2) 指導書を用いたセミナー・ワークショップ開催によるチェンマイ大学研究者への技術移転

5－2　課題別協力期間

各課題に対する協力期間の設定については、課題1.については当初より5年間、課題2.については2年目より4年間としたいという点で合意された。

5－3　専門家派遣計画

長期専門家は、リーダー、調整員を含めて3～4名を5年間、短期専門家については毎年数名で5年間派遣されることが合意され、具体的な派遣計画については、実施協議調査団派遣時期までに検討することとした。

5－4　研修員受入れ計画

研修員の受入れについては、毎年2～3名の線で、今後具体的に検討していくこととした。

5－5　機材供与計画（表5）

タイ側から課題別に必要な機材を、必要な年度毎に要求する案が提出され、今後、検討することになった。

5－6　合同委員会

合同委員会の設置について同意が得られたが、委員会の構成については関係機関と協議のうえで、今後、検討を行うこととした。

5－7　プロジェクト名の変更

本研究計画は「国立農産工業バイオテクノロジーセンター計画」から変更されたために、「農産工業バイオテクノロジー研究計画」と呼ばれてきたが、もう少し具体的にプロジェクト方式技術協力を表現する名称を付けたほうがよいのではないかという意見が、長期調査員派遣前の各省会議でも出されていた。

そこでチェンマイ大学の意見を求めた結果、プロジェクト名を、

「チェンマイ大学植物バイオテクノロジー研究計画」

“Chiang Mai University Plant Biotechnology Research Project”

にすることが合意された。

表５　機材供与計画

Item	Model	Req.	Price/Unit (1000 Y)	Total Cost	Year Required 1	2	3	4	5
Electrofusion equipment	Shimadzu SSH-10	1	5,800.00	5,800.00	5,800.00				
Electroporation equip.	Biorad	1	1,650.00	1,650.00		1,650.00			
Inv. Microscope	Olympus IMT2-21RFN	3	3,590.40	10,771.20	3,590.40		3,590.40		3,590.40
Micro manipulator system	Shimadzu MMS-20	1	4,500.00	4,500.00	4,500.00				
CO2 Incubator 148 L	It 63	2	1,140.00	2,280.00		1,140.00		1,140.00	
CO2 Incubator 77 L	IT 43	1	1,020.00	1,020.00		1,020.00			
Vibration Culture Shaker	Ik41W	3	1,140.00	3,420.00			1,140.00	1,140.00	1,140.00
Fermentor for plnat 5 L	Yamato CU21SD	3	4,200.00	12,600.00	4,200.00		4,200.00		4,200.00
Fermentor for plant 10 L	Yamato CU21SD	2	4,356.00	8,712.00			4,356.00		4,356.00
Freezer (V)	Yamato CU21SD	2	2,350.80	4,701.60	2,350.80		2,350.80		
Ultra deep Freezer (H)	Yamato CF 41SD	2	2,220.00	4,440.00		2,220.00			2,220.00
Water Purifier unit	Barnsted	2	778.80	1,557.60			778.80		778.80
Ul. Pipette Washer	Yamamoto AW 21	2	405.60	811.20	405.60		405.60		
Ultrasonic cleaner 20 L	Branson 8200 J4	1	564.00	564.00		564.00			
Ult.Clean. Freq.Sweep 46L		1	1,420.00	1,420.00					1,420.00
Ultrasonic cleaner 83 L	SH126-45-18	1	1,054.80	1,054.80			1,054.80		
Immersion Cooler	BD 36	2	276.00	552.00		276.00		276.00	
Ul. Cell Breaker	Powersonic 50	1	818.40	818.40		818.40			
Homogenizer	Yamato LH 21	2	391.20	782.40	391.20			391.20	
Aspirator	Yamato WP 51	2	444.00	888.00				444.00	444.00
Fraction Collector	Advantec SF-2120	1	414.00	414.00	414.00				
Turbing Pump System	Eyla	3	597.60	1,792.80	597.60	597.60		597.60	
Balance Top Load	Sartorius L610D	2	240.00	480.00				240.00	240.00
Analytical Balance	Sartorius R160P	1	594.00	594.00			594.00		
Hygrothermometer	YH-33R	2	864.00	1,728.00			864.00		864.00
Generator Humidifier	AHC-1	3	1,140.00	3,420.00			1,140.00	1,140.00	1,140.00
Microcentrifuge	Himac CF 15 D	1	1,342.00	1,342.00		1,342.00			
Low temp. Incubator	Yamato IN 81	3	600.00	1,800.00	600.00		600.00		600.00
Autoclave	SP52-2	2	649.20	1,298.40			649.20		649.20
Water bath	Yamato BL 22	2	468.00	936.00	468.00				468.00
Cooling Circulator	CTR82 AS, CTE 82 AS	4	984.00	3,936.00	984.00	984.00		984.00	984.00
Cent. Freez Dryer	RC 11	1	493.20	493.20			493.20		
Drying Sterilizer	SG 62	2	436.80	873.60			436.80		436.80

Rotary Evaporator	RE 52 A,B,C		3	536.40	1,609.20	536.40	536.40			536.40
Rotating Cultivator	Eyla		3	540.00	1,620.00	540.00			540.00	540.00
Biophotochamber	Eyla		5	2,541.00	12,705.00	2,541.00	2,541.00	2,541.00	2,541.00	2,541.00
Fume Hood	Yamato		2	2,308.80	4,617.60			2,308.80		2,308.80
Laminar Air Flow	Yamato		4	762.00	3,048.00	762.00		762.00	762.00	762.00
Mantel	Yamato EMA 200		3	191.04	573.12	191.04			191.04	191.04
Lab. Washer	Yamato AW 82		1	2,513.00	2,513.00				2,513.00	
Air Compressor	Sc-72		1	321.60	321.60	321.60				
Oven, Dryer	DG 81		2	348.00	696.00		348.00		348.00	
Desk top Centrifuge	Beckman or Himac		1	1,908.00	1,908.00		1,908.00			
pH Meter	Horiba F 16		3	480.00	1,440.00		480.00		480.00	480.00
Osmometer	Adv. Inst. 3W2		1	6,720.00	6,720.00			6,720.00		
Ice Maker			2	744.00	1,488.00	744.00			744.00	
Magnetic Stirer	Yamato		3	114.00	342.00		114.00	114.00	114.00	
Magnetic Stirer with heater	Yamato HS 4000		2	262.44	524.88				262.44	262.44
HPLC	Water		1	14,400.00	14,400.00				14,400.00	
Generator			1	6,000.00	6,000.00	6,000.00				
Vacuum pump	Yamato PD 52		2	780.00	1,560.00				780.00	780.00
Colony Counter	Olympus OL501A		1	6,240.00	6,240.00			6,240.00		
Table Top Ul. Cent.	Beckman Optima TL		1	9,433.85	9,433.85		9,433.85			
Waring Blender			2	264.00	528.00		264.00			264.00
Spectrophotometer UV-Vis	Shimadzu UV 3101PC		1	7,179.49	7,179.49				7,179.49	
CO2/H2O Analyzer set	Licor Li 6262		1	4,000.00	4,000.00		4,000.00			
TempCycler	Coycorp. 110P		1	1,270.77	1,270.77					1,270.77
Tamer Template PCR Clean	Coy Corp.		1	387.69	387.69					387.69
Hybridization Water Bath	Stovall BDHWB220		1	480.00	480.00					480.00
Biolistic System	Biorad PDS-1000/He		1	4,897.44	4,897.44		4,897.44			
Gas chromatograph	Hitachi or Shimadzu		1	6,000.00	6,000.00		6,000.00			
Prep Cell Set	Biorad 491		1	1,937.33	1,937.33				1,937.33	
Chromatopac	Shimadzu C-R7A		1	1,128.21	1,128.21		1,128.21			
4 WD Pajero			1	4,000.00	4,000.00	4,000.00				
Minibus			1	2,980.00	2,980.00	2,980.00				

Total Cost 200,000.37

12,917.64 42,262.89 41,339.40 39,145.10 34,335.34

200,000.37

6. プロジェクト実施可能性の検討

本長期調査の最も重要な項目であるプロジェクト実施可能性に関する1)～5)の各調査項目について厳密に総合的に検討した結果、次の4点が明らかにされた。

(1) チェンマイ大学における植物バイオテクノロジー研究についての人的、及び組織面での潜在能力は十分であり、プロジェクトの実施は可能であると思われること。

(2) チェンマイ大学が、ローカルコストのための対応予算を要求する正式な手順(チェンマイ大学→大学省→総理府予算局)が確認され、大学省が責任省庁になったこと。

(3) チェンマイ大学内における建物・施設の準備並びに新設計画が満足すべき状況にあること。

(4) 協力課題が5年間で成果のあがるように整理され、チェンマイ大学における過去の訓練コースの経験を考慮すると、プロジェクト方式技術協力の主眼である「人造り」に役立つ技術移転が容易であること。

以上のことから、本プロ技協「チェンマイ大学植物バイオテクノロジー研究計画」の実施可能性は極めて高いものと考えられる。

7. 実施協議調査団派遣の検討

タイ側の実施体制、協力課題の設定等からプロジェクト方式技術協力が可能であると判断されるため、実施協議調査団の派遣は可能と思われる。今後はロジカルフレームワーク、R／D案、TSI案を作成し、同調査団派遣のための各省会議の開催、実施協議調査団の派遣(平成5年2月ごろ)の順で進んでいくことが望まれる。

同調査団派遣の際、総理府技術経済協力局(DTEC)においてチェンマイ大学からの要請書を基に協議する必要があり、要請内容とR／D案に変更がある場合、説明を要する。

また、チェンマイ大学は、無償資金協力による麻薬代替作物開発のための高地農業開発訓練センターのプロジェクトサイトでもあるため、チェンマイ大学植物バイオテクノロジー研究計画とは全く関係ない旨、誤解のないよう了解を得る必要がある。

8. 今 後 の 予 定

長期調査員の報告が関係機関で了承された後、平成4年度内（平成5年2月ごろ）に実施協議調査団を派遣する。その際、タイ国会計年度（10月1日～9月30日）を考慮して、10月ごろ、プロジェクトを開始するよう検討する。

附　　属　　資　　料

1. 調査員レター
2. タイ側新規要請書（チェンマイ大学要請）
3. 調査前質問状（対チェンマイ大学）
4. 質問状回答
5. チェンマイ大学農学部概要

附属資料1. 調査員レター

October 5, 1992

Prof. Dr. Choti Theetranont
President,
Chiang Mai University
Chiang Mai, The Kingdom of Thailand

SUBJECT: Report of JICA Study Team
for the Project-type Technical Cooperation
on Plant Biotechnology in Chiang Mai University (CMU)

Dear Sir,

The JICA Study Team (hereinafter referred to as "the Team") led by Dr. Masanao UMEBAYASHI, Professor of Mie University, has studied on the items necessary for the implementation of the Project-type Technical Cooperation on Plant Biotechnology (hereinafter referred to as "the Project") in Chiang Mai University, from Sep. 22 to Oct. 5, 1992.

During its stay in Thailand, the Team had a series of discussions with the Thai officials concerned as listed in the ANNEX-I. The major subjects of discussions included the confirmation of proposal and the feasibility study on the implementation of the Project.

We are grateful for the kind cooperation of CMU staffs in providing necessary documents for discussions.

Our responsibility is to submit the report of the result of our study to Japanese authorities concerned. The result of the study which we have discussions is in the ANNEX-II.

We hope that our report will be fruitful for the Master Plan.

Sincerely yours,

Masanao Umebayashi

Prof. Dr. Masanao UMEBAYASHI
Team Leader,
JICA Study Team

cc.: Mr. Krisda Piampongsant, Director, External Cooperation Division I,
Department of Technical and Economic Cooperation (DTEC)

Prof. Dr. Wichit Srisa-an, Permanent Secretary,
Ministry of University Affairs (MOUA)

Prof. Dr. Yongyuth Yutharong, Director,
National Science and Technology Development Agency (NSTDA)

Dr. Sakarindr Bhumiratana, Director,
National Center of Genetic Engineering and Biotechnology (NCGEB)

Dr. Aphirat Arunin, Secretary General,
National Research Council of Thailand (NRCT)

Associate Prof. Dr. Pongsak Angkasith, Dean, Faculty of Agriculture,
Chiang Mai University (CMU)

Associate Prof. Dr. Prasartporn Smitamana, Head, Department of Plant
Pathology, Faculty of Agriculture, CMU

Mr. Hiromori Kuroki, First Secretary,
Embassy of Japan

Mr. Nobuji Abe, Resident Representative,
JICA Thailand Office

ANNEX- I

List of Thai officials concerned.

1.Department of Technical and Economic Cooperation(DTEC)
Mr.Krisda Piampongsant, Director,External Cooperation Division I,
Ms.Tipsuda Nopmongcol, Chief,Japan Sub-Division,
Mr.Tomikazu Inagaki, JICA Expert,Technical Cooperation Coordination,

2.Ministry of University Affairs(MOUA)
Prof.Dr.Wichit Srisa-an, Permanent Secretary,
Prof.Dr.Kasem Watanachai, Deputy Permanent Secretary(from Oct.1)
Ms.Chantavit Sujatanond, Director,Foreign Relations Division,
Ms.Vandee Ketanitinan, Chief,Asian Cooperation Section,Foreign Relation Division

3.Ministry of Science,Technology and Environment(MOSTE)
Dr.Sakarindr Bhumiratana, Director,National Center for Genetic Engineering and Biotechnology(NCGEB)
Dr.Sutat Sriwatanapongse, Deputy Director,NCGEB
Dr.Aphirat Arunin, Secretary General,National Research Council of Thailand (NRCT)
Ms.Prapasri Thanasukarn, Director,Research Project and Coordination Division, NRCT

4.Chiang Mai University(CMU)
Prof.Dr.Kasem Watanachai, President(until Sep.30)
Prof.Dr.Choti Theetranont, President(from Oct.1)
Associate Prof.Nakorn Nalampang, Dean,Faculty of Agriculture (until Sep.30)
Associate Prof.Dr.Pongsak Angkasith, Dean,Faculty of Agriculture (from Oct.1)
Associate Prof.Dr.Prasartporn Smitamana, Head,Department of Plant Pathology,Faculty of Agriculture
Associate Prof.Dr.Adsorn Krasasechai, Head,Department of Horticulture, Faculty of Agriculture
Associate Prof.Dr.Pimchai Apavatjrut, Department of Horticulture,Faculty of Agriculture, (Vice director,Institute for Science and Technology Research and Development)
Associate Prof.Dr.Kesinee Ramingnong, Department of Horticulture,Faculty of Agriculture
Assistant Prof.Dr.Danai Boonyakiat, Department of Horticulture,Faculty of Agriculture
Assistant Prof.Dr.Pajchima Smitamana, Department of Plant Pathology, Faculty of Agriculture
Assistant Prof.Dr.Sombat Srichuwng, Department of Plant Pathology,Faculty of Agriculture

ANNEX-II

Result of Study

1) Study on expected roles of MOUA and MOSTE for CMU's Project.

(MOUA:Ministry of University Affairs, MOSTE:Ministry of Science, Technology and Environment, CMU:Chiang Mai University)

On the first day, we had a visit to Department of Technical and Economic Cooperation (DTEC) and discussed the most important part of our study.

DTEC presented the principle of project proposal and counter budget issue, and concluded that MOUA should be the responsible ministry for the CMU's Project and CMU will request the counter budget of local cost for the Project via MOUA to Budget Bureau, Office of Prime Minister.

So National Center for Genetic Engineering and Biotechnology (NCGEB) and National Research Council of Thailand (NRCT) in MOSTE could give only supplementary support for research fund.

The above-mentioned conclusion were consented by MOUA, NCGEB, NRCT and CMU without any objections during our following visits for September 24-30.

2) Survey on background to the proposal of the Agroindustrial Biotechnology Research Project (hereinafter referred to as "the Project").

NCGEB had proposed "the National Agroindustrial Biotechnology Center Project" including grant aid, 2.6 billion, in 1987. In the annual meeting, however, between Thai government and Japanese government on June 19,1990, Japanese government had judged that it had been very difficult to support to the Thai government including grant aid because of remarkable economic development in Thailand at that time.

According to the above judgement, JICA had dispatched "the Preliminary Survey Team" in March 1991, headed by Dr.UMEBAYASHI, in order to search for the feasibility of implementation on the project-type technical cooperation without grant aid.

In spite of dispatch of the Survey Team, compromise plan between Thai side and Japanese side could not been found out owing to persisting in their first proposal including grant aid.

In November 1991, CMU had proposed project-type technical cooperation,"the Agroindustrial Biotechnology Research Project" as the revised proposal without grant aid, to Japanese government.

Our Study Team was displaced for this time by the Japanese government in order to search for the feasibility study on the implementation of the Project for the revised proposal.

3) Survey on present situation for implementation of the Project.

Agroindustrial private sector in Chiang Mai can be classified as from medium size factory to cottage industries, such as canned, fermented, dry and frozen vegetables and fruits. Although they do not put great emphasis on research, they want to get the result from the government sectors.

The Faculty of Agriculture, CMU, established in 1967, has three major functions, namely instruction, research and extension in order to contribute to the development of agriculture in the northern part of Thailand. In 1991, Faculty of Agriculture had 9 departments consisting of 131 talented teaching staffs, that is; doctor's degree 60, master's degree 63 and bachelor's degree 8. With the emphasis on research activities, Faculty of Agriculture has the plan to set up more 4 departments within next year.

On the field of plant biotechnology at Faculty of Agriculture, research activities have been initiated about 16 years ago. At the beginning period, cut flowers and orchids were studied. After 1983, the new trends of plant biotechnology research have been introduced to Faculty of Agriculture by the young staffs from abroad. In recent years, plant tissue culture and protoplast technology has been developed by the senior and young staffs in order to produce disease tolerant plant on economic crops. With the above endeavor, some novel plant were produced .

However, by the lack of research budget and instruments (electrofusion, plant fermenter, high performance liquid chromatography and so on), new information and new technology on plant biotechnology can not be expected for more development of research, only with supplementary budget support by USAID in last 4 years.

They have elementary and advanced training courses on plant biotechnology once a year in last 2 years for the technology transfer to the middle technologist around Chiang Mai.

All laboratories and facilities are used and cleaned up always by the staffs. The procedure of biotechnology research maintains accurately under 5% loss of treatments.

Within 3 years, the new building on research in Faculty of Agriculture will be constructed including new biotechnology research units. Advanced research on biotechnology can be expected by the above units.

4) Title of the Project.

As the Project was modified after the National Agroindustrial Biotechnology Center (NABC) project, it has been called as "Agroindustrial Biotechnology Research Project" so far.

But it is better to give a more definite name for the project-type

technical cooperation. After discussions with CMU, the Team would like to propose "Chiang Mai University Plant Biotechnology Research Project "as the new title of the Project.

5) Investigation of the Master Plan of the Project.

After discussions and consultations at CMU and MOUA, the Team worked out the master plan of the Project as follows:

" Chiang Mai University Plant Biotechnology Research Project"

1.Goal of the Project

The goal of the Project is to improve agricultural products and to extend them in the northern part of Thailand by means of plant biotechnology research in Chiang Mai University.

2.The Project's Purpose

The project's purpose is to enhance the capability of academic staffs at CMU in the field of plant biotechnology.

3.Activities of the Project

3-1 To establish the technology for practical production and acclimatization of disease-free seedling of economic crops.

(1) Plant biotechnology study to establish the technology for practical production of disease-free seedling of economic crops.

(1) Plant tissue culture technology research
(2) Plant protoplast technology research

(2) Culture medium and environmental effects study to establish the technology for the acclimatization of disease-free seedling of economic crops.

(1) Culture medium research
(2) Environmental effects research
(3) Acclimatization research of disease-free seedling of economic crops in field

3-2 To transfer the technology to academic staffs at CMU in the field of plant biotechnology.

(1) To produce the training manual on activities 3-1.

(2) To transfer technology to academic staffs at CMU by seminars and workshops by using those training manuals.

6) Feasibility study on the implementation of the Project.

As surveyed in 1)-5), the potential capability of CMU in plant biotechnology research deserves to receive the Project both in facilities and in personnels.

And the expected role of MOUA as the responsible agency for the Project and the local cost by counter budget to be requested by CMU to Budget Bureau are all assured.

Cooperative supporting systems, within CMU, exemplified in the preparations of land, building and facilities, are satisfactory.

As technology transfer in the Project to young and promising CMU staffs is the key for the project-type technical cooperation, the past experiences in training course are much evaluated.

With these studies, the Team will propose at the report meeting on October 28, 1992, that the Project could be implemented.

7) Suggestions and Comments

Counterpart researchers in each field would be selected both from senior and preferably junior staff. List of trainees in Japan could be prepared.

List of equipment could be prepared by CMU and should be strictly examined according to the refined Project activities.

The joint committee composition can be arranged after decision of dispatching R/D mission.

At last but not least, we would like to express our greatest thanks for the kind cooperations and arrangements by all the Thai and Japanese officials concerned.

August 27 ,1992

JICA

Long term survey team

QUESTIONNAIRE 1

The following are our questions concerning "Agro-industrial Biotechnology Research Project", which was requested by the Government of Kingdom of Thailand in November 26, 1991. This Questionnaire has been prepared to facilitate the formation of our new Cooperation Project. We would appreciate if you would answer them in writing or providing us with relevant data and materials.

1.Organization, Administration and Budget system for the implementation of the Project.

1)Organization responsible for the Project.
2)Organization responsible for Administration and Technological development matter.
3)Organization which allocates the Budget for the Project.
4)Organizational chart of the Project in Administration, management and technological development.

2.Knowledge related Chiang Mai University.

1)History of CMU.
2)Organizational chart at CMU.
3)Biotechnology research system at CMU.
-Past Research Activities.
4)System of Extension Activities for Agricultural Producers at CMU.
-Past Extension Activities.
-Status of Extension Officers.

3.Measures to be taken by Thai side such as Provision of land, building and facilities for the Project.

1)Number and area(sq.m) of laboratories, staff rooms, lecture rooms and other related academic space.
2)Facilities for electricity, gas, water-supply, drainage system, air-conditioning and whether any time limit is imposed on their usage.
3)If there is no such Facilities, the Budget and Time to provide them.

4.Present conditions of Agricultural sector and Agro-industrial sector in Chiang Mai.

1)Quantity produced.
2)Producing Capacity and Attitude.
3)Levels and activities of private Enterprises.

附属資料2. タイ側新規要請書（チェンマイ大学要請）

大　使	主　管 経　済
通　信　官	
総　務　参　事	
	写送付：1
	写配布先：

DEPARTMENT OF TECHNICAL AND ECONOMIC COOPERATION
Krung Kasem Road, Bangkok, Thailand
Cable : DEPTECO
TEL. 2800980 - 4

No. 1709/35418

The Department of Technical and Economic Cooperation presents its compliments to the Embassy of Japan and, with reference to the Annex II of the Summary Record of Discussions on the 1991 Annual Consultation, July 31-August 1, 1991, has the honour to submit herewith a revised proposal of the project request "Agro-industrial Biotechnology Research Project" of Chiang Mai University (CMU) for the Embassy's consideration. The afore-mentioned request is the revision of the original request 'The Establishment of National Agro-industrial Biotechnology Center' of the Ministry of Science, Technology and Energy (MSTE), which was confirmed to be taken up by the Government of Japan in Japanese fiscal year 1991 for the project-type technical cooperation. The MSTE would like to support the CMU to be the implementing agency of this revised proposal.

The Department of Technical and Economic Cooperation avails itself of this opportunity to renew to the Embassy the assurances of its highest consideration.

DEPARTMENT OF TECHNICAL AND ECONOMIC COOPERATION

November [illegible] B.E. 2534 (1991)

DEPARTMENT OF TECHNICAL AND ECONOMIC COOPERATION

在タイ日本国大使館 総務 NOV. 27. 1991 RECEIVED Bangkok, Thailand

The Embassy of Japan,
Bangkok.

DEC-III/Japan Sub-Division
Tel. 282-8798
FAX : (662) 280-1248

Project Title : Agro-industrial Biotechnology Research Project

Request Agency : Chiang Mai University

Proposed Source of Assistant : Government of Japan

I Project Description

Chiang Mai University, a state university, was established in 1964. It is situated in Chiang Mai, a city of 700 year old history approximately 800 kilometer from Bangkok. Among the universities founded in various parts of Thailand, Chiang Mai University is one of the biggest.

The University total area covers about 600 acres plus 860 acres of three agricultural field stations, two in the highlands and another in the lowlands. At present, Chiang Mai University offers various program of study in 13 Faculties : Agriculture, Engineering, Science, Associated Medical Sciences, Dentistry, Medicine, Nursing, Pharmacy, Education, Fine Arts, Humanities, Social Sciences and Graduate School. Beside the teaching Faculties, there are also 3 Research Institutes namely Health Sciences, Social Sciences and Science and Technology Research and Development.

Chiang Mai University is one of the institutes responsible for national higher education program. Approximately 11,000 Students from every part of Thailand are currently enrolled for Bachelor and higher degrees. Beside teaching, the university also plays important roles in research and public services. The prominent examples of community service and rural development can be realized from several agricultural extension project for the welfare of both the highlanders and lowlanders e.g. via Highland Coffee Research and Development Center supported by Government of the Netherlands. Moreover, the closed link with the Royal Project also supports the rural development activities of the university.

For research, Chiang Mai University has encouraged its staff to participate in both basic and applied research. The university has strongly put emphasis on research of integrated type in order to solve the problems encountered in northern region and to improve the use of the regional natural resources. However, with limited resources it is clearly impossible to collect the modern high standard equipment especially in the Agro-biotechnology field where the high technology equipment is extremely needed.

Since the Thai economy has for many decades depended on agricultural produces, though it will change to the NICs in the near future even that most of the Thai industries still based on agricultural produces. Therefore agriculture remains playing the most impor-

tant role in Thailand development. This project is therefore set up in order to facilitate the research activities in the agro-biotechnology area and could be divided in to three categories as follows :

1. Biotechnology for crop improvement
2. Environmental effects on the protected culture
3. Plant Materials Used in Pre- and Postharvest Wastage Control.

All of the three activities will be closely linked with the final goal to improve the agricultural produces in both quantity and quality. Details of each section will be as described in the particular parts.

Section 1 : Biotechnology For Crops Improvement.

1.1. Background Information and Justification for the Project

Thailand, though it will change from the agricultural based country to the industrial country in the near future, but this change still depends mainly on the agricultural produces. Therefore the new trend for the agricultural production will emphasis on the export market or supporting the agro-industries. Thus, any factors affecting the agricultural production could also directly influence the industrial growth too. In this case, plant diseases is one of the major limiting factors in the production, especially viruses, viroids and mycoplasmas which could not be controlled by any chemical mean. Losses caused by the plant diseases is not only limited on the visual symptoms or decreasing of yield but could also tremendously lower the quality of the produce. In order to enhance or promote the agro-industrial growth, this main constraint needs to be solved urgently. According to these reasons, establishment of the Biotechnology for Crop Improvement section is purposed with the following objectives:

a) production of disease-free plant materials,
b) development of disease resistant plants,
c) selection or development of stress resistant plants, (e.g. salinity, acidity or heat resistant)
d) development of pure line materials
e) germplasm collection through the biotechnology means for the germplasm exchanges or breeders and
f) production of monoclonal antibodies for detection of the major plant pathogens from the seed or propagated materials.

The progress in plant biotechnology has been highly achieved and broadly applied for the crop production and improvement in many developed countries. This technique has just started and recently used in Thailand for not more than 3 decades. For the faculty of Agriculture, Chiang Mai University, we have started

with the rapid multiplication of the economic crops, mainly orchids, in 1961, and have changed to creation of disease resistant or disease free plant production by using either the combination of meristem culture and thermotherapy or protoplast technology in 1982. Starting with the project on disease free seed potato production, many major viruses have been detected, e.g. potato leafroll virus, potato virus Y, potato virus X, potato virus S. Right now, the clean seed potatoes could be produced and distributed to the growers in the upper North of Thailand and the inland seed potato production project has been set up. Besides potato, the Department of Plant Pathology, Faculty of Agriculture has also succeeded in production of disease free materials in other crops, e.g. chrysanthemum, strawberry and garlic.

Though, the disease free materials could be produced through the project and could solve some present problems, but it is not the actual way to solve or get rid of the long-term problems. Because whenever these materials are planted in the production areas, they could be reinfected with the same or new pathogens. Therefore, the ideal method to solve the problems is to develop the disease resistant lines by using the plant genetic engineering which all the protoplast technologies and plant transformation are included. The Department of Plant Pathology has already begun some research in these area , with the support from the USAID. Anyhow, the problem in crop production is not limited only on plant diseases, but some other constraints also have to be concerned such as the unfavorable conditions (e.g. heat, soil salinity or acidity), and insect pests. All these problems could be solved by the biotechnology means.

The purposed Biotechnology for Crop Improvement Section in the Agro-Industrial Biotechnology Research Project could be the best solution in solving the mentioned problems and could also support to the existing activities. The most important thing is Japan, one of the leading countries in the biotechnology field and has many experts who could strongly support to this project.

1.2. Details of the Project

1.2.1 Program Goal or Development Objective

To develop new varieties of economic crops with high yielding and resistant or tolerance to the major diseases by using biotechnology means. The following methods would be included :

1.2.1.1 mutation breeding
1.2.1.2 protoplast fusion
1.2.1.3 genes transplantation or plant transformation
1.2.1.4 *in vitro* selection or screening
1.2.1.5 anther or ovule culture

In the first phase of the project, the major economic cash crops in the North will be emphasized, e.g. potato, strawberry, chrysanthemum, tomato, carnation, garlic and coffee.

1.2.2 Project Objective or Immediate Objective

a. Production of disease free materials within 2 - 3 years, depends on the species of plants and some which are the continuation of the existing research activities, could be distribute to the growers at the beginning of the project, e.g. potatoes, chrysanthemum, strawberry and garlic.

b. Development of disease resistant crops.

c. Development of stress resistant crops within 3 years.

d. Production of pure lines material within 3 years, some have already started.

e. Germplasm collection by using plant tissue culture technologies. This is the continuation of the present activities but will expand to other crops will be studied or added.

f. Production of monoclonal antibodies to the major plant pathogens in order to support the above mentioned activities and to studies the distribution of the major plant diseases in the economic cash crops.

1.2.3 Project Outputs or Conditions Expected at Completion of the Project

a. The well equipped Biotechnology for Crop Improvement laboratory will be set up and will be the center for both basic and applied research as well as a training in specific areas.

b. Disease free or resistant materials will be obtained. For some which are available at the beginning of the project could be multiplied to production scale.

c. Pure line crops will be produced, some are serviceable at the beginning of the project.

d. Germplasm service will be ready within 3 years, some are available by the beginning of the project.

e. Monoclonal antibodies for the important plant pathogens will be produced and used in detection of the pathogens in the planting materials and in studying of the distribution of the major pathogens and their vectors as well.

f. Increasing of yield at 10 - 40 %, depends on the species of the crops, by using clean materials.

g. The center could support the master and Ph.D. program in Biotechnology at the faculty of Agriculture.

1.2.4 Project Activity

a. Production of the clean materials in order to solve the present problems.

b. Development of disease resistant or tolerant to solve the long term problems.

c. Plant transformation for the desired characters.

d. Pure line materials through anther and/or ovule cultures.

e. Germplasm collection by using tissue culture techniques, *in vitro* tuber induction and cryopreservation.

f. Production of the monoclonal antibodies to support the activities a, b and c. Moreover, data collection for the distribution and relation of the pathogens and their vectors will also be investigated.

Section 2 : Environmental effects on the protected culture.

2.1 Background Information and Justification for the Project.

Tissue culture and relative techniques are becoming more and more imperative in the protected cultivation. Due to their handy application for the micropropagation and rapid multiplication of the novel plants nowadays, these techniques are widely used for the commercial production of the high value plant species. However, the clear data on the environmental effects in the cultured vessels is not yet available in many economic tropical crops. Besides, it is well known that 70% of the cost of the plantlets produced by this mean is the medium cost and this is the bottleneck. Moreover, the environments in the cultured vessels are sometimes far from the optimum requirement, therefore the acclimatization is usually needed in the transplanting of the plantlets from the laboratory to greenhouse or to the external environment. The concept of acclimatization which is time and budget consuming will be changed, if the proper environmental conditions in the later stage of the plantlet production could be manipulated. In order to solve these problems, fine environmental control studies are needed.

2.2 Details of the project

2.2.1 Program Goal or Developmental Objective.

To studies the effects of the cultural environments on the growth and vigor of the *in vitro* grown plants.

To find the suitable low cost constituents used in tissue culture medium in order to minimize the cost of production.

2.2.2 Project Objective or Immediate Objective

Under these section, the carbondioxide and oxygen concentration in the cultured vessels and the light,intensity will be studied. If these conditions could be manipulated, the *in vitro* grown plants can be grown in the normal hydroponic culture solution with low sugar content or even without adding sugar in the medium. Therefore, not only the cost of the tissue cultured plantlet production but also the microbial contamination will be drastically reduced. Other aspects of this project is to find the low cost gelling agent from the local plant materials, since many kinds of plant can also produce the agar like substances which is needed to be examined whether these can be used in the tissue culture medium. Besides, other natural produce can also be used to replace plant growth regulators or have some promoting properties for the growth and development of plants or tissue in the culture vessels. Many data on using banana, coconut milk have already shown this effects but other plant extracts or produces are not yet investigated.

2.2.3 Project Outputs or Conditions Expected at Completion of the Project

1. Data on the physical environments affecting the growth and development of the tissues and plantlets in the culture vessels can be obtained. This data can be modified for the hydroponic culture which is very useful in the production of high value crops. Moreover, the plantlets obtain through this procedure will be more vigorous and be ready for the transplanting, therefore the cost of pre-transplanting treatment or hardening period will not be anymore necessary.

2. Low cost and uncomplicated tissue culture medium can be obtained. Furthermore, this can also be leaded to the industrial production of the gelling agent as well.

2.2.4 Project activities

1. Setting up the experiments on effects of various carbondioxide and oxygen ratios on the development and growth of plantlets grown in the vessels.

2. Construct or apply the proper culture vessels used in 1 and for mass propagation of the plantlets.

3. Finding other gelling agents for the tissue culture medium.

4. Selection the suitable growth promoting agents from the local plants.

Section 3 : "Plant Materials Used in Pre- and Postharvest Wastage Control"

3.1. Background information and justification for the project

The northern part of Thailand is geographically suitable for cultivation of many economic important cash crops. The well known produces are cereal (rice and wheat) and fruits (mango, lychi, longan, orange, citrus and papaya). Among them longan, lychi and mango are popular and can be exported to many countries. However, there are many problems in these fruits production. Insects and plant diseases are the most destructive factor, for example, over 300 lychi trees in this area were annually destroyed even though the chemically pesticides has been used. Moreover, the losses can also be easily occurred during the transportation of the agricultural produce to the markets or during the storage especially under the high temperature and humid conditions. Some chemical control measures have been applied in order to reduce the losses, but these chemicals also have some effects on the consumers' health. Besides, they are not environmental friendly and are one of the major agents causing the world pollution. Recently the natural pesticides have been come to interest an investigate in many laboratories. Thailand, due to its rich of valuable medicinal plants and spices, will have a great profit if the new biological pesticides could be identified and produced in this project. The target plants in this project will be the plants that have already been used in the folk medicines or used in controlling insects such as lemon grass, azadirachta, galanga, citrus, leech lime and holy basil. Though these plants are known for their pesticidal properties, the active constituents are not yet identified or characterized. Therefore the commercial production of these natural pesticides are still not possible.

3.2. Details of the project

3.2.1 Program Goal or Development Objective

To increase the production of economically important agricultural product in the northern part of Thailand by using natural pesticides in order to reduce the pre- and post harvest losses.

3.2.2 Project objective

3.2.2.1 To find local plants for the pesticidal used in both pre- and postharvest periods.

3.2.2.2 Determination of postharvest disease and insect as well as physiological and biochemical changes of the products.

3.2.3 Project Outputs or Conditions Expected at Completion of Project

Many natural products used to control pests and plant diseases will be found and safely applied to the agro-industrial products. This could be an initiation for production of the natural pesticides in industrial scale.

3.2.4 Project Activity

3.2.4.1 Survey and analyze the components in the extract or essential oil of some local plant materials used as natural pesticides. The medicinal plants will be more emphasized.

3.2.4.2 Identification of the active constituents from 1.

3.2.4.3 Mass production of the active constituents using plant biotechnology techniques.

3.2.4.4 Develop and evaluate some techniques for controlling and minimizing wastage of horticultural crops during preharvest and postharvest periods.

II. Project Work plan

Activities	1991	1992	1993	1994	1995	1996
1. Project Management						
1.1 Set up working group	XX					
1.2 Activities planing	XXX					
1.3 Personnel, resources planing	XXXXX					
2. Purchasing and set up the requested equipment	XXXXXXXXXXXXXXXXXXXX					
3. Co-research activities with the Japanese experts		XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX				
Section 1. Biotechnology for Crop Improvement.						
4. Production of disease free crops		XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX				
5. Production of pure lines		XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX				
6. Development of disease resistant varieties		XXXXXXXXXXXXXXXXXXXXXXXX				
7. Germplasm collection		XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX				
8. Germplasm services		XXXXXXXXXXXXXXXXX				
9. Monoclonal antibodies production		XXXXXXXXXXXXXXXXXXXXXXXX				
Section 2 Environmental effects on the protected culture.						
10. Find the proper ratio of CO_2 and O_2 for the high light intensity *in vitro* culture		XXXXXXXXXXXXXXXXXXXXXXXXXX				
11. Select the gelling agents		XXXXXXXXXXXXXXXXXXXX				
12. Select the growth regulators used in tissue culture medium		XXXXXXXXXXXXXXXXX				
Section 3 Plant Materials Used in Pre- and Postharvest Wastage Control						
13. Screening for the natural pesticides		XXXXXXXXXX				
14. Identification and testing the active constituents		XXXXXXXXXXXXXXXXX				
15. Testing for the application doses and methods		XXXXXXXXXXXXXXXXXXXX				
16.Training	XX	XX	XX	XX	XX	XX XX
17. Training of staff in Japan		XXX	XXX	XXX	XXX	
18. Project evaluation						
18.1 Staff meeting	XX X	X	X	X	X	X X X X X X
18.2 Annual meeting	X	X	X	X	X	X
18.3 Evaluation	X	X	X	X	X	X
18.4 Reporting		X X	X X	X X	X	X X X

III. Target Groups

The northern farmers, especially Chiang Mai, Lumphoon and Chiang Rai provinces will be the selected target groups. For germplasm exchanges and services will be stressed on the universities staff, research personnel in the Department of Agriculture, Ministry of Agriculture and Co-operation and scientists in another countries for the international germplasm exchanges.

IV. Duration of the Project

5 Years, starting from April 1992 - March 1997.

V. Project Site

Faculty of Agriculture and Faculty of Science, Chiang Mai University.

VI. Recommended Source (s) of Information and Data Related to the Project Necessary for Project Verification

VI.1 The National Center for Genetic Engineering and Biotechnology (NCGEB), Ministry of Science, Technology and Energy

VI.2 Chiang Mai University

Progress report will be submitted to the DTEC and Japanese Government every 6 months. Besides the annual reports and reprints of the research papers will also submitted to the mentioned agencies. Previous activities and papers are as follows :-

Smitamana, P. , P. Smitamana. 1989. Production of virus free strawberry by using the combination of thermotherapy and meristem culture. Technical Report to NRCT. 40 p.

Smitamana, p. , P. Smitamana and V. Somsab. 1986. *In vitro* microtuber potato production. Paper presented at the first National Potato Conference, Chiang Mai University, Chiang Mai, Thailand. January 17 - 19, 1986. p. 117 - 120.

Smitamana, P. , P. Smitamana and V. Somsab. 1987. Diséase free potato production. Chiang Mai University Report. p. 13 - 14.

Smitamana, P. , P. Smitamana, V. Somsab, D. Boonyakiat and K. Ramingwong. 1989. Research on meristem technology for potato (*Solanum tuberosum*) seed production in the highland to replace opium based agriculture. Technical Report submitted to USDA/ARS. 79 p.

Smitamana, P. , P. Smitamana, V. Somsab, D. Boonyakiat and K. Ramingwong. 1988, 1989, 1990. Selection and development of virus resistant potato by using protoplast culture and fusion technique. First, second, third and fourth Progress Report submitted to USAID/PSTC.

Smitamana, P. , P. Smitamana and V. Somsab. 1989. *In vitro* microtuber potato production. J. Agriculture 5 : 21 - 27.

Smitamana, P. , P. Smitamana and P. Thanasanti. 1989. Production of virus free chrysanthemum by using heat treatment and meristem culture. J. of Agriculture 5 : 123 - 135.

VII. Details of the Implementing/Operating Agency

VII.1. Institutional Framework (including coordination with other agencies concerned).

Faculty of Agriculture, Chiang Mai University, has a major task in offering courses in various agricultural fields for both undergraduate and graduate levels. In this national economic development plan, the faculty will also offer at least two Ph.D. programs. Moreover, the faculty staff are also conducting researches in numerous agricultural fields which biotechnology is included.

Faculty of Science, Chiang Mai University is responsible for offering courses for undergraduate and graduate students. Ph.D. programs in biology and chemistry are already existed. Biochemical technology section is presently established. Research interests are mainly on the production technologies for biochemical products such as enzymes and carbohydrates.

VII.2 Staff/Personnel Participating in Project Implementation

The major staff who will involve in this project are listed below :-

Degree	No.	Academic rank	Experience (year)	Duty in the project
For Section 1 & 2				
Dr.rer.nat.	1	Assoc. Prof.	17	Production of disease free or resistant and pure lines crops
Ph.D.	2	Asst. Prof.	18	Plant tissue culture
Dr. agr.	1	Asst. Prof.	14	Production of disease free material and germplasm collection
Ph.D.	1	Asst. Prof.	12	Mutation breeding
Ph.D.	1	Lecturer	14	Cytological studies
M.S.	1	Assoc. Prof.	15	Morphological studies
M.S.	1	Scientist	3	Protoplast culture and fusion
For Section 3				
Ph.D.	1	Assoc.Prof.	17	Plant extract study
Ph.D.	1	Asst. Prof.	17	Plant Pathology and postharvest disease studies
Ph.D.	1	Asst. Prof.	22	Plant Physiology and Postharvest Physiology
Ph.D.	1	Asst. Prof.	16	Postharvest and Seed Seed Pathology
Ph.D.	1	Asst. Prof.	10	Postharvest Physiology
Ph.D.	1	Lecturer	19	Analysis of plant extract
Ph.D.	1	Lecturer	6	Postharvest Physiology
M.S.	1	Asst. Prof.	18	Postharvest wastage studies
M.S.	1	Asst. Prof.	16	Postharvest wastage studies
M.S.	1	Assoc.Prof.	20	Plant Physiology and Postharvest Physiology

Other staff in the Faculty of Agriculture and Faculty of Science will be supporting staff and will join in particular research activities.

VII. Assistance Requested

VIII.1 Expert

Field of Operation/Activity	Total No.	Total m/m	1992 No.	1992 m/m	1993 No.	1993 m/m	1994 No.	1994 m/m	1995 No.	1995 m/m	1996 No.	1996 m/m
(1) Project Leader	1	60	1	12	1	12	1	12	1	12	1	12
(2) Project Co-ordinator	1	60	1	12	1	12	1	12	1	12	1	12
(3) Plant Pathology	4	12	1	3	1	3	-	-	1	3	1	3
(4) Long term tissue culture	2	6	-	-	1	3	-	-	-	-	1	3
(5) Mutation breeding/ Protoplast Technology	3	11	1	4	1	4	-	-	1	3	-	-
(6) Monoclonal antibodies production	1	3	-	-	1	3	-	-	-	-	-	-
(7) Environmental effects on tissue culture plants	2	4	-	-	1	2	-	-	1	2	-	-
(8) Phytochemistry	2	6	1	3	-	-	1	3	-	-	-	-
(9) Analytical Chemistry	2	6	-	-	1	3	-	-	1	3	-	-
(10) Postharvest Pathology	1	3	-	-	-	-	1	3	-	-	-	-
Total	19	191	5	34	8	42	4	30	6	35	4	30

VIII.1.1 Justification for Requesting Experts

Though plant tissue culture has been used in Thailand for many decades but it is limiting only in the field of rapid multiplication in order to obtain a large number of the desirable species. One good example for this statement is the orchid industry which is very successful one. However, Thailand still lacks of expertise for the advanced tissue culture technologies especially for the special criteria e.g. disease resistant crops or genetic engineering and the related fields. Since those technologies could be widely applied in the crop production and improvement as well and might be a great benefit for the agricultural based country like Thailand. With the experience staff and the existing facilities, Faculty of Agriculture, Chiang Mai University is ready to co-operate with the Japanese experts and offering the good solutions for the major problem in crop improvement and production. By the same time, the experts in this project could also strongly support the academic programs of the faculty.

VIII.1.2 Job Description of Each Expert Requested

General job description for the experts are as follows:

1. Give advise on the special research project
2. Technology transfer in the specialized subjects.
3. Supporting the academic program by offering special course related to their specialization.
4. Give advise on setting up training courses.

VIII.1.3 Qualification

1. Hold the Ph.D. degree or equivalent.
2. Age not lower than 30.
3. Has at least 7 years experience in the area of specialization
4. Has a good command in English.

VIII.2 Fellowship

Field of Study/Training	Total No.	Total m/m	1992 No.	1992 m/m	1993 No.	1993 m/m	1994 No.	1994 m/m	1995 No.	1995 m/m
(1) Plant transformation/ Gene cloning	3	18	1	6	1	6	1	6	-	-
(2) Protoplast technology/ Gene technology	2	10	-	-	1	4	1	6	-	-
(3) Mutation Breeding/ Monoclonal antibodies production	2	12	1	6	-	-	1	6	-	-
(4) Phytochemistry/ Plant pathology	6	18	2	6	1	3	2	6	1	3
(5) Postharvest physiology	2	6	-	-	1	3	-	-	1	3
Total	14	64	4	18	4	16	5	24	2	6

VIII.2.1 Justification for Requesting Trainees to Japan.

Gene technology is widely use in the modern plant improvement nowadays. For the better application of this technique, another areas of plant tissue culture have to be concerned. One important area is the protoplast technology which is the vector or mean of the gene transplantation. Besides, plant transformation is another important area of modern plant tissue culture which could make a short cut for the crop improvement.

Mutation breeding is very useful technique in obtaining the new cultivars or varieties of plants with a desirable character.

Monoclonal antibodies production is a very useful technique for the precise detection of the plant pathogens in the plant materials or their vectors. This technique can be applied to many aspects of the agricultural fields and very important for the export and import of agricultural produces.

Phytochemistry is the key area in the extraction, separation and analyzing of the plant materials used in the pre- and postharvest losses control. Moreover, the characterization of the active constituents is also needed to be trained.

Plant pathology is also the key question in submitting this project. The request training area will be in the field of disease evaluation, screening for resistant crops and in postharvest pathology.

Postharvest physiology will be trained in the area of physiological changes in the disease produces and the proper packaging technology for the minimization of crop losses.

IX. Thai Government Counterpart Contribution to the Project

Thai Government Counterpart Contribution to the Project (million baht)

Description of Government Counterpart Contribution	Total Contribution		1992	1993	1994	1995	1996
	Already Available	to be Requested					
1. Project personnel							
1.1 Professional staff							
Ph.D	13	-	0.129	0.208	0.218	0.230	0.241
M.S.	5	4	0.107	0.172	0.240	0.309	0.327
B.S.	1	4	0.048	0.098	0.152	0.159	0.215
1.2 Administrative staff							
B.S	1	1	0.048	0.050	0.101	0.106	0.111
Cert. or Diplom.	-	1	0.031	0.032	0.034	0.036	0.037
2. Equipment							
2.1 Premises and buildings							
Transfer room	1	2	2	-	-	-	-
Green house(insect proof)	1	2	1	-	-	-	1
Media preparation room	-	1	1	-	-	-	-
Special laboratory	-	4	4	-	-	-	-
Cold room	1	1	1	-	-	-	-
Laboratory	1	-	-	-	-	-	-
Instrument room	1	-	-	-	-	-	-
Office	1	-	-	-	-	-	-
Total budget		6.580	5.180	-	-	-	1.400
2.2 Non-expendable equipment							
Refrigerated centrifuge	2	-	-	-	-	-	-
Laminar airflow	3	-	-	-	-	-	-
Growth chamber	4	-	-	-	-	-	-
Inverted microscope	1	-	-	-	-	-	-
Centrifuge	1	-	-	-	-	-	-
Refrigerator	3	-	-	-	-	-	-
Deep freezer	1	-	-	-	-	-	-
Ultra centrifuge	1	-	-	-	-	-	-
IR-Spectrophotometer	1	-	-	-	-	-	-
UV-VIS spectrophotometer	1	-	-	-	-	-	-

Other measures to be taken by the Government of the Kingdom of Thailand

In accordance with the laws and regulations in force in the Kingdom of Thailand, the Government of the Kingdom of Thailand will take necessary measure to secure at its own expense

1. Services of the Thai counterpart and administrative personnel as list in IX.

2. Land, buildings and facilities as listed in IX.

3. Supply or replacement of machinery, equipment, instrument, vehicles, tools , spare parts and other materials necessary for the implementation of the project.

X. Related Project/Activities

This project will support the academic program on Biotechnology, Biochemistry, Horticulture and Agronomy. Besides, the center will also support the research activities in the mentioned areas as well.

XI. Monitoring and Evaluation

Activities	1991	1992	1993	1994	1995
1. Board meeting	x x x	x x x	x x x	x x x	x x x
2. Annual meeting	x	x	x	x	x
3. Expert join the project	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx				xxxxx
4. Training in Japan		xxx	xxx		
5. Studying in Japan	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx				xxxxx
6. Installation of equipment	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx				xxxxx
7. Conducting research	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx				xxxxx
8. Report to DTEC and Japanese Government	x x	x x	x x	x x	x x

XII. Reporting

The technical reports and the comment of the experts working in the project will be submitted to the DTEC and the Japanese Government every 6 month.

XIII. Future Work Plan

The Agro-Industrial Biotechnology Research Project will conduct the research as stated in the objective and will support the academic programs in Chiang Mai University. Moreover, other related areas will also be expanded e.g. plant biochemistry especially biochemistry of bioactive compounds, natural products and medicinal plants. Furthermore, the training courses are also planed to offer to the government staff and scientists or staff from the private companies.

XIV. Requested Equipment for the project

(thousand yens)

Items	Amount for each item	Unit Price	Total	1992	1993	1994	1995	1996
Section : Biotechnology for Crop Improvement and Environmental Effects on the Protected Culture								
Electrofusion equipment	1	5,460	5,460	5,460				
Electroporation equipment	1	1,560	1,560	1,560				
Inverted light microscope	1	3,263.2	3,263.2	3,263.2				
Carbondioxide incubator 148 L	1	950	950	-	950			
Carbondioxide incubator 77 L	2	850	1,700			850	850	
Vibration culture incubator	1	870	870	870				
Fermenter 5 L	1	3,500	3,500	3,500				
Fermenter 10 L	1	3,960	3,960		3,960			
Freezer Ultralow Horizontal	1	1,850	1,850		1,850			
Freezer Ultralow Vertical	3	1,920	5,760	1,920	-	-	1,920	1,920
Water purifier unit	1	649	649	649				
Ultrasonic pipette washer	1	338	338	338				
Ultrasonic cleaner 20.5 L	1	470	470	470				
Ultrasonic cleaner 36 L	1	1,111	1,111	-	-	1,111		
Shaking bath incubator	1	468	468	-	468			
Immersion Cooler	2	230	460	230	230			
Ultrasonic cell breaker	1	567	567	567				
Tissue homogenizer	1	517	517	517				
Tubing pump system	2	409	818	409	409			
Aspirator	1	370	370	-	-	370		
Fraction collector	1	3,323.2	3,323.3	-	-	3,323.3		
Balance top load	1	370	370	370				
Hygrometer, humitop 33R	1	720	720	-	-	-	720	
Hygrometer,humitop 40M	1	350	350	-	350			
Generator humidity	2	950	1,900	-	950	-	-	950
Spectrophotometer	2	5,500	11.000	5,500	-	5,500		
Microplate reader	1	3,100	3,100	-	-	-	3,100	
Density meter	1	580	580	-	-	580		
Microcentrifuge	1	790	790	-	-	-	790	
Fluorescence microscope	1	17,942	17,942	-	-	17,942		
Analytical balance	1	1,700	1,700	1,700				
Colony counter	1	5,200	5,200	-	-	5,200		
Low temperature incubator	2	511	1,022	511	-	-	511	
Autoclave	2	586	1,172	586	-	-	586	
Centrifugal freez-dryer	1	350	350	-	-	-	350	
HPLC	1	12,000	12,000	-	-	-	-	12,000
Bioshaker	2	2,500	5,000	-	-	-	2,500	2,500
Rotating cultivator	2	350	700	350	-	350		
Biophotochamber	3	1,750	5,250	3,500	-	-	1,750	-
Hot air dry oven	1	620	620	620	-			

Items	Amount for each item	Unit Price	Total	1992	1993	1994	1995	1996
Plant Materials Used in Pre- and Postharvest Wastage Control.								
Fume hood	1	6,000	6,000	-	6,000			
Evaporator	1	6,000	6,000	-	6,000			
Extraction apparatus	4	3,000	12,000	-	3,000	6,000	3,000	
Distillation apparatus	4	3,000	12,000	-	6,000	-	6,000	
Gas chromatography	1	8,000	8,000	-	8,000			
Heavy duty pump	4	650	2,600	2,600				
Fraction collector	4	1,200	4,800	2,400	2,400			
Blender, waring	2	173	346	346				
Rotary evaporator	1	325	325	-	325			
Freez dryer	1	700	700	700				
Ultrasonic cleaner	1	225	225	225				
Laminar air flow	1	400	400	-	-	400		
Incubator	1	250	250	-	-	250		
Light microscope with camera	1	715	715	-	-	-	715	
HPLC	1	12,000	12,000	-	-	-	12,000	
TOTAL COST			171,091.5	39,161.2	39,942	39,826.3	34,792	17,370

Justification for Requesting Equipment

Electrofusion machine is very useful for protoplast fusion. Though chemical fusion could also induce cell fusion, but it has a great disadvantage in term of chemical toxicity and low fusion percentage. Using this equipment, 90 - 95 % fusant could be obtained and without any chemical residues or toxicity.

Electroporation equipment is used for the gene transferring experiment which is very important in the field of genetic engineering. Moreover, this could also help in studying the performance of the selected genes in the new protoplasts or cells as well.

Inverted microscopes with temperature control chamber and micro-manipulator are used for the selection of the fusant from the fusion product after the electrofusion. Besides, this equipment is very helpful in the injection of genes in the selected cells or protoplasts too. Moreover, this microscope is necessary for the observation of cell growth and development and following the effect of the genes in the transformants which could shortening the time for the crop improvement than the conventional method.

Carbondioxide incubators are used for the incubation of the cell lines and production of the monoclonal antibodies.

Ultrasonic cleaners and ultrasonic pipette washer are required for the better cleaning of the small equipment and glassware in the cell, protoplast,tissue culture works and the monoclonal antibodies work as well.

Freezers are required for keeping the serum and antibodies. Moreover, they are also used for preserving of the plant constituents, hormones and other organic compound used for media preparation.

Vibrational culture incubator is used for culturing the cells, calli or organs under the control conditions. The shaking condition will enhance the growth of the cultures by supplying the adequate amount of oxygen. Besides, the shaker will also promote the cell division as well.

Fermenters are required for the rapid propagation of the selected plant cells and organs and for the studying the effects of culture conditions, medium and gases supply on growth and development of the cells and organs.

Water purifier unit is requested for the better quality laboratory water supply since all the medium and the experiments need the high quality water.

Shaking bath incubator is needed for the studying of the serological reaction which the control temperature is needed.

Cooler immersion are need for the controlling of the temperature during the experiment e.g. gel electrophoresis, virus purification and plant transformation.

Ultrasonic cell breaker is requested for the virological work since the viruses are located in the host cells. Moreover, this equipment is very useful for the serological work as well.

Tissue homogenizer is used for the studying of the plant enzymes, protein and nucleic acid where the thoroughly homogenized plant saps are needed especially in the gel electrophoresis work.

Tubing pump system is required for the filtration of the solution and medium and also for the virus purification through column chromatography.

Aspirator is requested for the aeration and for the filtering the solution through the membrane filter.

Fraction collector is used in collecting the selected viruses, proteins and nucleic acid fraction where large volume has to be used in the column

Balance is used for weighing the chemical for medium, buffer and solution preparation.

Hygrometers are used for recording the temperature, relative humidity in the culture rooms, incubators and greenhouses.

Generator Humidity is used for generating the high humidity condition in the incubators and culture rooms.

Spectrophotometer is required for measuring the virus, nucleic acid and some chemicals concentration in the solution for the virology, serology and genetic engineering work.

Microplate reader is requested for the serological work especially ELISA method which is widely used for detection of plant viruses and other pathogens.

Densitometer is used in the gel electrophoresis work in order to calculate the concentration of proteins and nucleic acid in the gel slaps.

Microcentrifuge is used for centrifugation of cell lines and macrophage in the monoclonal antibodies production work and also in the plant transformation work.
Fluorescence microscope is used in the studying of the transformant cells or in the detection of plant pathogens in the infected cells and tissues.

Analytical balance is used for the highly accurate weighing especially for the media preparation which microgram quantity of chemical is needed.

Colony counter is used for counting the colonies of the plants or pathogens in the sensitivity test experiments. Moreover, this equipment is also used in studying the effects of growth hormones on the development and division of cells as well.
Low temperature incubators are used for incubating the protoplasts and cells after plating.

Autoclaves are requested for all the sterilization of medium and equipment for the aseptic work.

Centrifugal freez-dryer is used in condensation and preservation of the serum or the active constituents of plant extracts.

High performance liquid chromatography (HPLC) is used for separating and studying the plant active constituents and also for the differentiation of the selected transformants.

Bio-shakers are used for culturing plant cells under the control environmental conditions and also for the propagation of selected cell lines in the stress resistant selection as well.

Rotating cultivators are used for culturing the plant organs and plantlets under the submerge culture or in the liquid medium.

Biophotochambers are needed for cultivation of plants under the control conditions for the protoplast isolation and fusion work. Besides, these incubators will be used for incubating the plant protoplasts, cells and organs especially at the beginning and the organogenesis periods.

Hot air dry oven is used for drying the glassware and the small equipment used in the laboratory in order to prevent the contamination of dust and micro-organisms.

Fume Hood is indispensable equipment to ensure the security and health safety in the laboratory that has to manipulate with organic solvent.

Evaporator is for concentrate plant extract and also can be modified to used for extraction under reduce pressure.

Extraction and distillation apparatus, especially, the one that can be used with large amount of sample and with high performance is needed.

HPLC and GC are the most important that we do not have enough budget. They will be very useful in separation and identification of the constituents of plant extract.

Blender and Rotary Evaporator are used for the extraction method for further step of evaluation.

Vacuum freeze dryer is used for drying the sample for the measurement without any destruction of the heat labile sample.

Ultrasonic cleaner is used for cleaning glassware and pathological equipment in order to preventing the contamination.

Laminar air flow unit and incubator unit are necessary for pathological research.

Light microscope connected with camera unit is used for both morphological and pathological researches.

Contact person :

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Faculty of Agriculture
Chiang Mai University
50002 Chiang Mai, THAILAND.

Tel. 221828, 221699 ext. 4021, 4024
Telex 43553 UNICHIM TH
Fax. 6653 210000

附属資料 3. 調査前質問状（対チェンマイ大学）

August 27 ,1992
JICA
Long term survey team

QUESTIONNAIRE 1

The following are our questions concerning "Agro-industrial Biotechnology Research Project", which was requested by the Government of Kingdom of Thailand in November 26, 1991. This Questionnaire has been prepared to facilitate the formation of our new Cooperation Project. We would appreciate if you would answer them in writing or providing us with relevant data and materials.

1.Organization, Administration and Budget system for the implementation of the Project.

1)Organization responsible for the Project.
2)Organization responsible for Administration and Technological development matter.
3)Organization which allocates the Budget for the Project.
4)Organizational chart of the Project in Administration, management and technological development.

2.Knowledge related Chiang Mai University.

1)History of CMU.
2)Organizational chart at CMU.
3)Biotechnology research system at CMU.
-Past Research Activities.
4)System of Extension Activities for Agricultural Producers at CMU.
-Past Extension Activities.
-Status of Extension Officers.

3.Measures to be taken by Thai side such as Provision of land, building and facilities for the Project.

1)Number and area(sq.m) of laboratories, staff rooms, lecture rooms and other related academic space.
2)Facilities for electricity, gas, water-supply, drainage system, air-conditioning and whether any time limit is imposed on their usage.
3)If there is no such Facilities, the Budget and Time to provide them.

4.Present conditions of Agricultural sector and Agro-industrial sector in Chiang Mai.

1)Quantity produced.
2)Producing Capacity and Attitude.
3)Levels and activities of private Enterprises.

คณะเกษตรศาสตร์ มหาวิทยาลัยเชียงใหม่
Faculty of Agriculture Chiang Mai University
เชียงใหม่ 50002
โทร (053) 221699 ต่อ 4001, 221828
โทรพิมพ์ 43553 UNICHIM TH
โทรสาร 0853 217143

September 11, 1992

Mr. Nobuji Abe
Resident Representative
Japan International Cooperation Agency
1674/1 New Petchburi Road
Bangkok 10310

Fax. (02) 255-3725

Dear Mr. Abe,

Many thanks for your facsimile and the letter date August 28, 1992. Enclose herewith, please find the answer to the questionnaire for the preparation of the visit from the JICA mission team. . If you still have more questions or information please do not hesitate to let me know.

Look forward to hearing from you soon.

With best regards.

Yours sincerely,

P. Smitamana

Dr. Prasartpron Smitamana
Project Co-ordinator.

Chiang Mai 50002 Thailand Tel (053) 221699 Ext 4001 Telex 43553 UNICHIM TH Fax 6653 217143

Answer to the questionnaire 1

1. Organization, Administration and Budget system for the implementation of the Project.

   1. Organization responsible for the Project.

      Chiang Mai University

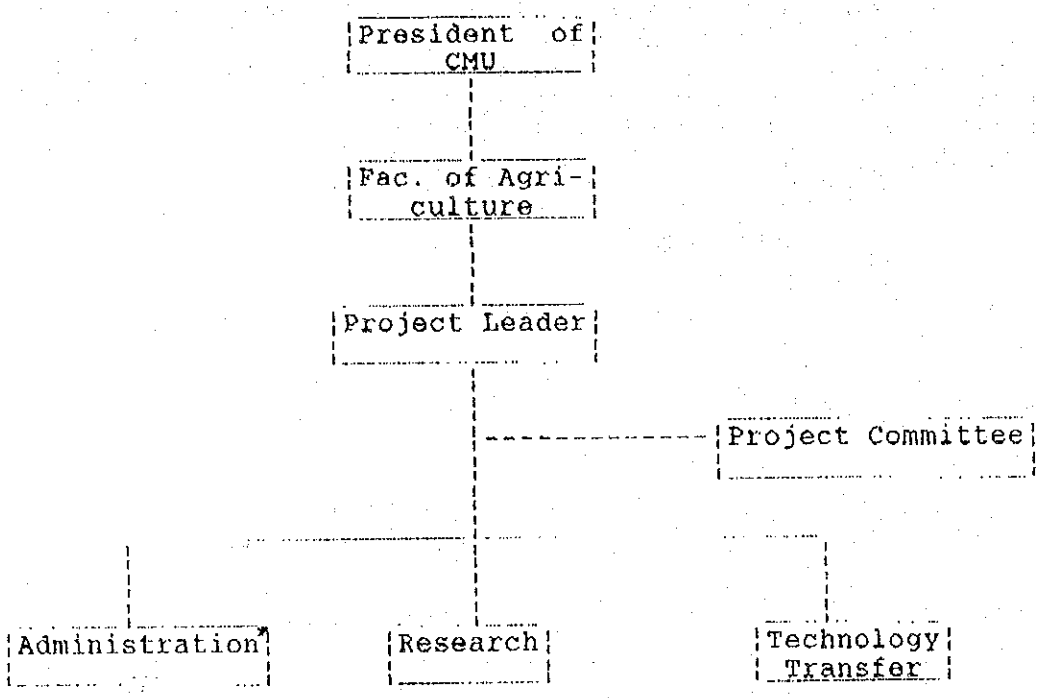
   2. Organization responsible for Administration and Technological development matter.

      Faculty of Agriculture, Chiang Mai University.

   3. Organization which allocates the Budget for the Project.

      Royal Thai Government through the Department of Technical and Economics Cooperation and Ministry of University Affairs.

   4. Organizational chart of the Project in Administration, management and technological development.



Deputy Dean for Research and Development will be the Project Coordinator and will take care of all administration and management work. Anyhow with the agreement of the Project committee and Project Leader.

2. Knowledge related Chiang Mai University

1. History of CMU.

Chiang Mai University is the first regional university in Thailand, having been established in accordance with the 1941 Government Policy to extend higher education into the rural areas. The Council of Ministers granted an official charter for the establishment of the University in 1960. The University was established for the following purposes :

- to set up a university in the northern region to ease the problems of overcrowded universities in Bangkok;
- to establish a complete university offering education in all fields;
- to encourage higher educational research at both the academic and vocational levels;
- to provide services to society, particularly those in the northern region;
- to produce quality graduates who are knowledgeable and have high moral and ethical standards.

Chiang Mai University started the operation in June 1964, with the first three faculties - Humanities, Social Sciences and Science. Now it consists of 13 Faculties (97 Departments), 3 Research Institutes and 4 Academic Support and Promotion Service. (See Organization Chart)

Education system : Semester System (Two regular semesters and summer semester)

Study Program : 142 Program (2 Certificate Program, 71 Undergraduate Program, 69 Graduate Program).

Total Number of Student : 13,003 (Certificate 86, Undergraduate 11,397, Graduate 1,520).

University Facilities and Services : Central Library, Computer Service, Residential Service, Postal Service, Banking Service, University Co-operative, Athletic and Entertainment Service/Facilities, Health Service and Counseling Service.

Staff : 8,811 (Full-time Faculty 1,618, Other 7,193).

2. Organizational chart at CMU (see attached paper).

3. Biotechnology research system at CMU.
Past Research Activities.

Biotechnology activities at Chiang Mai University could be divided in 4 areas as follow :-

a) medical science
b) microbiology

c) plant biotechnology and
d) animal science.

Since this project will deal mainly with the plant biotechnology, therefore only the plant biotechnology will be explained in this paper.

Plant biotechnology research activities have initiated at the Faculty of Agriculture for ca. 16 years ago under the Colombo plan. At first, only the rapid propagation of the cut flowers and orchids was emphasized. Thus selection for the suitable medium for those plants were conducted. Starting from 1983, the new trends of plant biotechnology research have been introduced to the faculty due to the return of more young staff from aboard. Production of diseases free plants was the first priority at that period in order to solve the virus problems in many economics important cash crops. In 1986 the faculty has set up the work on protoplast technology e.g., protoplast isolation, culture and fusion. The area of protoplast technology was now well established and some novel plants have already produced by the researchers. With the success of the protoplast technology, the plant genetic engineering has already begun, however still at the beginning stage.

4. System of Extension Activities for Agricultural Producers at CMU.

Past Extension Activities.

The faculty has the policy of extension of agricultural knowledge to the society, particularly those who lives in the northern region by many activities as follow :-

- offering special training courses at various levels

- on farm research in order to make direct contact with the farmers

- demonstration plots for the new crops produced/bred by the faculty's staff

- give advice or consults on the requested topics or areas.

Status of Extension Officers

Professor, Associate Professor, Assistant Professor and Lecturer. Besides, some of the academic supporting staff (Researchers, Scientists) have also involved in the extension program.

3. Measures to be taken by the Thai side such as Provision of land, building and facilities for the Project.

1. Number and area (sq.m.) of laboratories, staff rooms, lecture rooms and other related academic space.

Already exist

Laboratory			
Plant Pathology Laboratory			
General Plant Pathology	1	room	135 sq.m.
Fungal Diseases	1	room	112 sq.m.
Bacterial Diseases	1	room	46 sq.m.
Postharvest Pathology	2	room	55 sq.m.
Nematology	1	room	36 sq.m.
Virology	1	room	68 sq.m.
Media Preparation	1	room	23 sq.m.
Plant Tissue Culture Facilities			
General teaching Laboratory	1	room	46 sq.m.
Isolation room (PII)	1	room	12 sq.m.
Culture room	1	room	90 sq.m.
Plant Physiology Laboratory	1	room	
Staff rooms	2	room	92 sq.m.
Lecture rooms	2	room	140 sq.m.
Library	1	room	200 sq.m.

To be prepared during the project

Dept. of Plant Pathology	
Biotechnology Research Unit	
Research Laboratory	56 sq.m.
Clean room (PIII)	18 sq.m.
Centrifuge Room	18 sq.m.
Small animal room	24 sq.m.
Fungal Research Unit	70 sq.m.
Nematode Research Unit	45 sq.m.
Media Preparation Unit	30 sq.m.
Microscopy storage room	20 sq.m.
Staff rooms (4 rooms)	222 sq.m.
Seminar room	81 sq.m.

Central Laboratory Facilities	
Biotechnology Research Unit	
Media Preparation room	35 sq.m.
Clean room (PIII)	30 sq.m
Culture room	40 sq.m.
Teaching Laboratory	117 sq.m.
Serology Research Unit	
Centrifuge Room	12 sq.m.
Small animal room	40 sq.m.
Research Laboratory	30 sq.m.
Cytology and Genetics Research Unit	
Research Laboratory	30 sq.m.
Microscopy room	27 sq.m.
Plant Physiology Research Unit	
Growth Chamber Storage room	42 sq.m.
Laboratory	135 sq.m.
Culture Room (3)	40 sq.m.
Analytical Research Unit	
Research Laboratory	90 sq.m.
Teaching Laboratory	117 sq.m.
Postharvest Research Unit	
Research Laboratory	45 sq.m.
Teaching Laboratory	117 sq.m.
Isotope Research Unit	
Research Laboratory	45 sq.m.
Computer room	20 sq.m.
Training and Seminar Facilities	
General Laboratory	81 sq.m.
Seminar room	40 sq.m.
Conference room	25 sq.m.
Staff room (14)	240 sq.m.
Expert room	60 sq.m.
Cold room (4)	39 sq.m.

2. Facilities for electricity, gas, water supply, drainage system, air conditioning and whether any time limit is imposed on their usage.

Electricity : 220 V, 50 Cycles
Gas : available in tank form
Water supply : University reservoir and water system
Air condition : available only the major laboratory and the necessary working laboratories.
No time limit on the mentioned facilities accessment

3. If there is no such facilities, the budget and time to provide them.

Already available.

4. Present condition of Agricultural sector and Agro-industrial sector in Chiang Mai.

According to the 1991 survey, the vegetable and fruit processing factories in the North could be divided to 4 categories :-

1. Canned fruits and vegetable
2. Fermented fruits and vegetable
3. Dry and frozen vegetables and fruits
4. Fruit and vegetable beverage.

Total number of these factories located in the northern area is 59 which 27 of them located in Chiang Mai. Types and numbers of factories divided by their main activity could be as follow :-

1. Canned fruits and vegetable 27 (45.8%)
2. Fermented fruits and vegetable 21 (35.6%)
3. Dry and frozen vegetables and fruits 6 (10.2%)
4. Fruit and vegetable beverage 5 (8.5%).

Concerning with the Agro-industrial factories in the northern of Thailand, the total number of the active factories will be 1,030. Fifty seven of them located in Chiang Mai and can be categorized as follow :-

Canned vegetable and fruit	13
Fermented vegetable and fruit	10
Frozen and dry vegetable and fruit	2
Seed shelling or thrashing	21
Coffee roasting and grinding	1
Fermented soyabean products	9
Cold room	1
Total	57

The quantities and producing capacity as well as the attitude could be estimated from the raw materials used in the production lines which depended on the crops. Number of tons is given in the parenthesis.

Fruits.

Longan (682), Lychee (337), Rambutan (75), Peach (285), Mango (36),, Jack fruit (10), Others (2,280)

Vegetables.

Asparagus (73), Mushroom (105), Ginger (3,060), Potato (600), Garlic (265), Pea (1,200), Chili pepper (36), Bamboo and water chestnut (30), Tomato (2,400), Baby corn (120), Cucumber (3,984), Egg plant (1,272), Others (3)

Field Crops

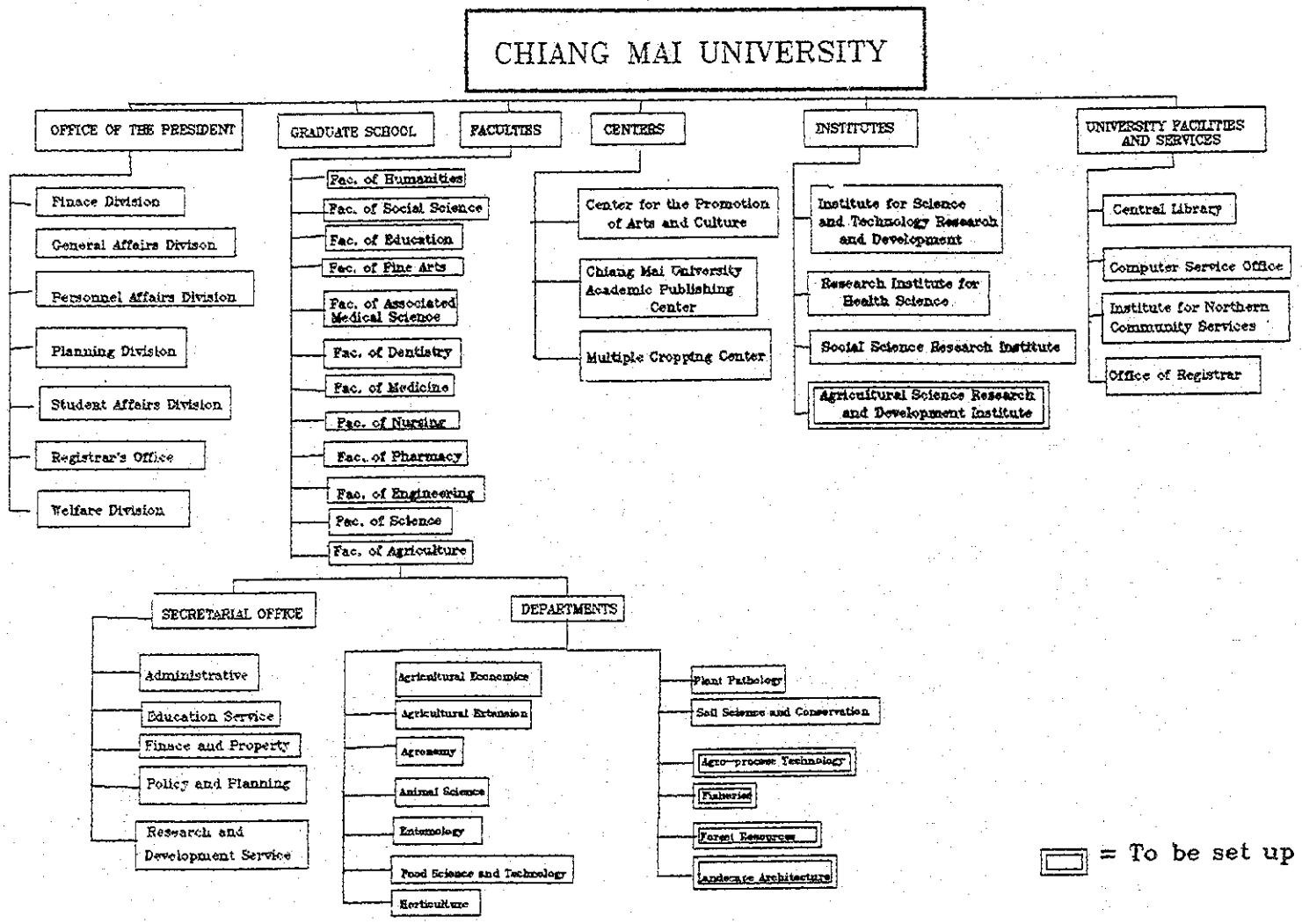
Soyabean (13,702), Ground nut (5,152), Mungbean (180), Rice for roasting (720), Sesame (510)

Beverage

Coffee (12)

For the levels and activities of private Enterprises in Chiang Mai could classify as medium size factory to cottage industries. They do not put great emphasis on research and development but would like to get the result from the government sectors.

CHIANG MAI UNIVERSITY'S ORGANIZATION



Faculty of Agriculture
Chiang Mai University

Chiang Mai, Thailand.

FACULTY OF AGRICULTURE

1991

The Faculty of Agriculture was established in 1967 ,and became the fifth faculty of Chiang Mai University, the first "regional university" in Thailand. The faculty has grown steadily over the last two decades, in quality and quantity.

The faculty is committed to three majors functions, namely; instruction, research and extension. In addition, the Faculty of Agriculture strongly believes that, in its endeavour to maintain a high degree of dynamism, its functions should not be pursued behind closed doors. In the pursuance of excellence and relevance in its teaching, research and extension programmes, the faculty vigourously professes and promotes collaboration with relevant institutions within and outside the country. However, the decision to establish an institutional linkage normally takes into consideration the symbiotic nature of the forementioned trilogy at functions as well as mutual need for continuous self-renewal by the institutions. It also considers the potential for maximum utilization of available resources and expertise to contribute to the progress and development of the beneficiaries which the institutions are accountable to.

In 1991, the Faculty of Agriculture had an enrollment of 914 in nine bachelor degree programmes including Agricultural Economics, Agricultural Extension, Agronomy, Animal Science, Entomology, Horticulture, Food Science and Technology, Plant Pathology, and Soil Science and Conservation.

The Faculty also offers five Master's degree programmes in graduate studies consisting of Agricultural Extension, Agricultural Systems, Agronomy, Horticulture and Soil Science, with a current enrollment of 157.

As of August 1991, a total of 2545 students have graduated and 63 master's degrees have been conferred.

MANDATE

Covering substantive educational programs and development projects, the Faculty's mandate can be broadly classified into four main categories of activities and objectives:

- to produce graduates in agricultural fields of high academic standard, who are endowed with a high sense of morality and creativity,
- to act as an information center extending and disseminating proper and advanced agricultural knowledge and technology to farmingcommunities, particularly in the North of Thailand,
- to encourange basic and applied research that supports efficient and sustainable use of agricultural and natural resources,
- to cooperate and to coordinate with other international institutes and organizations to assist in research and development activities leading to the economic improvement of the Southeast Asian people.

EDUCATIONAL SYSTEM

The Faculty has adopted an interdisciplinary program to provide students with the most flexible study programs. The acdemic year is divided into two semesters. Each semester is approximately 18 weeks long. There is also a Summer Session which runs for 8 weeks.

The Faculty offers courses along individual academic disciplines and evaluates the amount of credits each student may take per semester. The onecredit course requires one hour of lectures or two-three hours of laboratory work each week for the regular session. Three-credit course requires three hours of lectures per week throughout a semester.

Organization and degrees offered

The teaching and research facilities of the Faculty are organized into nine departments offering nine programs and 298 courses, leading to three Bachelor of Science degrees and 1 Master of Science. The annual graduating class is approximately 180.

Major Fields	Bachelor Degrees	Master Degree
- Agricultural Economics	B.S. (Agricultural Economics)	
- Food Science and Technology	B.S. (Food Science and Technology)	M.S. (Food Science and Technology)
- Agricultural Extension	B.S. (Agriculture)	M.S. (Agriculture)
- Agronomy		-
- Animal Science		-
- Entomology		-
- Horticulture		M.S. (Agriculture)
- Plant Pathology		-
- Soil Science		M.S. (Agriculture)
- Agricultural Systems		M.S. (Agriculture)
- Postharvest Technology	-	M.S. (Postharvest Technology)

For a 4 year program leading to a Bachelor's degree, the admission of the Faculty is based on one of the following criteria :

- passing an entrance examination arranged by the office of University Affairs.

- passing a quota entrance examination arranged by C.M.U. for the final year student from high schools of the 17 northern provinces.

Undergraduate courses

Nine departments in the Faculty of Agriculture provide academic courses of instruction and they are the basic units for the enrollment of the students. All of the Faculty curricula operate on a regular four year basis. Apart from the professionaloriented majors, students in the Faculty of Agriculture are allowed to enroll in the selected courses relating to their specialized field, as well as a number freely chosen electives. The students who work for the B.S. (Agriculture) will proceed along the corresponding programme of study during the freshman and sophomore years.

The process of choosing a departmental major will begin at the end of the second semester of the second year to provide students enough time to reflect upon their own capabilities and preference. Each student will designate a major field of study or specialized field, in accordance with his or her interests, and grade point average

(G.P.A.). The student choice is subject to approval by the Faculty Academic Committee for the undergraduate program.

Students who intend to be specialized in the field of Agricultural Economics or the field of Food Science and Technology, are required to pass the entrance examination for direct admission to the determinded study programme from the first year.

Curriculum structure

Classes are offered in a twosemester and one summer session system. Students are free to form their own curriculum following the suggestions of their advisors and within the general requirements shown below :

I.	General Basic Requirement		38
	Social Science	6	
	Humanities	6	
	Science & Mathematics	14	
	Modern Language	12	
II.	Field of Specialization		100
	Core Courses	52	
	Major	48	
	Minor (If any)	(15)	
III.	Free Elective		6
			144 Credits

UNDERGRADUTE COURSES ENROLLMENT 1991

Departments	Freshman	Sophomore	Junior	Senior	Total
- Agricultural Economics	25	25	23	20	93
- Agricultural Extension	-	-	3	25	28
- Agronomy	-	-	11	23	34
- Animal Sciences	-	-	46	44	90
- Entomology	-	-	3	3	6
- Food Science and Technology	37	50	34	33	154
- Horticulture	-	-	25	46	71
- Plant Pathology	-	-	16	9	25
- Soil Science and Conservation	-	-	3	2	5
- Unclassified	204	199	5	-	408
Total	266	274	169	205	914

Graduate programmes

The Faculty of Agriculture offers five Master's Degree Programmes which aim to train professionals with academic and technical expertise providing a broad intellectual outlook through specialized as well as interdisciplinary education. In other words, departments are responsible for teaching their respective subjects, which are classified as courses. The content of each course is evaluated and translated into the appropriate number of credits - the number of credits awarded to a course is weighted for the content of each course. The academic year is divided into two semesters and a summer session. Each student's academic performance in a course is assessed at the end of every semester, and the resulting conclusions are reported in the form of grades.

Curriculum structure

The curriculum requirements for graduate students are deliberated in the individual graduate programme which is generally designed to be a two-year programme consisting of two-thirds course work and one-thrid thesis research.

GRADUATE PROGRAMMES ENROLLMENT 1991

Programmes	Male	Female	Total
- Agricultural Extension	32	7	39
- Agricultural Systems	21	11	32
- Agronomy	21	16	37
- Horticulture	21	14	35
- Soil Science and Conservation	11	3	14
Total	106	51	157

English Language Programme

Since 1988 the Master's Degree Programme in Agricultural Systems has been implemented as an international programme providing courses of instruction in the English language for students from countries in Asia.

STUDENT PROFILE IN THE AGRICULTURAL SYSTEMS, 1991

Countries admitted	Total enrollment
Bangladesh	1
China	3
Nepal	2
Thailand	4
Vietnam	3
Total	13

Tuition and fees

The tuition and fees of students in national universities are determinded by the University Council. The tuition and fees for the academic year 1990 are shown below.

Tuition and fees	Undergraduate students	Graduate students
University registration fees		
- Student registration fee	200	200
- Insurance fee for any damage incurred	200	200
Semester registration fees		
- University fee	250	250
- Library fee	200	300
- Student's union subscription fee	50	50
- Sport expense fee	50	50
- Health service subscription fee	70	70
Course enrollment fees (per unit)		
- Lecture course fee		
Regular semester	40	300
Summer session	75	350
- Laboratory course fee		
Regular semester	100	300
Summer session	75	400

Thai students will spend about 800 Baht for various set expenses payable in the first semester. Course fees vary according to the courses enrolled by individual students, and are payable at the begining of each semester.

For the summer session, the sessional course fees for every subject offered is 75 Baht per credit, and the residential fee is 350 Baht per session.

Foreign students are subject to a 10,000 Baht annual student registration fee. Other fees are the same as those stated above for undergraduate and graduate students.

CURRENT RESEARCH PROGRAMME

As an institution of higher learning, the Faculty of Agriculture is actively striving towards achieving highest credibility for its research programmes. The Faculty, in the pusuance of excellence and relevance, recognises the instrumentality of collaboration with other universities or research institutions. The institutional linkage has been viewed as a viable machanism to continuously gauge its strengths and weaknesses and to formulate the line of action to be undertaken to arrest problems or to pursue new opportunities that have been identified. It has been recognized that the faculty is seldom at the same stage of development or exibits the same strengths in the research disciplines. Inter-university cooperative research programmes, if well designed, could provide a mechanism by which the relative strengths or facilities of some can be reciprocally shared by others.

As regards funding of current research programmes at the Faculty of Agriculture, a small amount of funding for research expenses comes from the Thai Government.Most of the research carried out has been generously funded by governments of several countries and overseas organizations.

The Faculty of Agriculture is now involved in 14 substantive areas of agricultural and technological research. The research and development concentrates on three distinct agro-ecosystems in Northern Thailand : the highlands, the uplands and the lowlands. The specific research interests include :

- Irrigated Farming Systems
- Rainfed Upland Farming Systems
- Highland Agricultural Development
- Arabica Coffee Research and Development
- Legume Crops
- Oilseed Crops Research and Development
- Temperate Grain Crops
- Vegetable Seed Production
- Ornamental Crops
- Soil Fertility and Plant Nutrition
- Postharvest Technology
- Biotechnology Research
- Animal Nutrition

CENTERS AND STATIONS

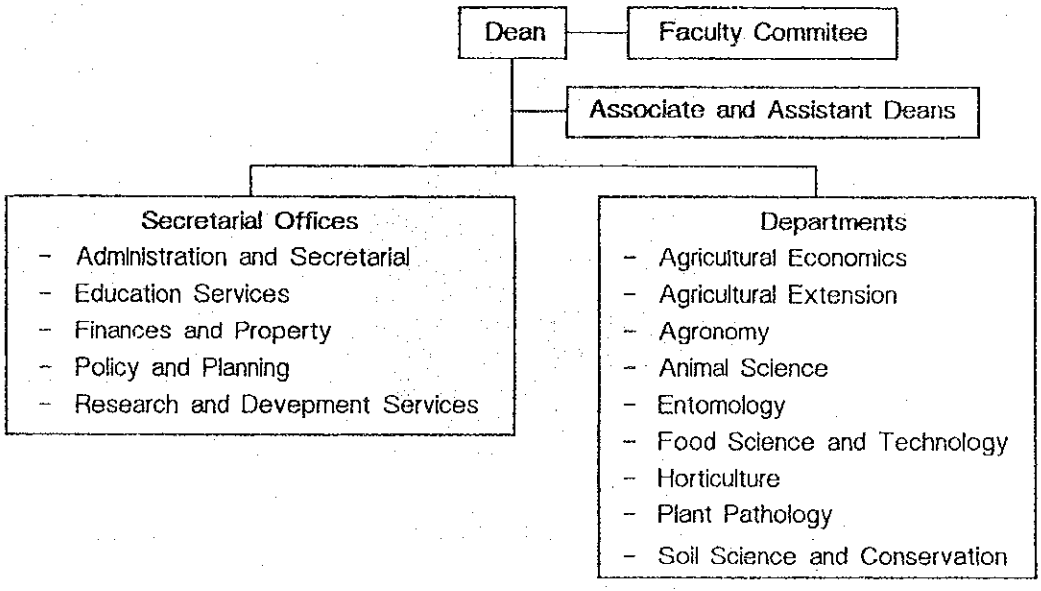
The Faculty of Agriculture has three experiment stations both on and off campus for students' training activities. Each experiment station represents a major agroecosystem of Northern Thailand. These are: the Lowland Irrigated Experiment Station, the Mae Hia Agricultural Experiment and Training Station (for rainfed upland work) , and the Highland Experiment and Training Station. These experiment stations cover a total area of 348.5 hectares. Besides the experiment stations, the faculty also has research centers and laboratories namely :

- Multiple Cropping Center
- Highland Coffee Research and Development Center
- Postharvest Technology Research & Training Center
- Biotechnology Research Unit
- Animal Nutrition Research Laboratory

FACULTY ADMINISTRATION

The Dean is responsible for supervising the administrative and academic affairs of the Faculty of Agriculture in accordance with the policies of the Faculty Committee, which consists of the Dean, Associate and Assistant Deans, the heads of each department in the faculty, and five representatives of the faculty selected every two years.

ORGANIZATION STRUCTURE



FACULTY PERSONNEL

The Faculty personnel working in the secretariat office, the research centers and the experiment stations, as well as with departments and study programs, consist of members of the following categories :

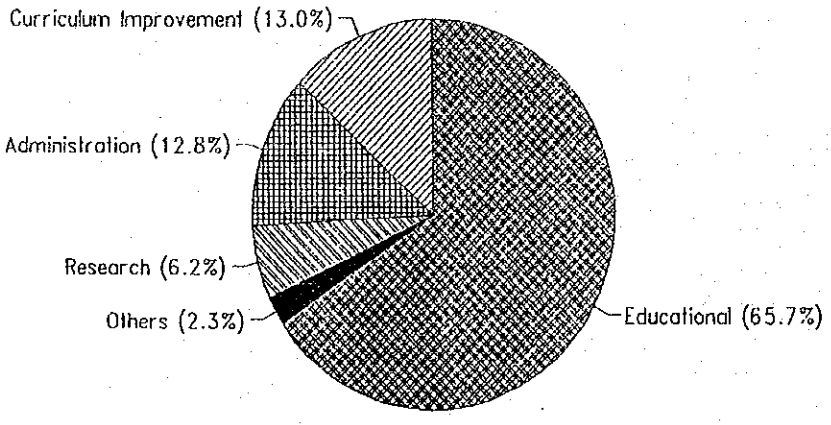
	No. of persons
Teaching staff	126
Academic assistants	40
Administrative personnel	64
Permanent employees	218
Temporary employees	66
Total	514

The qualification held by the teaching staff consist of 53 Ph.D., 65 Master's Degrees, and 8 Bachelor's Degrees holders.

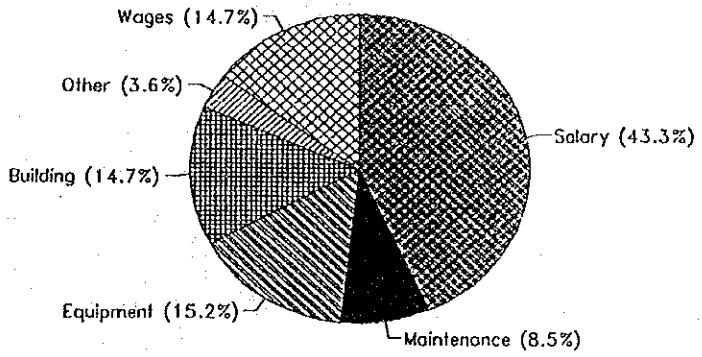
BUDGET

The Faculty of Agriculture operates on budgets drawn mainly from the Government, and partly from other sources both within and outside the country.

In 1991, the Faculty of Agriculture received 53.24 million Bahtfrom the Government budget and 3.86 million Baht from the University budget.This amount has been allocated to various programmes according to the programme-budgeting system.



BUDGET ALLOCATION BY PROGRAMMES



BUDGET ALLOCATION BY ITEMS

BUILDING AND GROUND FACILITIES

Building and ground facilities in the Faculty of Agriculture consist of six main complexes providing a total area of 19,973 m^2 for the following service groupings.

Offices, library, classrooms, teaching facilities, and laboratories	= 17,003	m^2
Workshops, plants, and insect nurseries	= 2,352	m^2
Meeting halls	= 618	m^2
Total	= 19,973	m^2

The Faculty of Agriculture also has field facilities for use in education and research. The 348.5 hectares of land is used for highlands and lowlands agricultural research and experiment stations.

COOPERATION

The implementation of cooperation in training, research or extension at the Faculty of Agriculture are usually being executed through national coordination, bilateral arrangements, and the establishment of networks formed by a consortium of universities. Of these, the most common form of cooperation adopted by the Faculty is through formal or informal bilateral arrangements. Such collaborations are usually based upon mutual interests and benefits otherwise, unattainable. Staff and student exchange programmes, or collaborative research are examples of bilateral arrangements. Personal contacts and meeting donor agency requirements are factors determining the mode of the arrangements.

CURRENT COOPERATIVE ARRANGEMENT

In addition to cooperative arrangements with local institutionssuch as the Agricultural Department, the Land Development Department, and the Agricultural Extension Department, etc, the Faculty of Agriculture has, to date, established bilateral cooperation with overseas institutions. This cooperation includes collaborative research, short visits and exchange of academic staff and external consultants, and joint academic and staff development programmes.

The following foreign institutions have established formal linkage with the Faculty of Agriculture through general agreement:

1. Japan
   * Kinki University (General Agreement Concluded June 16, 1987)
   * Mie University (General Agreement Concluded August 22, 1989)
   * Kagawa University (General Agreement Concluded April 24, 1989)
2. Philippines
   * International Rice Research Institute : IRRI (Agreement Concluded January 12, 1989)
3. United States of America
   * University of California (General Agreement Concluded October 2, 1987)
   * Oregon State University (General Agreement Concluded August 24, 1988)
   * Auburn University (General Agreement Concluded November 27, 1989)

INTERNATIONAL ORGANIZATIONS AND NETWORK

As a result of the academic linkages and joint research programmes established with foreign universities and institution, the Faculty of Agriculture has been recognized as one of the leading institutions of higher learning in this region. Consequently, this recognition has enabled the Faculty to attract several regional and international institutions to set up their operational bases and networks in the Faculty of Agriculture, as well as to fund research and consultancy projects. Some of these institutions and networks are as follows:

CIMMYT (International Maize and Wheat Improvement Center)
FFTC (Food & Fertilizer Technology Center)
ACIAR (Australian Center for International Agricultural Research)

IDRC (International Development Research Center)
IAEA (International Atomic Energy Agency)
USAID (U.S. Agengy for the International Development)
JSPS (Japan Society for the Promotion of Science)
NIAR (National Institute of Agrobiological Resource)
HITACHI FOUNDATION
FORD FOUNDATION
ROCKEFEELER FOUNDATION

THE FACULTY AND THE FUTURE

As regards the Seventh Educational Development Plan in higher learning institutions (1992-1996), the Ministry of University Affairs has approved the Faculty of Agriculture operating four new departments and offering three new programmes leading to a Bachelor's Degree, six leading to a Master's Degree and two leading to a Ph.D. degree as follows:

New departments
- Agro-process Technology
- Fisheries
- Forest Resources
- Landscape Architecture

Bachelor's Degree Programmes
- Agro-process Technology
- Fisheries
- Landscape Architecture

Master's Degree Programmes
- Animal Science
- Biotechnology
- Entomology
- Food Science and Technology
- Natural Resource Management
- Plant Pathology

Ph.D. Degree Programmes
- Agronomy
- Horticulture

NAMELIST OF THE FACULTY'S ADMINISTRATION

Dean	Associate Professor Nakorn Nalampang
Associate Dean for	
- Academic Affairs	Assistant Professor Dr.Sanit Rattanabhumma
- Administrative Affairs	Assistant Professor Lakkana Rujanakrikarn
- Research and Development Affairs	Associate Professor Dr.Boonlom Chevalsarakul
- Special Affairs	Associate Professor Dr.Boonlue Phuagphong
- Student Affairs	Assistant Professor Dr. Choke Mikled
Assistant Dean	
- Academic Service	Assistant Professor Dr.Vicha Sardsud
- Community Service	Miss Warapa Kunaporn
- Welfare and Building Affairs	Assistant Professor Viruch Chavalakul
Head of Departments	
- Agricultural Economics	Assistant Professor Dr.Benchaphun Shinawatra
- Agricultural Extension	Assistant Professor Dusdee Nalampang
- Agronomy	Assistant Professor Suthat Julsrigival
- Animal Science	Assistant Professor Dr.Therdchai Vearasilp
- Entomology	Assistant Professor Dr.Manas Titayawan
- Food Science and Technology	Associate Professor Dr.Narin Thongsiri
- Horticulture	Assistant Professor Dr.Wichian Poosawang
- Plant Pathology	Associate Professor Dr.Prasartporn Smitamanna
- Soil Science and Conservation	Assistant Professor Chavalit Chalothorn
Faculty's Secretary	Mr. Paibool Paripai