

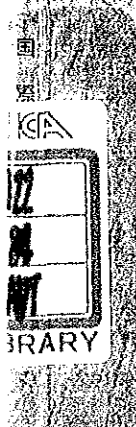
タイ国立農産工業バイオテクノロジー センター計画事前調査(コンタクト)報告書

平成3年4月

国際協力事業団

タイ国立農産工業バイオテクノロジーセンター計画事前調査(コンタクト)報告書

平成3年4月



農開技
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タイ国立農産工業バイオテクノロジー
センター計画事前調査(コンタクト)報告書

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序 文

タイ王国政府は、バイオテクノロジーによって高付加価値生産物の増強に貢献する素材を開発し、その
実用化によって輸出振興を図る政策を推進することとしており、その一環として国立農産工業バイオテ
クノロジーセンターの創設を計画し、本センターに係る技術協力を要請してきました。

国際協力事業団はこの要請に基づき、平成3年3月19日から3月30日まで、三重大学生物資源学部農芸
化学講座 梅林正直教授を団長とする事前調査団（コンタクト）を派遣し、タイ王国関係機関との協議を
踏まえたプロジェクト方式技術協力実施の可能性等を検討することとしました。

本報告書は、同調査団がタイ王国政府関係者と協議した内容及び現地において調査した結果についてと
りまとめたものであり、今後、プロジェクト実施についての検討に当たり活用されることを願うものであ
ります。

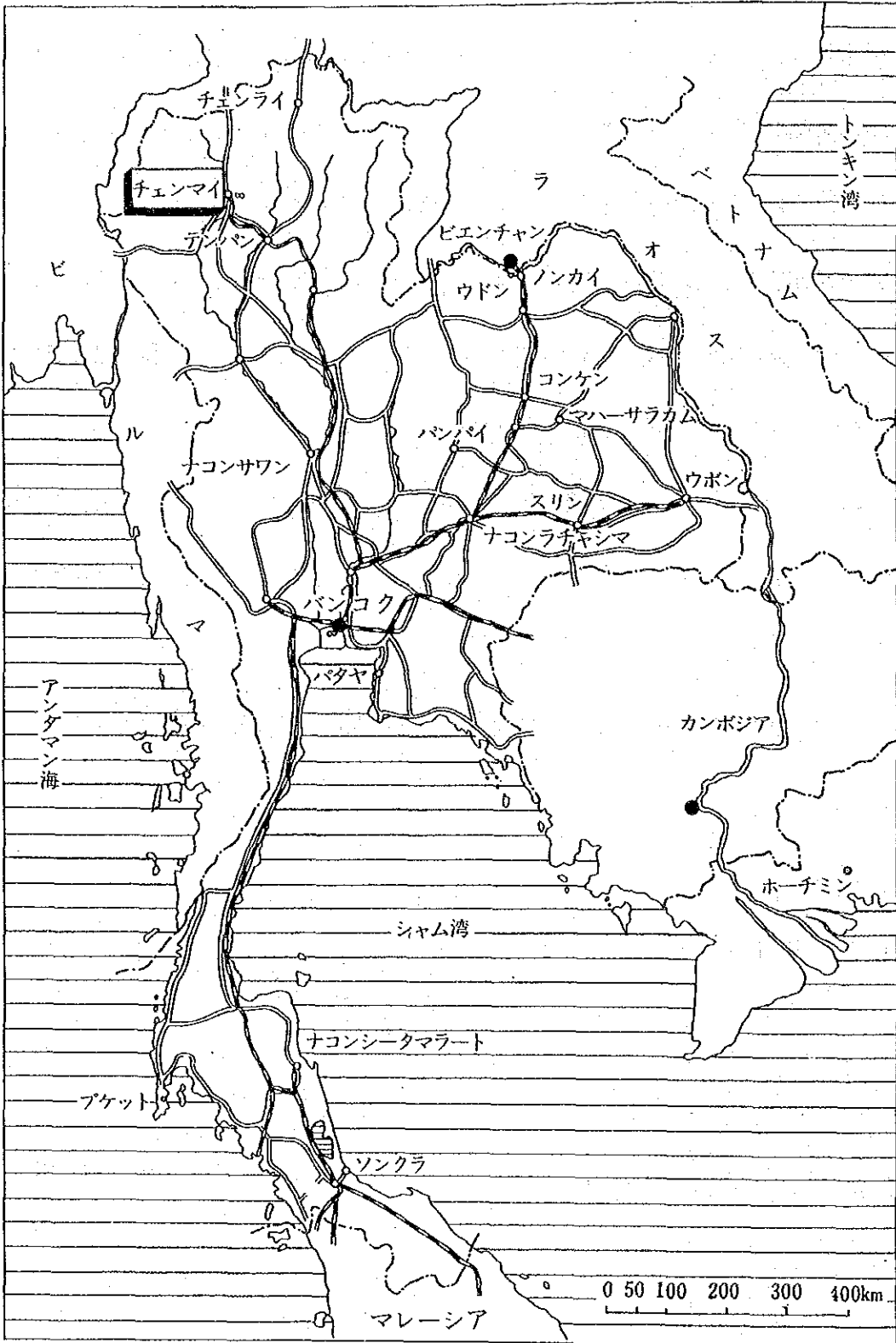
終わりに、この調査に御協力と御支援を頂いた内外の関係各位に対し、心から感謝の意を表する次第で
あります。

平成 3 年 4 月

国際協力事業団

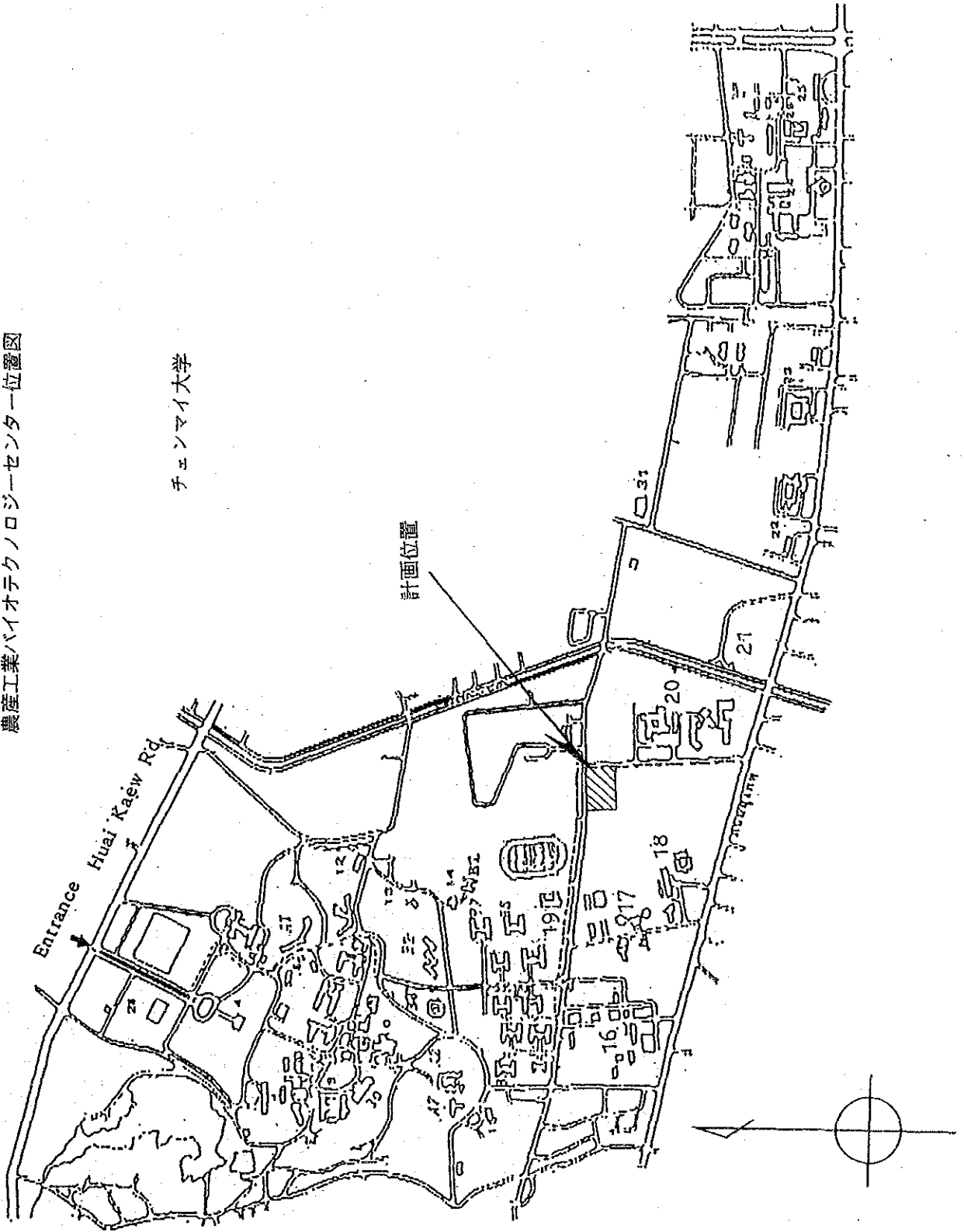
理 事 田 口 俊 郎

タイ王国



農産工業バイオテクノロジーセンター位置図

チェンマイ大学



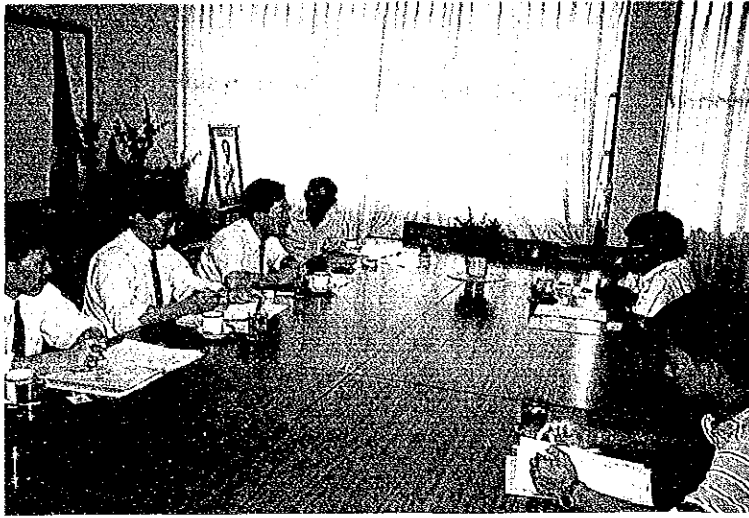
総理府技術経済協力局
(DTEC) との協議



科学技術エネルギー省
(MOSTE) との協議

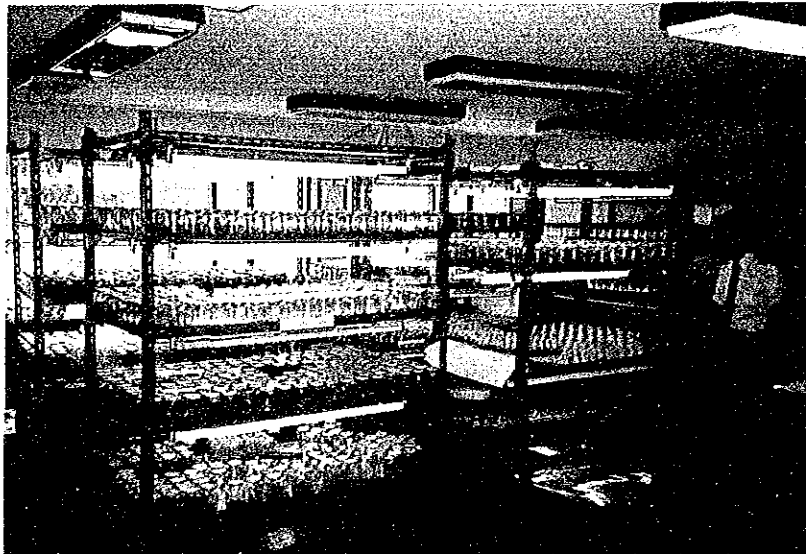
チェンマイ大学との
打合せ





マエジョ農工大学との
打合せ

農産工業バイオテクノ
ロジーセンター(NABC)
建設予定地



組織培養研究
(チェンマイ大学)

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1. 事前調査団（コンタクト）の派遣

1-1 調査団派遣の背景と目的

本件は、5-1において述べる背景の下で要請が出されたもので、技術協力の要請の一方で、実験用資機材約11億円、施設の建設約15億円の無償資金協力の要請が中心となっている。しかしながら、無償資金協力要請に対する日本側の協力が困難と想定されており、技術協力のみでどのような対応が可能なのか検討する必要性が生じていた。

このため、主に無償資金協力を前提としないプロ技協実施の可能性等を検討するため、事前調査団（コンタクト）が派遣されたものである。

1-2 調査団員の構成

| 担当業務 | 氏名 | 現職 |
|-----------|------|-------------------------------|
| 総括兼研究計画 | 梅林正直 | 三重大学生物資源学部 農芸化学講座教授 |
| バイオテクノロジー | 藤目幸擴 | 香川大学農学部 農業生産学科教授 |
| 協力企画 | 斎藤晃 | 文部省学術国際局国際企画課 教育文化交流室文部事務官 |
| 技術協力 | 服部龍一 | 国際協力事業団農業開発協力部 農業開発課課長代理 |

1-3 調査日程

| 日順 | 日程 | 調査内容 |
|----|----------|---|
| 1 | 3月19日(火) | 移動(成田→バンコク) |
| 2 | 20日(水) | 日本大使館及びJICA事務所と打合せ 総理府技術経済協力局(DTEC)と打合せ 科学技術エネルギー省(MOSTE)と打合せ |
| 3 | 21日(木) | カセサート大学と打合せ 移動(バンコク→チェンマイ) |
| 4 | 22日(金) | チェンマイ大学と打合せ |
| 5 | 23日(土) | マエジョ農工大学と打合せ 現地調査 |
| 6 | 24日(日) | 資料整理 |
| 7 | 25日(月) | チェンマイ大学及びマエジョ農工大学との協議 |
| 8 | 26日(火) | 団員打合せ 移動(チェンマイ→バンコク) |
| 9 | 27日(水) | JICA事務所で中間報告及び打合せ |
| 10 | 28日(木) | 団長レター作成 |
| 11 | 29日(金) | 団長レター提出 日本大使館及びJICA事務所報告 |
| 12 | 30日(土) | 移動(バンコク→成田) |

1-4 面談者リスト

総理府技術経済協力局 (DTEC)

Chief, Japan Sub - Division
Japan Sub - Division

TIPSUDA NOPMONGCOL
VUDHISIT VIRYASIRI

科学技術エネルギー省 (MOSTE)

Deputy Permanent Secretary
NCGEB 所長

Dr. PRATHES SUTABUTR
Prof. YONGYUTH YURTHAVONG

カセサート大学

President
Vice - President for Planning
and Development
Vice - President for Research
and Academic Affairs

Ph. D. SUTHARM AREEKUL
Prof. Dr. SUJIN JINAHYON
Ph. D. THIRA SUTABUTRA

KU - Japan Project (カセサート大学研究協力 (II) 計画)

チームリーダー
業務調整

堤 利 夫
井 尻 民 雄

チェンマイ大学

President
Vice President for Reserch
and Planning
Director Institute for Science &
Technology Research & Development
Vice Director Department of
Horticulture Faculty of Agriture

M. D. Prf. KASEM WATANACHAI
M. D. CHOTI THEETRANONT
Assoc. Prof. Dr.
THIRAPHAT VILAITHONG
Ph. D. PINMCHAI APAVATJRUT

マエジョ農工大学

President
Dean
Vice - President (Special Affairs)
Vice - President (Academic Affairs)
Vice - Dean
Deputy Director

Ph. D. AHNON TIANGTRONG
VICHAI TANVATANAGUL
Ph. D. BOONRAWD SUPA - UDOMLERK
SARAN PERMPOOL
Assist. Prof. SWING PENG - ONT
SIRICHAJ UNSRISONG
Assist. Prof. PISOOT NIUMSUP

日本大使館
一等書記官

平 島 和 男

JICA タイ事務所
所 長
副 参 事

阿 部 信 司
三 輪 哲 也

2. 要 約

本件は、農産工業バイオテクノロジーセンター設立に関する協力要請であるが、センターの設立に当たっては、併せて無償資金協力の要請も出されている。しかしながら、無償資金協力に対する日本側の協力は困難と想定されていることから、本調査団を派遣し、無償資金協力を前提としないプロ技協の実施の可能性を検討することとした。

タイ側との協議・調査の結果では、「無償資金協力を前提としないプロ技協は要請できない。」とのタイ側の強い意向が確認された。このため、本件技術協力の可能性は低いものと判断し、その旨を団長レターに記して手交した。

なお、本調査団としては、結果的にタイ側の本件要請に関するプロ技協のみの実施の意向についての確認に主眼を置くこととなり、要請のあった案件に対する詳細な調査・検討は行わなかった。

3. タイ国におけるバイオテクノロジーと農産工業

3-1 国家開発計画におけるバイオテクノロジーと農産工業の位置づけ

第6次国家経済社会開発計画（1987～1991）は、科学技術の興振、産業開発、市場及び雇用機会の拡大がうたわれているが、中でも科学技術についてはバイオテクノロジー、金属材料科学、電子・コンピュータ技術の強化にその目標が置かれている。

国立遺伝子工学バイオテクノロジーセンター（NCGEB）は、この国家開発計画を受けて1983年に科学技術エネルギー省内に設立されたもので、本件農産工業バイオテクノロジーセンター（NABC）は、NCGEBバイオテクノロジーネットワークにおけるバイオテクノロジー研究の北タイ地方での要として位置づけられている。

3-2 バイオテクノロジー研究の現状と問題点

タイにおけるバイオテクノロジー研究は、NCGEBで統括されている。NCGEBから補助を受けている研究課題をみると、農業生産に直結した課題が多く、基礎研究に属する課題は少なく、今後の発展のためには以下の様な問題点があげられる。

(1) バイテク分野での研究者のうち、大学院修士あるいは博士号の取得者の分布は、全国で455名、そのうち390名はバンコク首都圏に集中しており、極端な地域偏在がみられる(表1)。

表1. タイ国の大学・機関において遺伝子工学・バイオテクノロジーに従事している研究者数(修士または博士号取得者)

| 大学・機関名 | 所在地 | 研究者数 |
|--------------|--------------|------|
| マヒドン大学 | バンコク | |
| 理学部 | | 50 |
| その他学部 | | 20 |
| チュラロンコン大学 | バンコク | |
| 理学部 | | 30 |
| その他学部 | | 20 |
| カセサート大学 | バンコク及びナコンパトム | 70 |
| キングモンクット工科大学 | バンコク(トンブリ) | 20 |
| アジア工科大学 | バンコク | 10 |
| チェンマイ大学 | チェンマイ | 20 |
| コンケン大学 | コンケン | 20 |
| プリンスオブソンクラ大学 | ソンクラ | 10 |
| シナカリンピロート大学 | バンコク | 20 |
| 農業局 | バンコク | 75 |
| 医科学局 | バンコク | 20 |
| タイ国赤十字 | バンコク | 20 |
| タイ国科学技術研究所 | バンコク | 30 |
| 食品科学研究所 | バンコク | 10 |
| マエジョ農工大学 | チェンマイ | 10 |
| 合計 | | 455 |

(2) 全大学のバイオテク分野からの学部卒業生は2,070名あるが、関連部門での従事者数は2割程度にすぎない(表2)。

表2. タイ国の諸大学における遺伝子工学・バイオテクノロジー関連分野の学部卒業生数

| 分 野 | 大 学 | | | | | | | 合 計 | |
|---------|-----|-----|-----|------|-----|-----|-----|-----|-------|
| | CU | KU | MU | KMIT | KKU | CMU | PSU | | |
| 農 学 | | 338 | | | | 170 | 137 | 85 | 730 |
| 生 化 学 | 16 | | | | | | | | 16 |
| 化 学 技 術 | 26 | | | 39 | | | | 12 | 77 |
| 化 学 工 学 | 49 | | | | | | | | 49 |
| 生 物 工 学 | | 12 | 22 | | | | | | 34 |
| 食 品 工 学 | 34 | 31 | | | | | 36 | | 101 |
| 獣 医 学 | 45 | 51 | | | | | | | 91 |
| 遺 伝 学 | 7 | | | | | | | | 7 |
| 医 学 | 137 | | 416 | | 70 | 114 | 75 | | 812 |
| 微 生 物 学 | 22 | | | 10 | | | | | 32 |
| 衛 生 工 学 | 17 | | | | | | | | 17 |
| 環 境 工 学 | | | | | 6 | 16 | | | 22 |
| 水産学・養殖学 | | 65 | | | | | | 14 | 79 |
| 海 洋 科 学 | 3 | | | | | | | | 3 |
| 合 計 | 356 | 497 | 438 | 49 | 246 | 303 | 186 | | 2,070 |

CU: チュラロンコン大学 KU: カセサート大学 MU: マヒドン大学
 KMIT: キングモンクット工科大学 KKU: コンケン大学 CMU: チェンマイ大学
 PSU: プリンズ オブ ソンクラ大学
 1986年卒業生

(3) 大学での研究者の過半数は欧米で修士または博士号を取得しており、帰国後バイオテク分野での研究に従事しているが、その分布の偏りなどから、教育体制に問題がある。

(4) バイオテク分野での研究が実施されている大学での研究課題をみるとそれぞれ特色がみられるが、研究者の絶対数が少なくまた全体を通じて基礎的研究の充実が望まれる(表3)。

表3. 国立遺伝子工学バイオテクノロジーセンターによって研究費補助が行なわれている主な植物バイオテクノロジー課題

| 大学・機関 | 課題 | 内容 |
|---|---|--|
| 1. Kasetsart University (KU) | 売渡用ジャガイモ無病塊茎の供給技術 | 無病塊茎、特にウイルスフリー塊茎の獲得のために茎頂組織培養、馴化技術によって大量生産を目指す。 |
| 2. KU | 園芸作物の改良技術 | 切り花およびショウガの大量生産を組織培養によって行なう。突然変異株を得るためにガンマー線照射を併用する。 |
| 3. KU | タイに特異的な植物の維持 | タイに特有な重要な植物を維持するテクニックを開発する。ジャックフルーツの組織培養など。 |
| 4. Mahidol University (MU) | ディソゲニン高産生の <i>Costus lacerus</i> の検索と供給 | ディソゲニン(一種のアルカロイド)高産生の <i>Costus lacerus</i> の株を検索し、大量生産を目指す。茎の節間の組織培養。 |
| 5. Prince of Songkla University (PSU) | 油ヤシの改良と供給技術の開発 | 高品質の油ヤシの大量供給を組織培養によって目指す。 |
| 6. Chulalongkorn University (CU) | イネと窒素固定細菌の相互作用 | 肥料の使用を減少させるために窒素固定細菌の能力を活用する。イネ根面への細菌付着能はイネのレクチンと高い相関があることを予備研究で確認済み。 |
| 7. KU | 堆肥生産への微生物利用 | セルロース分解能を有する微生物を堆肥生産に利用する。 |
| 8. Institute of Sci. and Technol. Res. (ISTR) | マメ科植物の菌根菌と窒素固定細菌の活用 | 植物のリン酸吸収を促進する菌根菌と窒素固定細菌を活用し、肥料使用の減少を図る。 |
| 9. ISTR | 水田における窒素固定青緑藻の利用 | 窒素固定能を有する青緑藻を検索し、水稻の増収を図る。 |
| 10. PSU | 高収量ゴムの検索と交配 | 高品質のゴム苗を得るためにクローンの酵素活性を検討し、優良クローンの選別と交配を図る。 |
| 11. CU | シイタケ栽培のバイオテクノロジー開発 | 生木ではなく、堆肥を利用したシイタケ栽培の技術を開発する。 |

- (5) 各大学でのバイテク分野での研究の実体を聞いてみると、研究機器の購入、更新の予算の少ないことに加え、消耗品など実験実施に必要な予算が非常に少なく、外国からの援助に依存している。
- (6) カセサート大学のプロジェクトに本課題と関連の計画がみられるが、それは作物改良のための生物工学と育種、農業環境と品質保証技術、農業機械化技術の開発などを含んだ広範な計画である。対象作物にしても主として国内消費に必要な食品作物につき、耐病性育種などに重点をおいており、積極的に輸出を目指した園芸作物の品種改良を対象としたものではない。
- (7) オーストラリアはすでに実施しているアセアンにおけるバイテク援助に加え、バイテク技術を導入した園芸作物の品種改良について検討をしているようである。
- (8) バイテク分野での研究課程では、試験管内等の無菌の状態から、徐々に自然の栽培条件下に植物をなれさせる順化の過程が必要であり、またその生産性、品質を検定する育成過程が必要である。その両過程には対象となる植物の生育に適した環境条件の所が望ましく、その点から熱帯低地のバンコクより熱帯高地のチェンマイの方が良い立地条件にある。

3-3 農産工業の現状と問題点

タイの産業上の問題点は対外的にみればコメに依存してきた輸出品目の多核化であり、国内的には調和の取れた農業と工業の発展であり、またバンコク首都圏と北部・東北部の農村地帯の所得並びに生活較差の是正であろう(表4)。そのため北部の中心地チェンマイに本プロジェクトによるバイテクセンターが機能するようになればその貢献する所は大きい。以下のような問題があげられるであろう。

- (1) 稲作などの伝統的な農業には一応の体系は出来ているが、その生産性・品質の向上を更に図るには最近のバイテク技術の導入が有効である。しかし、前節で述べたようにこのことについてその指導体制は出来ていない。
- (2) コメだけでなく熱帯果樹、野菜、花などの輸出を推進するためには生産物の徹底した規格化、高品質化、出荷量の安定供給などが図られなければならない。この点について生産者の意識の改革と共に、生産技術のきめこまかな指導とその体制の確立が必要となる。
- (3) 熱帯果樹、野菜、花などの輸出を図るためには、上記の目的に沿った高品質の形質をもつ品種の育成と、更に輸出上の障害となる防除上の問題点を克服するのが望ましい。そのためにはバイテク技術の導入は有効な手段となるであろう。
- (4) 輸出品目の付加価値を更に高めるためには、消費者の動向に対応した生産物の形、色、味、香りなどの形質の急速な改良が必要となる。この点従来の農業技術に期待は出来ず、高度のバイテク技術を駆使する必要がある。
- (5) タイにおいても自給自足の段階から生産地と消費地の分化が起きてきているがその対応は十分でない。つまり、生産物の収穫・加工・流通・貯蔵などについては、それぞれに適した品種・栽培などの検討が必要であるがまだその対応は出来ていないように思われる。
- (6) 近年、人件費の高騰から農業生産の一部については、韓国、台湾を経てタイに依存する割合が高まってきている。しかしイチゴ、エダマメ、アスパラなどの温帯作物についての栽培技術

の指導体制は出来ておらず、このままでは生産性に問題がある。品質についてもタイの気候に適合した品種の育成を、バイオテク技術を利用して早急に図る必要がある。

- (7) バイテク技術の導入を図ることにより、産業構造の一体化、更に産業化、工業化を促進する効果が期待できるであろう。

表4. タイ国の地方別一世帯収支の平均値（一か月当り）

単位：バーツ（＝約6円）

| 地 方 | 収 入 | | 支 出 | | 収 支 | |
|-------|-------|-------|-------|-------|------|-------|
| | 1986 | 1988* | 1986 | 1988* | 1986 | 1988* |
| 全 国 | 3,631 | 4,042 | 3,783 | 4,314 | -152 | -272 |
| 首都圏** | 6,949 | 7,793 | 6,527 | 8,074 | +422 | -281 |
| 中 部 | 4,006 | 4,106 | 4,187 | 4,310 | -181 | -204 |
| 北 部 | 3,106 | 3,444 | 3,242 | 3,576 | -136 | -132 |
| 東北部 | 2,555 | 2,961 | 2,854 | 3,356 | -299 | -395 |
| 南部 | 3,657 | 3,938 | 3,901 | 4,225 | -244 | -287 |

統計局の家庭経済社会状況調査による

* 1988年上半期のみ平均値

** ノンタブリ、パトムタニ、サムットプラカンを含む

Siam Business News Vol 2, No. 165(1989)による

3-4 関係機関（行政及び研究機関）の組織と機能

中央行政組織のうち、農業省、科学技術エネルギー省、保健省、工業省、大学省の5省が、それぞれの試験研究機関・大学において、バイオテクノロジー関連の研究開発を進めてきたが、既に述べたように、1983年にタイ国政府は科学技術エネルギー省内に「国立遺伝子工学バイオテクノロジーセンター（NCGEB）」を設置し、タイ全土の遺伝子工学及びバイオテク関連の研究開発を総合調整する組織をスタートさせた。このセンターは、全国の大学及び研究機関における研究に対し、研究費の補助と共同研究の促進を行うことによって、タイ国におけるバイオテク研究を振興・調整する研究行政的役割を果たしているが、直轄の研究拠点施設や研究者を有しておらず、その機能を十分に発揮しているとはいえない。

また諸外国の大学との一般的な学術交流の推進は、科学技術エネルギー省所管の「タイ国学術研究会議（NRCT）」が当たっているが、この組織には予算が極めて少なく、バイオテクの展開をバックアップするような資金体制を持っていない。

3-5 バイオテクノロジーと農産工業に係る第三国及び国際機関等の援助動向

国立遺伝子工学バイオテクノロジーセンター（NCGEB）は、諸外国との共同研究や専門家の派遣を通して、下記の国々や機関からバイテク関係の援助を受けている。

〔英 国〕 英国バイオテクノロジー研究所の Dr.G.Holt 教授訪タイした際に、NCGEB とブリティッシュ・カウンシルの Dr.M.Nance と共に協議が行われた結果、酵素を利用するバイテク、特に炭水化物の変換、抗生物質や診断用薬剤の生産に関する共同研究を推進しており、将来は遺伝子操作を行った酵母を工業的に利用する方向をめざしている。

〔オーストラリア〕 オーストラリア国際開発援助局（AIDAB）の援助により、植物の薬効成分についての研究開発と、炭水化物の変換に役立つ細胞や酵素の生産と利用の二つの共同研究が、アセアン-オーストラリア・バイテク計画のもとで、1989-1991年の3年間行われている。また園芸・花卉産業へのバイテクの応用も実用的な商業ベースからの検討が進められている。

〔オランダ〕 植物の遺伝子工学とバイオテクノロジーの現状についてのワークショップが開催された。

〔アメリカ合衆国〕 ロックフェラー財団は NCGEB と協力して、タイにおいてバイテクを用いた稲の育種事業を1989年にスタートさせ、現在約10課題に対して援助している。また研究奨学金制度も設けている。

〔アセアン機構〕 前述のオーストラリア政府の資金援助により、食品分野と産業廃棄物の有効利用分野の共同研究が進められている。

〔日 本〕 工業省関連では醗酵プラント技術援助、チュラロンコン大学へのバイテク機材供与、カセサート大学への研究協力などがあるが、現在計画準備中のものでタイ国立農産工業バイオテクノロジーセンターがあげられている。

その他諸外国からの研究奨学金による学部、大学院レベルのバイテク関係の留学の機会が、アメリカ合衆国、英国、日本、オーストラリア、ノルウェー、カナダ、フランスから与えられている。

以上を総括すると、オーストラリアによる援助が最も組織的に行われ、拡大の方向をたどっている。

4. 国立遺伝子工学バイオテクノロジーセンター (NCGEB) について

4-1 設立の目的

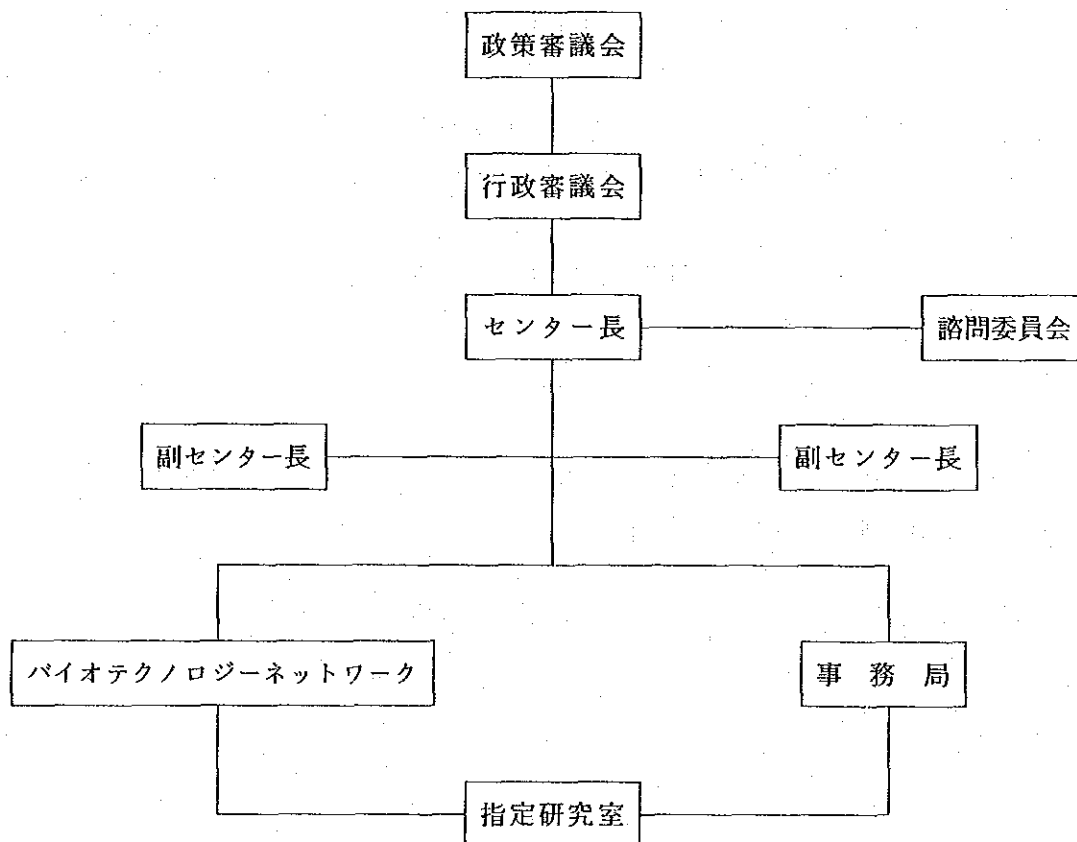
国立遺伝子工学バイオテクノロジーセンターは、特定分野の研究援助、学究部門と私部門間の情報交換、情報提供、国内外における科学者の集会の奨励、私部門への技術移転調整を行うことを目的としている。

4-2 センターの実施体制

(1) 組織及び予算

NCGEBは、政策審議会 (Policy Board)、行政審議会 (Executive Board)、諮問委員会 (Advisory Board)、技術小委員会 (Technical Subcommittee) 及び事務局により組織されている。

(国立遺伝子工学バイオテクノロジーセンター組織)



政策審議会： 科学技術エネルギー大臣を長とし、NCGEBの政策を決定し、行政審議会や小委員会の構成員を選考する。

行政審議会： 科学者、省庁、研究機関関係者により構成され、NCGEBの所長・副所長の任命、事業や予算の監督、事業の決定評価を行う。

諮問委員会： 所長及び副所長と共に、政策審議会及び行政審議会の決定した事業計画を遂行する。

1988年度から1990年度までの予算は下記の通りである。

| | | 1988年度 | 1889年度 | 1990年度 |
|----|--------|--------------------------|--------------------------|--------------------------|
| 収入 | 国費 | 28,514,400バーツ (100%) | 30,001,900バーツ (100%) | 35,240,000バーツ (100%) |
| 支出 | 研究開発事業 | 23,291,800バーツ (81.7%) | 23,291,800バーツ (77.6%) | 30,735,000バーツ (87.2%) |
| | 研究サービス | 3,130,700バーツ (10.9%) | 4,907,000バーツ (16.4%) | 2,427,300バーツ (6.8%) |
| 出 | 事務費 | 2,091,900バーツ (7.4%) | 1,803,100バーツ (6.0%) | 2,077,800バーツ (6.0%) |

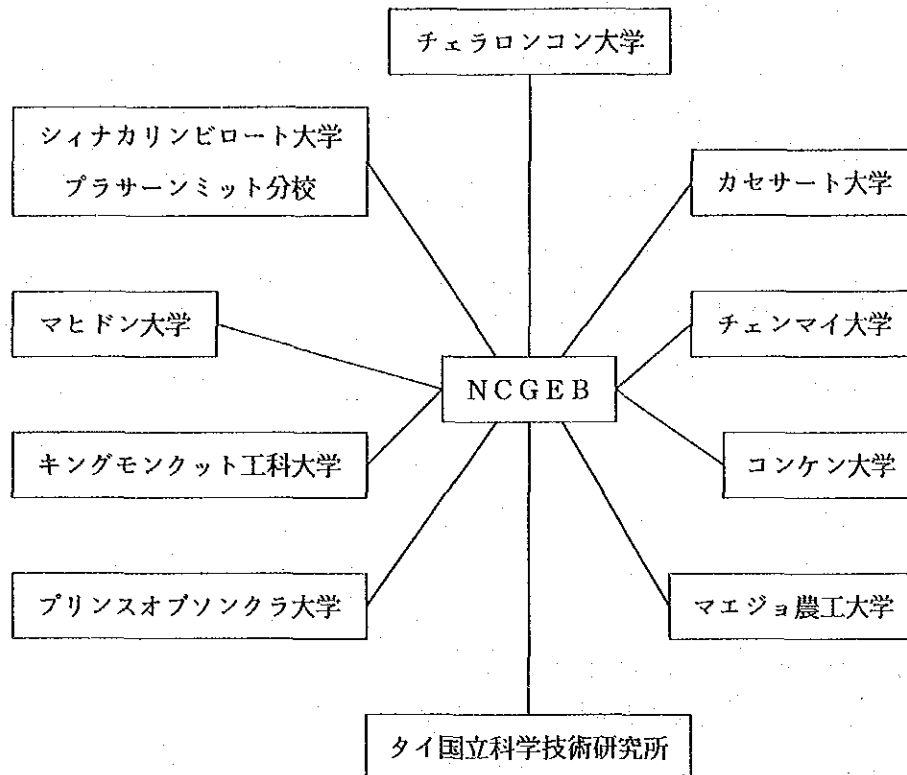
(2) 業務実施方針と活動計画

NCGEBは、国内各地の大学や研究機関における遺伝子工学及びバイオテクノロジーの①工業への応用、②農業への応用、③公衆衛生、エネルギー環境への応用、④インフラストラクチャーの強化、の研究開発を企画、推進するため、国内の社会経済的重要性に鑑み、下記の12分野を研究課題として選定し、活動を行っている。

- 1) 特定酵素を用いたデンプンの生体変化
- 2) 工業用のアミノ酸などの有機酸の製造
- 3) 試験工場の開発、設計、建設
- 4) 家畜開発のためのバイオテクノロジー
- 5) 農業、アグロ産業開発のための植物組織培養と遺伝子工学
- 6) 改良リゾビウム、有機肥料、菌根、その他窒素固定作用を助ける微生物の製造
- 7) 天然ゴムの開発
- 8) 病原媒介動物抑制のためのバイオ物質の製造
- 9) バイオガスの製造
- 10) 工業廃棄物の利用
- 11) バイオテクノロジー及び遺伝子工学によるワクチン、診断薬の製造
- 12) 遺伝子工学及びバイオテクノロジーのインフラストラクチャーの強化

また、下記の9大学、1研究機関とのバイオテクノロジーネットワークを組織し、協力関係を促進している。更に、政府関係省庁、私部門とも密接な協力関係を保ち、実験室から産業界への技術移転に力を入れている。

〔 国立遺伝子工学バイオテクノロジーセンター (NCGEB) を
中心としたバイオテクノロジーネットワーク 〕



(3) 実施中の業務内容 (研究支援・調整等)

NCGEBでは、特定分野のバイオテクノロジーを推進し、私部門を含めあらゆる関係者のための研究開発センターとして機能するため、下記の機関を設置し、財政面を含む研究支援を行っている。

- 1) カセサート大学 カンベンセン分校 植物遺伝子工学ユニット
- 2) マヒドン大学 細胞レベル遺伝子工学ユニット
- 3) チェラロンコン大学 シチャン海洋学研究訓練所 海洋バイオテクノロジー実験室
- 4) キングモンクット工科大学 化学工学・試験工場 研究開発ユニット
- 5) タイ科学工学研究所 微生物学ユニット

この他、NCGEBは大学院生への研究助成、学生・研究者に対する海外留学スカラーシップ授与、国際交流活動、情報の収集・提供も行っている。

5. 国立農産工業バイオテクノロジー計画に係る技術協力について

5-1 要請の背景と経緯

国立遺伝子工学バイオテクノロジーセンターはバイオテクノロジーによって高付加価値生産物の増強に貢献する素材を開発し、その実用化によって輸出振興を図る政策を推進することとして設立されたものであるが、その活動は緒についたばかりで、研究者、研究拠点施設共に整備不十分な状況となっている。

このため同国政府は、農業の中心地である北タイ地方にNCGEBネットワークの一環として、また、同地域における農業振興と併せて農業者研修の場の拠点として国立農産工業バイオテクノロジーセンターの創設を計画し、本センターに係る技術協力と無償資金協力を要請してきたものである。

なお、6の「プロジェクト方式技術協力の実施の可能性について」において述べているように、タイ側は「無償資金協力を前提としないプロ技協は要請できない」として、既に提出されている要請書は変更しない方針を調査団との協議の中で強く主張した。

このため、以下の「要請内容」は、現在要請されているものについて述べたものであり、無償を前提としたものとなっている。

5-2 要請内容の検討

(1) 技術協力の目的と上位計画との関連

タイ国における農産工業を振興し、植物バイオテクノロジーの研究開発及び生産部門への技術移転を支援することは、第6次経済社会開発計画（1987-1991年）に強調されている科学技術の振興、産業の育成、マーケット及び雇用機会の拡大、貿易不均衡の改善などに大きく貢献するものである。

具体的な技術協力の目的を達成することにより以下の効果をもたらし、所得と経済発展成果の地方への分散が可能となる。

- 1) 植物バイオテクノロジーを農産工業振興の原動力として提供できる。
- 2) バイテクの共同研究、研修並びに生産部門への技術移転のための共同利用国立研究開発センターとして機能させるとともに、アセアン諸国の国際研修センターとしても機能させることができる。
- 3) 農産物の品質向上に資するとともに、高付加価値の農産物を効率的に生産するための新技術を開発し、輸出振興に役立たせることができる。

(2) 技術協力の項目と達成目標（期待される効果）

- 1) 熱帯高地で熱帯並びに温帯作物の栽培可能なチェンマイにバイテクセンターが出来れば、バンコクとまた異なった立地条件のもとで、特に園芸作物についてバイテク技術の応用による広範な品種の育成が期待される。

- 2) 本センターはカセサート大の施設と異なり、NCGEBを通じて外部に開かれた施設であり、大学だけでなくその他の県あるいは民間の研究機関の共同利用センターであり、情報交換、研究の進展が期待される。
- 3) 人口過密のバンコクと異なり、広大なキャンパスのチェンマイでは本センター地にも広いスペースが当てられおり、研究・教育だけでなく、アセアン諸国からのバイテク技術の研修地としても立地条件はすぐれており、その効果が期待される。
- 4) チェンマイ大のカセム学長によれば、北部タイには1千万の人口が在り、山地民族50万の人口を加え、観光収入以外にバイテク技術応用による新しい農業の産地形成が出来れば、その寄与するところは大きいと思われる。

(3) 専門家派遣、研修員受入、機材供与等の内容

1) 専門家派遣

要請のあった技協分野は、次のように三つの柱からなっている。

① 植物バイオテクノロジー

a. 植物組織培養

組織培養研究により、耐病性の強い熱帯果樹、花卉、薬用植物等を作り出す。

b. 植物遺伝資源及び遺伝子工学

植物遺伝資源の収集、登録、評価及び細胞レベルによる遺伝情報操作を行う。

② 制御環境下における研究評価

バイオテクノロジーにより生み出された植物を野外で研究評価する前に順化させるために制御された環境の中で評価する。

③ 農産工業へのバイオテクノロジーの適用

a. 輸出用果物、野菜生産物のポストハーベスト、品質管理

b. 高付加価値農産物への転換技術の開発

c. 「サイエンスパーク」概念の導入による官民協力の促進

これらの協力分野に関して、以下の専門家派遣計画の要請となっている。

| | 分 野 | 人数 (1年目) | 人数 (2年目) | 人数 (合計) |
|---|-----------------|----------|----------|---------|
| 1 | リーダー | 1 | (継続) | 1 |
| 2 | 植物組織培養 | 2 | 2 | 4 |
| 3 | 植物遺伝子 | 2 | 2 | 4 |
| 4 | 制御環境下におけ遺伝子工学研究 | 1 | 2 | 3 |
| 5 | 収穫後技術 | 1 | 2 | 3 |
| 6 | 生物化学工学 | 1 | 2 | 3 |
| 7 | 短期専門家 | 4 | 4 | 8 |

2) 研修員受入

植物バイオテクノロジー、制御環境下における研究評価、農産工業へのバイオテクノロジーの適用についての日本における研修要請が含まれているが、詳細については未定となっている。

3) 機材供与等

NABCにおけるバイオテクノロジー研究及び研修研修に必要な機材で、走査電子顕微鏡等の各種顕微鏡、アミノ酸分析器等の各種分析機器、その他の各種測定器等を含む試験研究機器の他、研究棟、パイロットプラント、ファイトロン（人工気象室）、グリーンハウス等の施設建設についても要請が出されており、概算総額は約26億円となっている。

試験研究機器関係 11億円

建物関係 15億円

6. プロジェクト方式技術協力の実施の可能性について

今回の調査団派遣の前提であった「日本側においては無償資金協力による対応が困難である」との立場から、タイ側に対してプロ技協のみで実施することが可能かどうかについて、質問と説得を繰り返して試みた。

しかしタイ側からは、「要請の中心である無償資金協力による施設やバイテク関連研究機材の整備をタイ側で対応することは全く不可能であること。特に植物バイテクに係る研究開発の技術協力を行うに当たって不可欠である高額な設備・機材の整備は、プロ技協による機材ではあまりにも少なく問題にならない。もしプロ技協を実施する場合でも、国立センターとしての体をなさないので、大学間で、独自にやってほしい。」との強い意向が表明された。

これらの事情を考慮して、1991年3月29日付で、タイ側に提出した団長レター（付属資料）には、「現在のタイ国の状況では、要請のあった案件に対するプロ技協の実施の可能性は低いものと思われる。」と記さざるを得なかった。

従って今回の調査団は、タイ側からの要請のあった無償資金を前提とした要請内容自体の具体的な検討は行わなかった。

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No.520/3 H

March 29, 1991

Prof.Dr. Yongyuth Yuthavong
Director
National Center for Genetic
Engineering and Biotechnology
Ministry of Science, Technology
and Energy
Bangkok 10400, Thailand

Subject : Report of the JICA Preliminary Survey Team for
the National Agroindustrial Biotechnology Center
Project in Thailand

Dear Sir,


The Japan International Cooperation Agency Preliminary Survey Team (hereinafter referred to as "the team") headed by Dr. Masanao UMEBAYASHI, Professor, Department of Agricultural Chemistry, Faculty of Bioresources, Mie University, has been dispatched by the Japan International Cooperation Agency with regard to clarify the background and the content of the project. During its stay in the Kingdom of Thailand from March 19 to March 30, 1991, the team had a series of discussions with the authorities concerned.

It is my pleasure to have herewith the proposed plan and documents related to the ESTABLISHMENT OF NATIONAL AGROINDUSTRIAL BIOTECHNOLOGY CENTER (see ANNEX). I will convey this proposed plan to the Japanese authorities concerned for its feasibility study. The both sides, however, could not reach the mutual compromise for setting up this project. The Thai side implied, through the discussions, that they didn't accept the alternative plan "the Project-Type Technical Cooperation", as long as the future possibility of the grant aid programme is not specified.

I feel further discussion in Japan is needed from our preliminary survey regarding the possibility of "Project-Type Technical Cooperation" to the proposed project under the present circumstances in Thailand, but I understand that there is less possibility of its implementation.

I would like to take this opportunity to express my sincere appreciation for the warm cooperation and kindful arrangement extended to us during our stay.

Sincerely yours,



Prof. Dr. Masanao UMEBAYASHI
Team Leader
JICA Preliminary Survey Team

cc. Department of Technical and Economic Cooperation
Embassy of Japan
JICA Thailand Office

Technical Cooperation

The Application Form for Japan's Grant Aid

| | |
|--|---|
| Applicant The Government of <u>Thailand</u> | Project Title <u>Establishment of National Agroindustrial Biotechnology Center (NABC)</u> |
|--|---|

| | |
|--|--|
| Economic Sector <u>Overseas Development</u> <u>Assistance-The Japan International</u> <u>Co-operation Agency</u> | Project Type 1. Facilities Construction 2. Equipment Supply 3. Training |
|--|--|

Total Project Cost Y 3,000 million

| | |
|--|--|
| Responsible Ministry (Ministry requesting the aid) <u>Ministry of Science, Technology and Energy</u> | Implementing Agency (Agency in charge of execution of the project) <u>National Center for Genetic Engineering and Biotechnology</u> |
|--|--|

I Project Description

1. Background (Please describe in detail)

(1) Current Situation of the Sector

The National Center for Genetic Engineering and Biotechnology (NCGEB) was established in September 1983 under the Ministry of Science, Technology and Energy to be the focal point for strengthening Thailand capabilities in genetic engineering and biotechnology, and for applying them to national economic and social development. In performing these functions, the NCGEB promotes research in wide-ranging areas, from gene and cell manipulation through biomaterial processing and improvement to areas of biochemical engineering and technology with good potential for development in Thailand. The NCGEB also promotes industry-university links in relevant projects and activates selected programs by coordinating support from government and international sources to the several institutions active in the field of genetic engineering and biotechnology.

The areas of agroindustries and agricultural applications form a focus of interest of NCGEB. In these and other areas of research and development the NCGEB forms a network with 10 major institutions in Thailand as follows:

1. Chiang Mai University
2. Chulalongkorn University
3. Kasetsart University
4. Khon Kaen University
5. King Mongkut's Institute of Technology Thonburi
6. Maejo Institute of Agricultural Technology
7. Mahidol University
8. Prince of Songkhla University
9. Srinakharinwirot University ; Prasan Mit Campus
10. Thailand Institute of Scientific and Technological Research

In the proposed establishment of NABC, the NCGEB will place emphasis on cooperation with Chiang Mai University and Maejo Institute of Agricultural Technology, so that the center is established in Chiang Mai as focus of the cooperative activities.

(2) Problems to be solved in the Sector

- . low efficiency of agricultural production in the North of Thailand
- . lack of new technology for conversion of agricultural products to higher value-added agroindustrial products especially for export orientation
- . lack of technology transfer center especially in agroindustry field from the public to production sector

(3) Necessity and Importance of Improvement in the Sector which lead to the formulation of the project

The proposed project is necessary for implementation of the future activities of NCGEB, namely to establish facilities for R&D, training and support activities with special personnel, recruited from specially gifted students presently trained on a special program on agroindustry and other areas of biotechnology. The NCGEB will use the National Agroindustrial Biotechnology Center as the model for co-operation among network institute and linkage with the production sector.

(4) Relation between the Sector and the Project

Project activities will be coordinated by NCGEB, the Ministry of Science, Technology and Energy, with the supports of the member of the network institutions including Chiang Mai University (CMU), Maejo Institute of Agricultural Technology (MIAT) and other universities.

(5) Reasons why Japan's Grant Aid is requested for this particular Project

The Overseas Development Assistant (ODA) would help Asian countries in joint collaboration programme in biotechnology between Japan and Thailand.

Thailand will gain substantially in the development of agroindustrial biotechnology with the help of Japan. This will help to promote export of agroindustrial products to Japan among other countries, thereby helping in achieving a better balance of trade with Japan, in accordance with the policies agreed upon by both countries.

Japan will also gain from this project, since it will gain experience in helping Thailand producing and processing agricultural products. Thailand is rich in bioresources, many of which Japan would be interested in having access.

Another very attractive reason is the possibility that Thailand and Japan can jointly use this proposed center as regional training center for agroindustrial biotechnology, which can give training to personnel from neighbour countries with which both Thailand and Japan have common interest in forming technological and trade relations.

2. Objectives and Outline of the Project

(1) Objectives of the Project

(i) Short-term Objectives

- To set up the National Agroindustrial Biotechnology Center (NABC) research building, control environment facilities, and information office at Chiang Mai University, Maejo Institute of Agricultural Technology, and Ministry of Science, Technology and Energy.
- To establish close co-operation in research of integrated-approach programme between Thai researchers in NABC and Japanese researchers.

- To examine the physiological performance of plantlets produced by meristem culture or tissue culture technology prior to field studies.
- To determine the optimum environmental conditions for plant growth and development in order to obtain maximum economic yield of particular plant species.
- To define the effects of climatic, edaphic and biotic factors on growth and yield of plants grown under field conditions.

(ii) Medium and Long-term Objectives

- To continue having close collaboration of interdisciplinary research programmes so that the outcome of research work can be applied to agroindustry of the country for export-oriented.
- To be training Center for researchers both from Thailand and from overseas with the emphasis on Indochina and South East Asian countries of tropical and sub-tropical regions.
- To provide information on, and an understanding of, the mechanisms involved in the adaptation of plant species which lead to the selection of better adapted and higher yielding cultivars for particular environments.
- To promote agroindustries for commercial production of plant species suggested by the NABC for export and there improve the trade balance of Thailand.

(iii) Please describe relations between the project and objectives, and how the project will contribute to the accomplishment of the objectives.

The establishment of NABC will definitely contribute to the accomplishment of the objectives for various reasons

1. The Project main site is in Chiang Mai located in the North where agriculture is different from other regions of the country in that many crops suitably grown there are of "high-value" commodities e.g. flowers, coffee, vegetables, and some are unique i.e., sub-tropical and temperate fruits as longon, lichee, peaches, apple, pear and persimmon.

Although these crops can be grown, however, very little has been done for varietal improvement and development of post-harvest and processing technology. In order to promote exporting of these produces, and to meet the requirement of international markets research and development programmes in biotechnology and agroindustry have to be initiated at the soonest since there is no organization at the national level responsible for integrated-approach research with the emphasis on these crops.

2. At present, personnel in the two main implementing agencies i.e., Chiang Mai University and Majeo Institute of Agricultural and Technology are comprised of various research teams in biotechnology and agroindustry fields. However, some of these cannot work at their highest capacity due to the lack of necessary equipment. The establishment of NABC will help to reduce the pressure and with co-operation between institutes both in the North and other regions, the accomplishment of the objective will be obtained.
3. Northern region is known to be the gem of Thailand for natural resources. Despite of this very little has been utilized from such resources. It is anticipated that with the NABC set up in the region, it will definitely assist to obtain the success in highest utilization of such resources in the most effective ways i.e., via the production of "high-value-added" natural products such as pesticidal and pharmaceutical purposes.
4. In addition, the controlled environment facilities are seen as important research tools of the plant biotechnology in studying the responses of plants to environmental factors and determining the precise limits of productivity of plants. They provide essential links between plant

biotechnology research laboratories and production sectors including agroindustries.

(2) Outline of the Project (Please give a full description of each facility and equipment and their detailed specifications.)

- . Construction of plant biotechnology main building, controlled environmental green houses, and agroindustry pilot plants in Chiang Mai and construction of co-ordination and support center in Bangkok
- . Training activities in Japan and Thailand.
- . R&D activities and technology transfer
- . Preliminary equipment list for NABC.

| <u>Item</u> | <u>Description</u> | <u>Quantity</u> |
|-------------|---|-----------------|
| 1. | Research light microscope | 2 |
| 2. | Research stereo microscope | 2 |
| 3. | Research invertech microscope | 1 |
| 4. | Scanning electron microscope | 1 |
| 5. | Transmission electron microscope | 1 |
| 6. | Shadow casting machine | 1 |
| 7. | Freeze etching machine | 1 |
| 8. | Sample preparation machine for scanning electron microscope | 1 |
| 9. | Ultramicrotome | 1 |
| 10. | Freezing microtome | 1 |
| 11. | Glass knife maker | 1 |
| 12. | Incubator | 2 |
| 13. | Amino acid analyzer | 1 |
| 14. | Gas chromatograph | 1 |
| 15. | High pressure liquid chromatograph | 1 |
| 16. | Freeze dryer | 1 |
| 17. | Kjeltex for N-analyzer | 1 |
| 18. | Rotary vacuum evaporator | 1 |
| 19. | Electronic balance | 3 |

| <u>Item</u> | <u>Description</u> | <u>Quantity</u> |
|-------------|--|-----------------|
| 20. | Shaker bath | 5 |
| 21. | Hot air oven | 2 |
| 22. | pH meter | 2 |
| 23. | Infrared for milk and analyzer | 1 |
| 24. | Moisture determinator balance | 1 |
| 25. | Spectrophotometer | 2 |
| 26. | Fibertex for cell wall analyzer | 1 |
| 27. | Ultra centrifuge | 1 |
| 28. | Refrigerated high speed centrifuge | 1 |
| 29. | Low temperature incubator | 2 |
| 30. | Deep freezer | 3 |
| 31. | ELISA-testing set | 1 |
| 32. | Analytical centrifuge | 1 |
| 33. | Cold room | 2 |
| 34. | Liquid nitrogen container | 4 |
| 35. | Freezing room | 1 |
| 36. | Laminar air flow | 4 |
| 37. | Transfer room | 2 |
| 38. | Desk top centrifuge | 2 |
| 39. | Shaker incubator | 3 |
| 40. | Shaker | 3 |
| 41. | Culture room for plant tissue culture | 1 |
| 42. | Phytotron | 5 |
| 43. | General equipment for electron microscopic film development and enlargement | 1 |
| 44. | General equipment for controlling temperature and moisture in 5 green house units | 5 |
| 45. | High pressure autoclave | 2 |
| 46. | Iodine value measurement set | 1 |
| 47. | Hydroxy value measurement set | 2 |

| <u>Item</u> | <u>Description</u> | <u>Quantity</u> |
|-------------|---|-----------------|
| 48. | Acid value measurement set | 1 |
| 49. | Melting point measurement set | 1 |
| 50. | Filter press | 1 |
| 51. | Pressing machine | 1 |
| 52. | Small pilot plant for hydrogenation of vegetable oil | 1 |
| 53. | Nitrogen tank | 1 |
| 54. | Fluidized bed dryer | 1 |
| 55. | Furnace 0-1200 Deg.C | 2 |
| 56. | Atomic absorption spectrophotometer | 1 |
| 57. | X-ray photographic equipment | 1 |
| 58. | Ultrasonic testing equipment | 1 |
| 59. | Colorimeter | 1 |
| 60. | Machine Shop equipment | 1 |
| 61. | Electronic shop equipment | 1 |
| 62. | Glass-blow equipment | 1 |
| 63. | Phytotron : Large room phytotron consists of 4 rooms (4.0 X 4.0 m) with natural light. Each room has its own machinery to maintain the temperature at the desired value. The temperatures range from 9° to 40°C (day) and 6° to 30°C (night). At least six mobile trolleys (1.0 X 1.0 m) provided in each room. | 1 |
| 64. | Superglasshouse : The approximate 9 X 15 X 3 m temperature-controlled glasshouse by air injection. Superglasshouse (contd.) the air may be cooled by the evaporative cooling obtained with the moist pad and fan technique. Day length control provided by artificial light bench (1.0 X 2.0 m) provided at least 9 benches for each glasshouse. | 5 |

| <u>Item</u> | <u>Description</u> | <u>Quantity</u> |
|-------------|---|-----------------|
| 65. | Electronic Balance 'Toploader' 0.001 - 1200 g | 2 |
| 66. | Electronic Balance 'Toploader' 0.01 - 8000 g | 2 |
| 67. | Electronic Balance 'Toploader' 0.1 - 3000 g | 2 |
| 68. | Electronic Analytical 'Toploader' 0.001 - 500 g | 2 |
| 69. | Data interfaces (bidirectional) | 1 |
| 70. | Forced-draught Oven 2 X 2 X 1.0 m | 2 |
| 71. | Electronic Planimeter (Leaf Area) | 1 |
| 72. | Electronic Seed Counter | 1 |
| 73. | Seed Cleaner and Sieve | 1 |
| 74. | Refrigerator (12 cu.f.) | 2 |
| 75. | Plant Material Mixer/Mill | 1 |
| 76. | Scintillation counter | 1 |
| 77. | Freezer (Large Size) | 1 |
| 78. | Quantum Sensor (Light Meter) | 1 |
| 79. | Tube Solarimeter | 1 |
| 80. | Meteorological Equipment (Complete Set) | 1 |
| 81. | Microcomputer 20 MB Hard Disk | 2 |
| 82. | Image Writer with Cables | 2 |
| 83. | Laser Writer with Cables | 1 |
| 84. | Vehicles : Station Sedan | 1 |
| 85. | Vehicles : Utility, 4 WD | 2 |
| 86. | Precision Camera (Complete Set) | 1 |

(3) Location Plan of each Facility and/or Equipment.

Located in Chiang Mai at Chiang Mai University and Maejo Institute of Agricultural Technology.

(4) Cost Estimates (Please describe in detail all the premises on which the cost estimates are based such as basic unit prices, inflation rate, foreign exchange rate, and so on. Please attach detailed tables of estimated costs of each facility and item of equipment. If estimated in local currency, please mention the latest exchange rate of the

currency to the U.S. dollar or the Japanese Yen.) The estimated cost of this project is Japanese Yen 3,000 million.

- | | | | |
|---------------------------------------|---|-------|---------|
| a) Experts/Consultants | Y | 200 | million |
| b) Training fellowships | Y | 200 | million |
| c) Laboratory equipment and materials | Y | 1,100 | million |
| d) Building construction | Y | 1,500 | million |
- (including green houses and pilot plants)

3. Benefit, Effect and Publicity of the Project

(1) Population that will benefit directly from the project

People privilege in the north of Thailand, and in the country as a whole. The private sector will also benefit from linkage with this project.

(2) Population that will benefit indirectly from the project

Thai people and Indochinese countries through training

(3) Area that will benefit from the project

The north of Thailand

(4) Economic and Social Effects of the Project (Please describe in detail)

(i) & (ii) Current Situation and Expected Effect of the Project

NABC can help to increase yield of agricultural products and to change them to agro-industry products for exportation. The success from biotechnology-based agroindustry research and development will improve the way of life of Thai people in the north and Thailand may be able to hope to shift from agriculture and low income status to semi-industrial and middle income status soon

(5) Publicity (How many people are expected to notice the benefit or positive effect of the project implemented with Japan's grant aid when it is completed.)

About 7 million people in agriculture and agro-industry part in the north of Thailand (National Statistical Office)

People in the whole country will also notice this as a model project, in which national effort is given to promote regional development through new technology.

4. Request to Other Donor

(1) Is there any request made to other donors for assistance closely related to this project

1. Yes / 2. No

(2) If yes, please fill in below:

(i) Name of donors, ----

(ii) Title and outline of the assistance;-

(iii) Possibilities that the donor will extend the assistance requested;-

(iv) In the case where other donors do not extend assistance, please describe in detail appropriateness and effectiveness of the project;-

(v) In the case where other donors extend loans, please describe the reason why Japan's Grant Aid is requested for the project;-

5. Priority

(Please describe priority of this project among other projects for which requested are made to Japan)

See Attachment I.

(Please attach project list with priorities)

6. Ministry and Agency in charge of the Project

(1) Outline of Implementing Agency (Please describe the detail)

(the Agency in charge of the execution of the project)

The National Center for Genetic Engineering and Biotechnology, Ministry of Science, Technology and Energy, Thailand.

(i) Organization Chart of the Agency (in general)

(Please mark the responsible department and division in charge of the project)

See Attachment II.

(Please attach detailed organization Chart pointing out the responsible department, division and sections in charge of this project)

(ii) Authorities and Duties of the Agency

The NCGEB plans and promotes research and development from the laboratory scale to the pilot scale, with emphasis on transfer and utilization of genetic engineering and biotechnology in the following of major areas:

1. Industrial applications
2. Agricultural applications
3. Public health, energy and environmental applications
4. Strengthening of infrastructure in genetic engineering and biotechnology

Under these guidelines, the NCGEB has also commissioned various studies on the status of specific technologies or industries, links and international links.

(iii) Personnel (Please mention the number of staff, workers, and employees of the agency and the responsible department, division and section in charge of the Project)

The number of personnel in the NCGEB is 15

(iv) Budget

Budget of the NCGEB (Revenue and Expenditure)

(1989) Revenue B 30,001,400 Expenditure B

(1990) Revenue B 35,240,100

\$1 = B 25.97

(2) Outline of Supervising Ministry (Please describe in detail)

(i) Organization Chart of the Ministry (in general)

See Attachment III.

(ii) Authorities and Duties of the Ministry

- * To lay out the policy, plan, scheme and project related to science, technology, energy and environment.
- * To control, conduct, command and perform the works related

to science, technology, energy and environment along the policy, plan, scheme and project for the efficient working and good co-ordination which will bring the most socio-economical benefit and the national stability.

- * To perform the working plan, follow up and evaluate the works related to science, technology energy and environment.
- * To improve the plan, scheme and project concerned to be always appropriate and modern.
- * To develop technology within the country towards the production and marketing.
- * To provide service and promote both the internal and external technology transfer.
- * To study, analyze, research and provide the significant data for science, technology, energy and environment.
- * To collect, compile and propagate the outcome of the research and the development related to science technology, energy and environment.

(iii) Personnel

The number of personnel in the Ministry of Science, Technology and Energy is 5,649.

(iv) Budget

Budget of the MOSTE (Revenue and Expenditure)

(1989) Revenue B 2,015,157,700 Expenditure B 1,878,171,050

(1990) Revenue B 2,862,066,300

U.S. \$ 1 = B 25.97

7. Preparation

- (1) Project Site (Please attach photographs and maps of the site with the various scales including that of 10,000:1)

- (i) (a) Address of the Site
- Maejo Institute of Agricultural Technology
Tambol Nong Han, Amphoe San Sai
Chiang Mai 50290
 - Chiang Mai University
130 Huai Kaew Rd., Amphoe Muang
Chiang Mai 50002
 - National Center for Genetic Engineering and Biotechnology
Ministry of Science, Technology and Energy
Rama VI Road, Bangkok 10400

(b) Total Area of the Site

- Approx. 20 acres

(ii) Land Preparation

- (a) To which extent has the land been expropriated for the project?

All is available for the project

- (b) When will the expropriation of the land be completed?

(No expropriation needed)

(Please attach the laws and procedures concerning the expropriation of land)

(2) Electricity, Water Supply, Telephone, Drainage and Other Facilities

(Please describe the extent to which above mentioned incidental facilities have been prepared)

All the basic facilities are already available, since the main building will be within the campus of already well-developed Chiang Mai University.

- (3) Is there any information, statistics and data regarding geographical, geological, meteorological, oceanographical situations, etc.

(If any, please attach those information)

(See Attachment IV.)

8. Capabilities of the Implementing Agency

(1) Current Situation (2) Problem of the Agency and (3) Improvement Plan

The NCGEB has been established for over 6 years and has obtained general recognition both locally and internationally as a leading agent for national biotechnology efforts. It has supported more than 50 research projects, many of which have been successfully concluded. It is currently the coordinating office for ASEAN-Australia Biotechnology Project (1989-1992), and other national and regional projects. To celebrate the 5th anniversary of its formation, it organized the International Symposium on Application of Biotechnology for Small Industries Development in Developing Countries. The Symposium was opened by the Prime Minister and was highly successful.

In technological, research the NCGEB coordinate the activities of four operational units in various institutes, ranging from molecular biology to pilot plant units. The NABC will be first unit outside Bangkok, and will have a much larger scope of operation than the other units. Both Chiang Mai University and Maejo Institute of Agricultural Technology are well established in the proposed activities.

9. Operation and Management of the Project

(1) Personnel

| | Current | When the Project is completed |
|--------------------------------|---------|-------------------------------|
| Supervising Ministry | 5,649 | - |
| Implementing Agency | 60 | - |
| Directly Responsible Personnel | 15 | - |

(2) Budget

| | 2 years ago (1988) | 1 year ago (1989) | Now (1990) | When the Proj will be compl |
|---------------------------------|-----------------------|----------------------|-----------------|--------------------------------|
| Supervising Ministry | B 556,822,000 | B 2,015,157,700 | B 2,862,066,300 | - |
| Implementing Agency | B 28,514,400 | B 30,001,400 | B 35,240,100 | - |
| Direct Budget of the project | | Y 385 m* | Y 425 m* | |

* Counter part from Thai Government

(In the case where additional budgetary allocation is needed for the implementation of the project, please answer the following question.)

(i) Has the additional budget been already allocated?

/ 1 Yes (tentative) 2 No

(ii) If no, has and when will the additional budget be allocated

(3) Technical Abilities of Local Staff

(i) Please describe technical abilities of local staff operating the project

- The NCGEB will contribute to research and development of biotechnology in Thailand through the R&D activities in Chiang Mai University, Maejo Institute of Agricultural Technology and other support agencies

(ii) Please describe in detail educational background of those who are in charge of the operation and management of the facilities and equipment.

1. Chiang Mai University and Maejo Institute of Agricultural Technology

Approximately 56 Ph.D., 39 M.Sc., and 13 Ph.D., 32 M.Sc. level researchers of Chiang Mai University and Maejo Institute of Agricultural Technology respectively will participate in implementing this project.

2. Support Agencies

Approximately 44 Ph.D., 40 M.Sc. and 20 B.Sc. level researchers working on 12 collaborative projects at various agencies.

3. NCGEB

2 Ph.D., 2 M.Sc., 3 B.Sc. and 5 Bachelor degree of related field staff of NCGEB will be responsible for the co-ordinating activities.

10. List of Related Projects

Please fill in below if there is a project executed by another donor country or international organization in related areas.)

- (1) Name of donor -
- (2) Project Title -
- (3) Project Outline -
- (4) Type of Assistance -
(Grant, loan, technical assistance, etc.).
- (5) Project Period -
- (6) Relation with this project -

Note : The NCGEB is involved in promoting biotechnology in other areas than agroindustries and agricultural applications, mainly, public health, energy, environment and general strengthening of infrastructure in genetic engineering and biotechnology. The NCGEB has some collaboration with the UK, Netherlands and USA. However, it has never requested any major development aid before.

11. Technical Assistance

- (1) Has technical assistance been extended to this project?
/ (i) Yes (ii) No
- (2) Is technical assistance needed for the implementation of this project?
/ (i) Yes (ii) No
- (3) If no, please describe the reasons why technical assistance is not needed. -
- (4) If yes, please fill in below
 - / (i) Short-term experts (22 persons) (sector:)
 - / (ii) Long-term experts (4 persons) (sector:)
 - / (iii) Acceptance of trainees (104 persons) (course : Plant Biotechnolo
: Controlled
Environmental
: Applications of
Biotechnology to
Agroindustry
- (iv) Project-type Technical Cooperation
(If needed, please describe the project outline)

A. Plant Biotechnology

(1) Plant Tissue Culture :

To produce virus-free plants by meristem culture and tissue culture of tropical fruits, flowering plants, medicinal plants, horticultural crops, and etc.

(2) Plant Genetic Resources and Genetic Engineering :

Collection, documentation and evaluation of plant germplasm to select better adapted and higher yields for particular types of environment. Reprogramming genetic information at the level of the whole organism and at the cellular and molecular level.

B. Controlled Environment Studies

Plantlets produced by meristem culture or tissue culture technology as well as genetically reprogrammed plants resulting from cell fusion or recombinant DNA technology still need to be evaluated in controlled environments prior to field studies to ensure that their genetic constitution is stable.

C. Applications of Biotechnology to Agroindustry

(1) Post harvest and quality control of agricultural products such as fruits and vegetables for export.

(2) Development of new technology for conversion of agricultural products to higher value-added agroindustrial products.

(3) Promotion of public-private cooperation in technology generation and utilization through employment of "science park" concept.

The project to be carried out will involve bilateral cooperation between the Government of Thailand and Government of Japan.

(v) Japan Overseas Cooperation Volunteers

(vi) Development Survey Programme (Feasibility Studies; and Master Plan)

Two short-term, Dr. M. Umebayashi and Dr. H. Kunoh (Professors of Faculty of Bioresources, Mie University, were sent by JICA to Thailand to survey the present state and potentiality of plant biotechnology to establish NABC in Thailand during Aug. 16, 1989 - Sept. 10, 1989

(5) Has an official request for technical assistance been already made?

/ (i) Yes (ii) No

(iii) If yes, please mention the date of the request

Feb 10, 1989

(iv) If no, please describe the reason why the official has not yet been made.

(v) When will the request be made

II General Development Plan

1. Title of the Plan (Please attach the whole volume of the latest general development plan.)

THE SIXTH NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT PLAN (1987-1991)

2. Economic and Social Situation

(Please mention the basic statistics of economic fundamentals.)

(1) GDP

Growth average 8.4 percent (at constant 1972 prices)

(2) National Income, Sector by Sector

Agriculture grows at annual rate of 2.1 percent and manufacturing will grow at 11 percent annually.

(3) Unemployment Rate

3-5 percent

(4) Inflation Rate

5.4 percent

(5) Growth Rate

6-8 percent

(6) Balance of international Payments

Trade deficit/GDP (%) is approximately 6.0 percent

Current account deficit/GDP (%) is approximately 3.2 percent

- (7) Labor Population (as a whole, and sector by sector)
It was 30.6 millions in 1988, which comprised of 19.6 million in agriculture and the rest was non-agriculture
- (8) Debt Service Ratio
Public 7.6
Private 4.9
- (9) Outstanding Debts (1988)
14,860 million U.S. \$
- (10) Major Items of Exports and Imports and their value
Major export items are tourism, textile product, rice and tapioca product which account for 29 percent of total export in 1988, Major imports are machinery and parts, fuel & lubricant and chemicals which account for 36 percent of total import bill.
- (11) Major Trading Partner
U.S.A., Japan, E.E.C., East Asian, and South-east Asian countries
- (12) Population and its Growth Rate
Total population is 55 million in 1989 and growth rate is approximately 1.3 percent in 1991
- (13) Average Life Expectancy (Male and Female)
Life expectancy for male and female are 62 and 68 years respectively
- (14) Death Rate and Birth Rate
Death Rate is 5.7 per 1000 population
Birth Rate is 19.1 per 1000 population
- (15) Medical Structure
According to 1986 data, the population per one (hospital) bed, one physician, one dentist and one nurse were 629, 5739, 38077 and 1,297 respectively
- (16) Ten Diseases most afflicting the nation. Diseases of the Heart, Accidents and Poisonings, Malignant Neoplasm, Tuberculosis, Pneumonia, Malaria, Diarrhoeal Diseases, Diseases of Stomach and Duodenum, or Pregnancy and Others

(17) Illiteracy Rate for Literacy Rate

Literacy rate is 89%

(18) Other data

| | |
|------------------------|--|
| Access to safe water : | Primary school enrollm |
| urban : | 65% of population rate in 1987 was 97% |
| rural : | 63% of population |

3. Outline of the Plan

(1) Most Important Sectors in the Plan

- Main building (including green house and pilot plant) at Chiang Mai University
- Coordinating building at National Center for Genetic Engineering and Biotechnology, Ministry of Science, Technology and Energy

(2) Basic Objectives of the Plan

(Please describe in detail the objectives by using concrete figures.)

1. To serve as a major force in promoting agroindustries by means of plant biotechnology and agroindustry.
2. To act as the national research and development center for collaborative R&D, training, and technology transfer to production sector.
3. To upgrade the quality of agricultural products-- primary and processed, and to generate new technology required for efficient industrialization of higher value-added agricultural products.

(3) How will the above mentioned objectives be achieved?

The above-mentioned objectives will be achieved according to the outline of the project

Detailed Work Plan.

The national center will contribute to research and development of biotechnology in Thailand through the R&D activities in Chiang Mai University, Maejo Institute of Agricultural Technology and other support agencies:

- A. Plant Biotechnology
- B. Controlled Environment Studies
- C. Applications of Biotechnology to Agroindustry

The project to be carried out by bilateral cooperation between the Government of Thailand and Government of Japan will involve:

By Japan

1. Buildings and controlled green house

Chiang Mai

- Main building
- Laboratories
- Greenhouses
- Pilot Plants

Bangkok

- Coordination and support center
(Administration, Meeting, Display, Service/Training,
Computer/Library/Information)

2. Basic facilities for building
3. Equipments and materials for laboratories, green houses, and pilot plants
4. Training services and experts

By Thailand

1. Provision of respective data and information required for the construction
2. Provision of the sites and site clearance
3. Provision of data of boring test
4. Staff salaries
 - (a) research staff
 - (b) supporting personnel
5. Tax exemption of machineries, equipments and materials to be imported and customs clearance

6. Exemption of Japanese nationals concerned from customs duties, internal taxes and other fiscal levies which may be imposed in Thailand
7. Maintenance cost (partly supported by agroindustrial private sectors in Thailand)

(4) When will the plan be executed and completed?

A.D. 1992

(5) Relations between this project and the general development plan

The general development plan emphasizes the need to apply science and technology to increase agricultural production throughout the country.

The establishment of NABC will be an important factor to achieve this purpose.

(6) Is there any assistance that other donors have extend will extend to the projects and/or programme listed in the general plan?

(i) Yes / (ii) No

(iii) If yes, please give basic information on the assistance

(a) Name of donor

(b) Project Title

(d) Type of Assistance (Grant, Loan, Technical Assistance, etc.)

(e) Project Outline

Attachment I

List of projects which requested are made to Japanese Government (1989)

| Priority | Project/Responsible Agency | Grant Aid | Description |
|----------|--|-----------|--|
| 1. | Establishment of National Agroindustrial Biotechnology Center (ABC or NABC) (National Center for Genetic Engineering and Biotechnology) | Grant | This project is in harmony with the VI National Economic and Social Plan during 1987-1991 to improve the science and technology efficiency and develop production system, marketing and job creating. The objective of this project is to promote agroindustry by using plant biotechnology, to collaborate research and development and technology transfer and to improve agricultural products to high added value products. |
| 2. | Request for Technical Assistance in Preparation of Preliminary and Feasibility Studies of Mekong-Chi-Mun Pumped Irrigation Project (The National Energy Administration) | | Project proposes to develop high technology for irrigation planning in order to solve a drought in Chi-Mun. It is useful to develop irrigation system in North-Eastern region and to strengthen the Green E-SARN Project of Thai government. |

List of projects which requested are made to Japanese Government (1989)

| Priority | Project/Responsible Agency | Grant Aid | Description |
|----------|--|---|---|
| 3. | Experts attached to the Energy Conservation Centre (The National Energy Administration) | Expert, Equipment and Training Fellowship | This project was created under the cabinet resolution to conserve the national energy. |

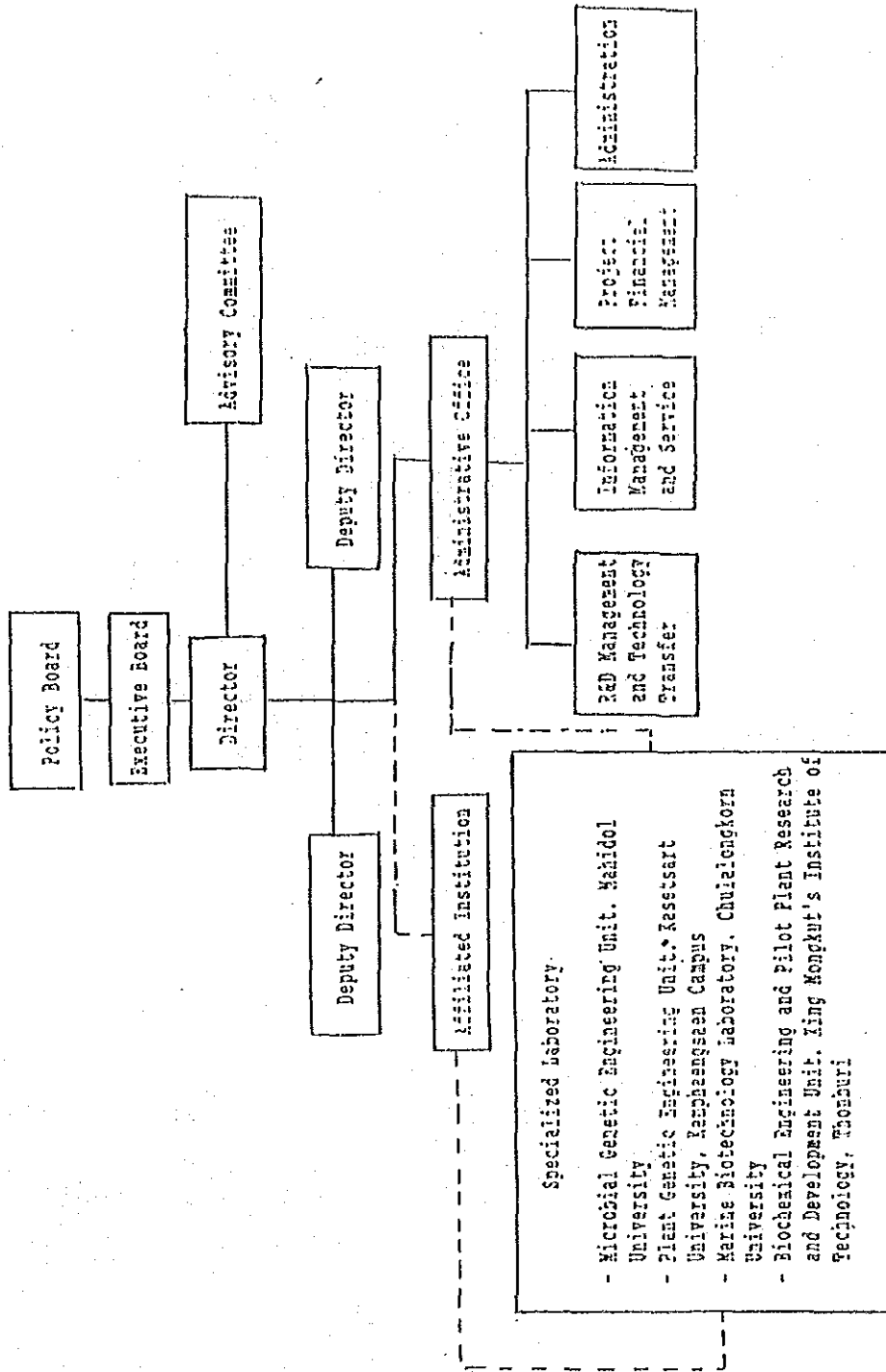
List of projects which requested are made to Japanese Government (1990)

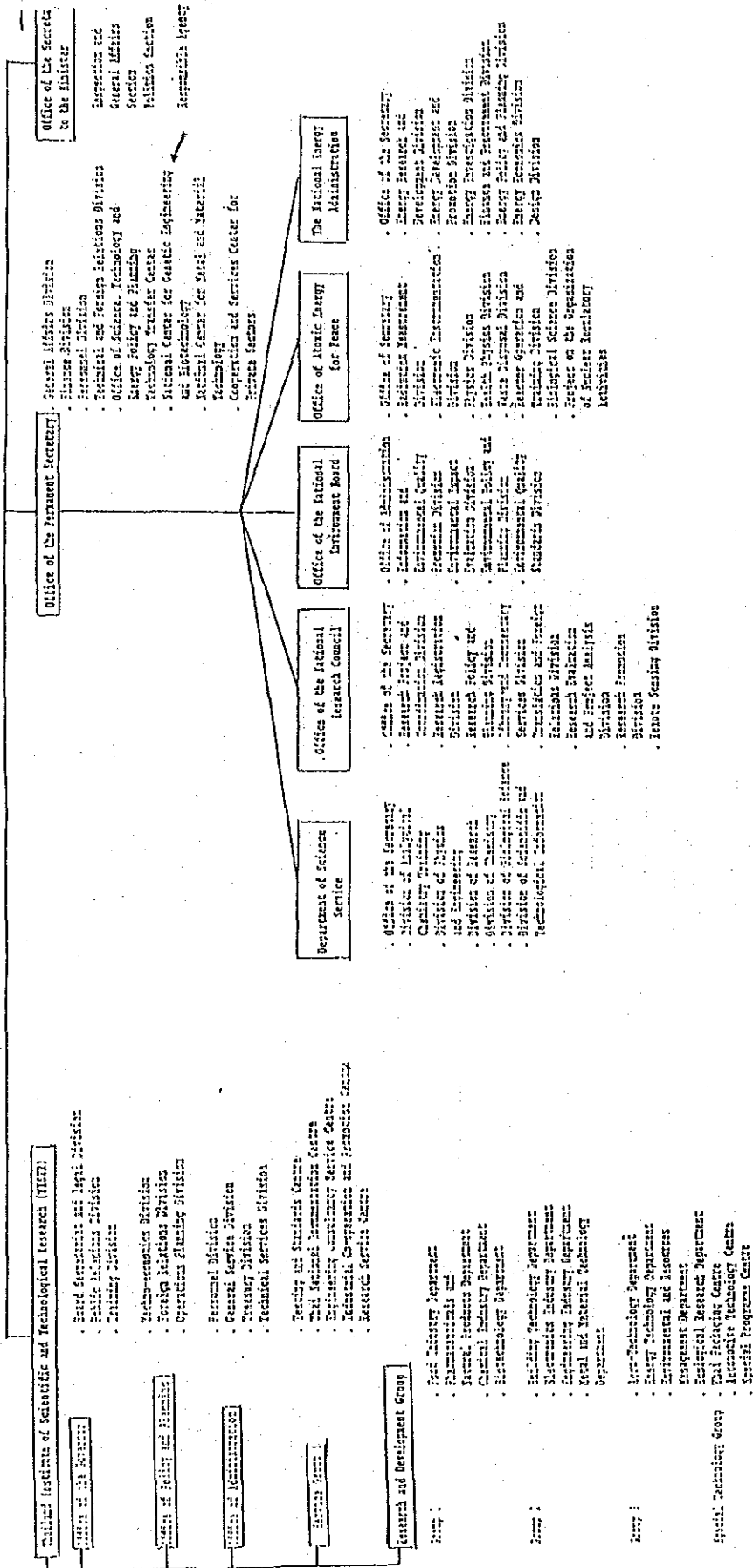
| Priority | Project/Responsible Agency | Grant Aid | Description |
|----------|--|---|--|
| 1. | Development Facilities and Capabilities of Automotive Technology Center (Thailand Institute of Scientific and Technological Research) | Expert, Training Fellowship and Equipment | This project is in harmony with Science and Technology Capability Strengthening Plan in the VI National Economic and Social Development Plan. The project proposes to transfer technology to vehicle industry. This emphasis is on R&D and technology transfer in the field of vehicle technology. |
| 2. | Postharvest Technology Centre Project (Thailand Institute of Scientific and Technological Research) | Grant | This project is under the Export Promoting Plan. |

List of projects which requested are made to Japanese Government (1990)

| Priority | Project/Responsible Agency | Grant Aid | Description |
|----------|--|---|---|
| 3. | Feasibility Study on the Production of Briquette (The National Energy Administration) | Grant and Technical Assistance | This project is to strengthen the VI National Economic and Social Development Plan. |
| 4. | Cooperation in the Development of Tableware for Exportation | Expert, Training Fellowship and Equipment | This project is under the Export Promoting Plan. |

Organization Plan



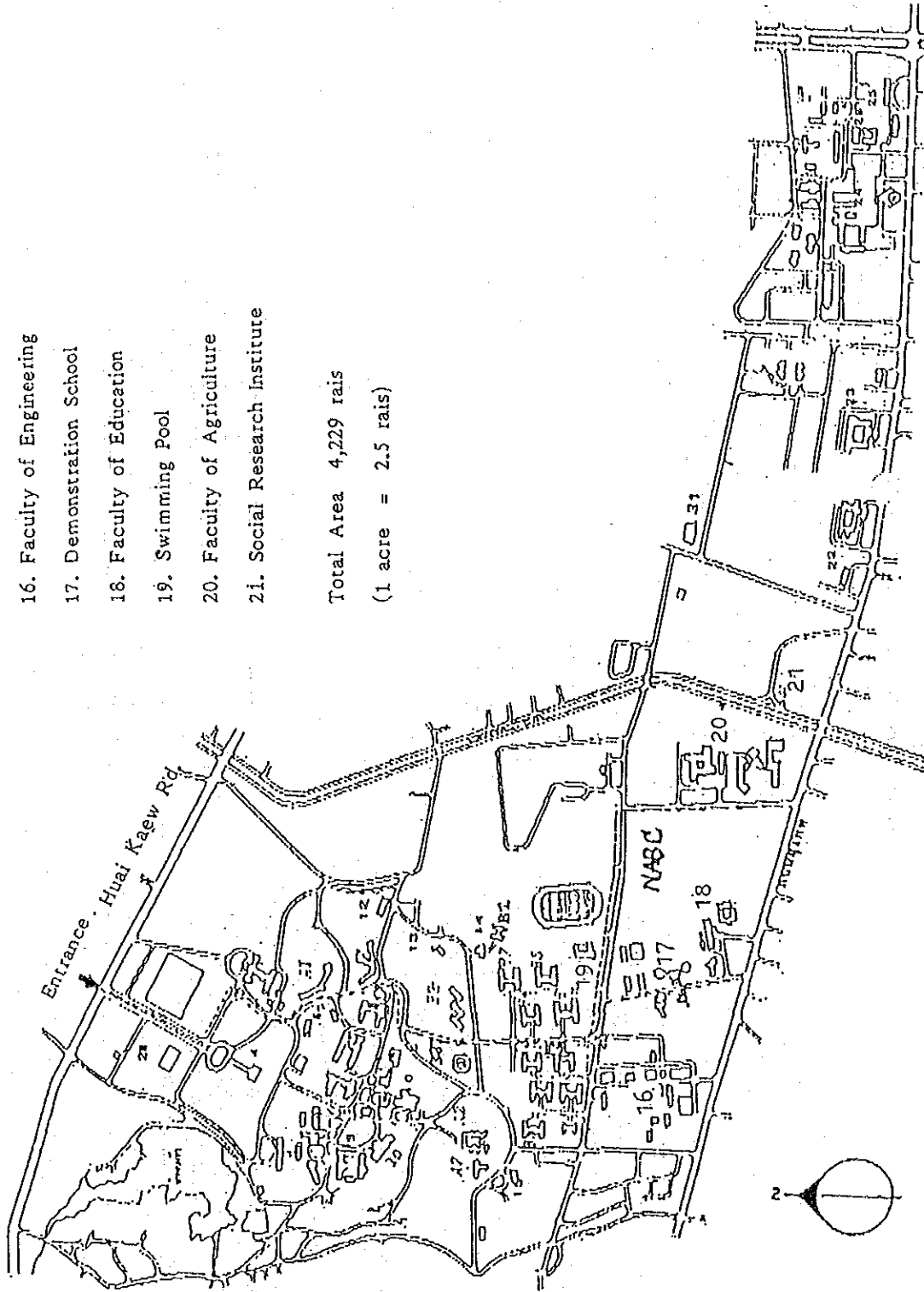


CHIANG MAI UNIVERSITY MAP

Attachment IV

- 16. Faculty of Engineering
- 17. Demonstration School
- 18. Faculty of Education
- 19. Swimming Pool
- 20. Faculty of Agriculture
- 21. Social Research Institute

Total Area 4,229 rais
(1 acre = 2.5 rais)



CMU AND MLAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

Final volume. 25 September 1989

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MLAT | TOTAL |
|------|------------------------------|--|----|-----|---------|----------|-----------|----------|---------|--------------------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI/SUB TOTAL | | |
| 1 | Research light microscope | Olympus AHS514 with accessories (See attached) Olympus AHS 514 | | | 2 | | | | 1 | | 1 | |
| 2 | Research stereo microscope | Olympus SZH141 with accessories (See attached) Olympus SZH141 | | | 2 | | | | 1 | | 1 | |
| 3 | Research inverted microscope | Olympus IMT-2-21 with accessories (See attached) Olympus IMT-2-21 | | | 2 | | | | | | | |

Remark : Group I = Tissue culture and crop plant development
 Group II = Genetic engineering
 Group III = Utilization of Thai plants for control of insect pests and for pharmaceutical purposes
 CL = Central Laboratory,
 IRD = Instrument Repair and Development
 Group IV = Development of new technology for conversion of agricultural products to higher value-added agroindustrial products
 Group V = Post harvest technology
 Group VI = Frozen fruit and vegetable
 MLAT = Control environmental unit

CMU AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MIAT | TOTAL | |
|------|--|---|----|-----|---------|----------|-----------|----------|---------|--------------------|------|-------|--|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI SUB TOTAL | | | |
| 4 | Freezing microtome | Reichert-Jung, cryocut 1800 | | | 1 | | | | | | | | |
| 5 | Incubator | Eyela SLI-1000D LTI-1000D | | | 2 | 1 | 3 | 1 | 1 | 2 | | | |
| 6 | Gas chromatograph | Shimadzu GC-16A, equipped with C-R4A and accessories | | | 1 | | 1 | 2 | | | | | |
| 7 | High pressure liquid chromatograph | Shimadzu LCC6A, equipped with autosampler, RID, UV-Vis detector | | | | 1 | 1 | | | | | | |
| 8 | Rotary vacuum evaporator completed set with water cooling units | Eyela NE-11, +CA-210 N-51, +CA-500 N-21S NE-1V CA-210 | | | 3 | | 3 | | | 1 | | | |

CMU AND MLAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | | MLAT | TOTAL |
|------|----------------------------------|--|--------|-----|---------|----------|-----------|----------|---------|----------|-----------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | SUB TOTAL | | |
| 9 | Electronic balance | Shimadzu, AEL-200-3501020 AEL-40SM-351030 EB 620S EB 60S 1mg. ER 3200H | 2 1 | | 1 1 | 1 1 | 1 1 | 1 1 | 1 1 | | | | |
| 10 | Shaker bath | Eyela NTS-221 | | | 4 | | 4 | | | 2 | | | |
| 11 | Hot air oven | Eyela NDS-600D WFO-1000SD (forced air flow oven type) | | | 1 1 | | 1 1 | | | 1 | | | |
| 12 | pH meter | Eyela PHM-2000 TOA RM-7E | | | 2 | 1 | | 2 | | | 1 1 | | |
| 13 | Moisture determinator balance | Shimadzu EB-330 MOC with electronic printer (EP-50) and interface (RS-232C) | | | 1 | | | 1 | | | | | |

CMU AND MIAT REQUESTED EQUIPMENT I I
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MIAT | TOTAL | |
|------|---------------------------|--|--------|-----|---------|----------|-----------|----------|---------|----------|------|-------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | TOTAL |
| 14 | Deep freezer. | Eyela, RC-M1001 Sanyo/MDF 790AT | | | 1 | 1 | 1 | 1 | | | | | |
| 15 | ELISA-Testing set | Toyo oriental instruments Ltd. EYI-96 | | | 1 | | | | | | | | |
| 16 | Cold room equipment | Size 3x4 m ² -4 °C -20 °C -0 °C | 1 1 | | | | | | 1 | | | | |
| 17 | Liquid nitrogen container | Capacity : 50 l Cryogenic liquefied gas, Dewars and cylinder DLS-50B | | | 4 | 1 | | 3 | | | | | |
| 18 | Laminar air flow | Eyela CCV-130EC | | | 4 | 1 | | 1 | | 1 | | | |
| 19 | Desk top centrifuge | Heraus-biofuge 17RS with 3090, 2147, 8560 rotors | | | 2 | 1 | | 2 | | | | | |

CHU AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CHU | | | | | | MIAT | TOTAL | |
|------|---|--|----|-----|-----------------------|----------|-----------|-----------------------|---------|----------|------|-------|-----------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | GROUP VII |
| 20 | Incubate shaker (control temperature and light) | Temperature range from 10 °C below room temp. to 80 °C ; variable shaking speed. | | | 4 | | | 3 | | | | | |
| 21 | Shaker | Eyela MBS-10 OSI 503L OSI-505L MMS-2000 OSI-501 | | | 1 1 1 1 1 | | | 1 1 1 1 1 | | 2 | 1 | | |
| 22 | Low temperature incubator | Eyela LTI-1000P | | | 5 | | | | | 1 | | | |
| 23 | Electric muffle furnace | Adventec Toyo Kaisha Ltd., ESF | | | | | | | | | | 1 | |
| 24 | Electro fusion equipment (Bioelectronics) | Model 1000 (See attached) | | | 1 | | | | | | | | |

CMU AND MIAT REQUESTED EQUIPMENT I T
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MIAT | TOTAL |
|------|----------------------------------|--|----|-----|---------|----------|-----------|----------|---------|--------------------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI/SUB TOTAL | | |
| 25 | Fermentor | Eyela MBF-80LP with a set of MAU-1, MZ-10, FAC-1, MF-3D, FM-11, FC-10 See attached leaflets | | | 3 | 1 | | | | | | |
| 26 | Carbondioxide incubator | Espec, BNA 320D | | | 2 | 1 | 1 | | | | | |
| 27 | Dispenser | Oxford | | | 2 | | 2 | | | | | |
| 28 | Growth chambers | Eyela FLI-301 | | | 5 | | | 2 | | | | |
| 29 | Magnetic hot plate | Eyela RC-12 PS-60 | | | 2 | | | 6 | | 2 | | |
| 30 | Microwave oven | National NN6508 | | | 1 | | | 1 | 1 | | 1 | |
| 31 | Gel electrophoresis complete set | Pharmacia 2117-001 | | | 1 | | | 2 | | | | 1 |

CMU AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MIAT | TOTAL | |
|------|---|---|----|-----|---------|----------|-----------|----------|---------|--------------------|------|-------|--|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI SUB TOTAL | | | |
| 32 | Ultra water purification system | Eyela ER55-610104 | | | 1 | | | | | | | | |
| 33 | Micropipette(variable volume) | Jasco 1-10 µl 5-20 µl 5-50 µl 10-100 µl 20-200 µl 200-1000 µl | | | 3 | | | | | | | | |
| | | | | | 3 | | | | | | | | |
| | | | | | 2 | | | | | | | | |
| | | | | | 2 | | | | | | | | |
| | | | | | 2 | | | | | | | | |
| | | | | | 2 | | | | | | | | |
| 34 | Multichannel pipette | Titertex multistepper 25/50 | | | 1 | | | | | | | | |
| 35 | Camera and transilluminator (longwave UV) | equivalent to polaroid MP4 | | | 1 set | | | | | | | | |
| 36 | Power supplies | 0-3K Volts, 2 mA 0-5K Volts, 1 mA | | | 1 | 4 | | | | | | | |
| | | | | | 1 | | | | | | | | |

CMU AND NIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL IRD | CMU | | | | | | NIAT | TOTAL | | |
|------|--|--|--------|---------|----------|-----------|----------|---------|----------|------|-------|-----------|--|
| | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | SUB TOTAL | |
| 37 | Vacuum oven | Eyela VOS-450D | | | 1 | | 2 | 1 | | | 1 | | |
| 38 | Refrigerated water bath for temp. of 10-18 °C | Ogawa Seiki Co.Ltd. OSK6524 | | | 1 | | | | | | | | |
| 39 | French press | Any model | | | 1 | | 1 | | | | | | |
| 40 | Sonicator | Ohtake ultrasonic disruption 5202-PZT | | | 1 | | 1 | | | | 1 | | |
| 41 | Complete DNA workstation | Any model | | | 1 | | | | | | | | |
| 42 | Biological safety cabinets for aerosol-producing equipment | Nippon Med & Chem Inst.Co.Ltd. VB-1300BH-11A | | | 2 | | | | | | | | |
| 43 | Jar fermenter | Eyela MU-30 with complete control system | | | 1 | | | | | | 1 | | |

CSU AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IND | CSU | | | | | | MIAT | TOTAL |
|------|---|--|----|-----|---------|----------|-----------|----------|---------|--------------------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI/SUB TOTAL | | |
| 44 | Droplet counter current distribution | (See attached) | | | | 1 | 1 | | | | | |
| 45 | Chromatotron | Harrison research | | | | 1 | 1 | | | | | |
| 46 | Fast protein liquid chromatograph | Pharmacia | | | | | 1 | | | | | |
| 47 | Water aspirator | Eyela A-3S | | | | | | 2 | | | | |
| 48 | Dialysis unit | Spectrum | | | | | | 1 | | | | |
| 49 | Ultrafiltration unit | Sartorius, SML65 25 with pump SML66 50/16655 | | | | | 1 | | | | | |
| 50 | Peptide synthesizer | Dupont, Coupler 2100 or Pharmacia, Biolynx 4170 | | | | | | 1 | | | | |
| 51 | Metering pump | ST-1211-H | | | | | | | | 3 | | |

CHU AND MLAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CHU | | | | | | MLAT | TOTAL |
|------|-------------------|---|----|-----|---------|----------|-----------|----------|---------|--------------------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI/SUB TOTAL | | |
| 52 | Feeding pump | Type II | | | | | | 3 | | | | |
| 53 | Peristaltic pump | Pharmacia, Perpepump No. 2132-002 | | | | | | 3 | | | | |
| 54 | Filter press | Advance, Toyo kaisha 200G | | | | | | 1 | | | | |
| 55 | Phytotron | Koitotron, FR 535A with KE50D two of KB-20 lighting unit, XG-206 SHL-D. | | | 1 | | | | 1 | | | |
| 56 | Spectroradiometer | Topcon, SR-1 | | | | | | | | 1 | | |
| 57 | Vacuum pump | Alcatel 2020A with dust filter, remote gas ballast, oil-mist eliminator | | | | | | | | | 1 | |
| 58 | Vacuum gauge | Pirani PE101 | | | | | | | | | | 1 |

CSU AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL IND | CSU | | | | | | MIAT | TOTAL | |
|------|--|---|--------|---------|----------|-----------|----------|---------|--------------------|------|-------|--|
| | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI/SUB TOTAL | | | |
| 59 | Refrigerated condenser | Edwards Super Modulo 12K with E2M12 | | | | | | 1 | | | | |
| 60 | Recording hygrometer | Shaw SHRA or equivalent | | | | | | 2 | | | | |
| 61 | Relative humidity sensor | Vaisala, HMP 14U or equivalent | | | | | | 2 | | | | |
| 62 | 36-channel temperature and humidity recorder | Chino | | | | | | 1 | | | | |
| 63 | Transport simulator | To be identified by Tsukuba Distribution Engineering Laboratory | | | | | | 1 | | | | |
| 64 | Vibration meter | IMV VM-3324AL IMV VM-4115FA IMV VM-2123 IMV VM-4316 | | | | | | 1 | | | | |
| | | | | | | | | 1 | | | | |

CMU AND MIAT REQUESTED EQUIPMENT LIST
FOR NAEC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL IND | CMU | | | | | | MIAT TOTAL | |
|------|--------------------------------------|--|--------|---------|----------|-----------|----------|---------|--------------------|------------|--|
| | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI SUB TOTAL | | |
| 65 | Transport logging system | Grant, Squirrel SQ32 | | | | | | 1 | | | |
| 66 | Transport vibration recording system | Same as in 84 | | | | | | 1 | | | |
| 67 | Oxygen analyzer | Riken OX-227 or Shimadzu POT-101 | | | | | | 1 | | | |
| 68 | Rheometer | Fudoh Kogyo, NRM-1002A | | | | | | 1 | | | |
| 69 | Isotachopheresis | Shimadzu, IP-2A | | | | | | 1 | | | |
| 70 | Mechanical peeler | Iwase tekko, MOD DOGS 75-6 | | | | | | | | 1 | |
| 71 | Dicer and slicer | Santos, No.16 with accessories T2, T8 GC8, GF8, TB 2x2 | | | | | | | | 1 | |
| 72 | Fluidised-bed freezer | Frigo scandia flo freeze 2NA | | | | | | | | 1 | |

CMU AND HIAAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | HIAAT | TOTAL | |
|------|--|--|----|-----|---------|----------|-----------|----------|---------|----------|-------|-------|--------------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | VI SUB TOTAL |
| 73 | Precooler | Accessory to flo freeze | | | | | | | | | 1 | | |
| 74 | Air blast freezer | Capacity 100 cu.ft, air velocity 6m/s, temperature -40°C | | | | | | | | | 1 | | |
| 75 | Vacuum plastic seamer | Multivac a 300/42 | | | | | | | | | 1 | | |
| 76 | Plastic seamer | Ratcliffe | | | | | | | | | 1 | | |
| 77 | Wrapping machine | Quick pack pacific, minipack MOD-RAS/FM75 | | | | | | | | | 1 | | |
| 78 | Weight balance Capacity 1 kg. Capacity 5 kg. | Yamato mod., UDS-1000 | | | | | | | | | 2 | | |
| | | | | | | | | | | | 1 | | |
| 79 | Viscometer | Brookfield HBIV-II with helipath stand | | | | | | | | | 1 | | |

CMU AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MIAT | TOTAL | |
|------|--|--|----|-----|---------|----------|-----------|----------|---------|----------|-------|-------|--------------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | VI SUB TOTAL |
| 80 | Amylograph with integrator and recorder | Brabender | | | | | | | | | 1 | | |
| 81 | Titrator(automatic) | TOA, AUT-301 KEM, AT-310 | | | | | 1 | | | | 2 | | |
| 82 | Burette (digital) | TOA, AUT-310 KEM, AT-310 | | | | | | | 2 | | 2 | | |
| 83 | Refractometer(digital) | Atago RX-1000, DEX-55, PR-1 Abbe | | | | | | | | 1 set | 1 set | | |
| 84 | Computerized time temperature indicator recorder | CMC 821 Temperature microprocessor System | | | 1 | | | | | | 1 | | |
| 85 | Fiber analyzer | Tecator, fibertec system M | | | | | | | | | 1 | | |
| 86 | Fraction collector | Eyela DC-180 | | | | | | | 2 | | 1 | | |

CMU AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MIAT | TOTAL | |
|------|--------------------------------|---|----|-----|---------|----------|-----------|----------|---------|--------------------|------|-------|--|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI/SUB TOTAL | | | |
| 87 | Preparative fraction collector | Eyela DC-40 | | | | | 1 | | | | 1 | | |
| 88 | Fat analyzer | Buchi 428 Hydrolysis unit Buchi 810 Extraction apparatus | | | | | | | | | 1 | | |
| 89 | Fluidised bed dryer | Fuji Pandal, MDP-2000N | 1 | | | | | | | | | | |
| 90 | Refrigerator | National 20 ft ³ | | | | | 3 | | | | 1 | | |
| 91 | Homogenizer | Seikensha high pressure JH 31-2.2 | | | | | | | | | 1 | | |
| 92 | Water bath | Contherm, 360 and 370 | | | | | 3 | | | | 2 | | |

CMU AND MLAT REQUESTED EQUIPMENT -SI
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MLAT | TOTAL | |
|------|---------------------------------|---------------------------------------|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|-----------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | SUB TOTAL |
| 93 | Low temperature circulator | Pharmacia multi temp II or equivalent | | | | | 3 | | | | 1 | | |
| 94 | Thermo-regulator | Eyela, T-80 | | | | | | | | | 1 | | |
| 95 | Cold room with humidity control | NK system LP-2PH NK system LP-3PH | | | | | | 2 | 1 | | | | |
| 96 | Automatic dewpoint meter | Shaw SADP or equivalent | | | | | | 1 | | | 1 | | |
| 97 | Flash evaporator | Eyela, F-200 | | | | | | | 1 | | | | |
| 98 | Chromameter | Minolta, CR-200 & DP-100 | | | | | | | | | 1 | | |

CHU AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IND | CHU | | | | | | MIAT | TOTAL | |
|------|------------------------------------|---|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|-----------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | SUB TOTAL |
| 99 | D-gel electrotransfer system | Kontes | | | | 1 | | | | | | | |
| 100 | DNA synthesizer | DuPont coder 300, Applied Biosystems, 380B | | | | 1 | | | | | | | |
| 101 | Thermobarrel extruder | Lipex Biomembranes, Inc. | | | | 1 | | | | | | | |
| 102 | Microcentrifuge | Hermle, 2229 | | | | 1 | | | | | | | |
| 103 | Electrophoresis blotting apparatus | Gene | | | | 1 | | | | | | | |
| 104 | DNA amplification system | Perkin Elmer Cetus | | | | 1 | | | | | | | |
| 105 | Nucleic acid extractor | Applied Biosystems, 340A | | | | 1 | | | | | | | |

CMU AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MIAT | TOTAL |
|------|------------------------|--|----|-----|---------|----------|-----------|----------|---------|--------------------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI/SUB TOTAL | | |
| 106 | Drum washer | Kiremko bv | | | | | | | | 1 | | |
| 107 | Inspection belt | Kiremko bv | | | | | | | | 1 | | |
| 108 | Size grader | Kiremko bv | | | | | | | | 1 | | |
| 109 | Blancher | Kiremko bv | | | | | | | | 1 | | |
| 110 | Ion meter | TOA, IM-20E with NO ₃ , NO ₂ , Ca, F, Cl, Na, K, CO ₂ electrodes | | | | | | | | 1 | | |
| 111 | Automatic vortex mixer | Chiltern, MT19 | | | | | | 4 | | 2 | | |

CMU AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MIAT | TOTAL | |
|------|---|-----------------------------------|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|-------------------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | GROUP VISUB TOTAL |
| 201 | Electron microscope | JEOL JEM-1250 with accessories | 1 | | | | | | | | | | |
| 202 | Scanning electron microscope | JEOL JSM-840A with accessories | 1 | | | | | | | | | | |
| 203 | Specimen preparation devices for electron microscopy: | JEOL | | | | | | | | | | | |
| | -Vacuum evaporator | JEE-4x15B | 1 | | | | | | | | | | |
| | -Freeze etching equipment | JFD-9000 | 1 | | | | | | | | | | |
| | -Ion sputtering device | JFC-1100 | 1 | | | | | | | | | | |
| | -Ion beam thinner | JIT-100 | 1 | | | | | | | | | | |
| | -Microtome | Ultratome NOVA | 1 | | | | | | | | | | |
| | -Critical point dryer | JCPD-5 | 1 | | | | | | | | | | |
| | -Electrolytic polishing unit | JET-N | 1 | | | | | | | | | | |

CMU AND MLAT REQUESTED EQUIPMENT I.
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MLAT | TOTAL | |
|------|---|--|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|--------------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | VI SUB TOTAL |
| 204 | FT NMR spectrometer (high field) | JEOL JNM-GX400 with all accessories | 1 | | | | | | | | | | |
| 205 | FT NMR spectrometer (low field) | JEOL JNM-FX100 with all accessories | 1 | | | | | | | | | | |
| 206 | Gas chromatograph- mass spectrometer | JEOL JMS-DX303HF with GC/MS Data system | 1 | | | | | | | | | | |
| 207 | Ultrahigh-performance mass spectrometers | JEOL JMS-HX110HF with JMA-DA500 data system & other accessories | 1 | | | | | | | | | | |
| 208 | X-ray diffractometer | JEOL JDX-800 rotating anode type, two goniometers, and all other accessories. | 1 | | | | | | | | | | |

CSU AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CSU | | | | | | MIAT | TOTAL |
|------|--|---|----|-----|---------|----------|-----------|----------|---------|--------------------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI/SUB TOTAL | | |
| 209 | Texture analyzing X-ray diffraction system | JEOL JDX-851 with all accessories | 1 | | | | | | | | | |
| 210 | Ultramicrotome | Reichert-Jung, Ultracut E | 2 | | | | | | | | | |
| 211 | Amino acid analyzer | Hitachi L-8500 | 1 | | | | | | | | | |
| 212 | Freeze dryer | Eyela FD-800 FD-81 | 2 | | | | | | | | | |
| 213 | Kjeldahl | Mitsubishi Chemical Ind.Ltd. Kjeldahl nitrogen analyzer KM-03 | 2 | | | | | | | | | |
| 214 | Spectrophotometer (UV-visible) | Jasco, 7850 Shimadzu Mfg.Co. UV-2100 | 1 | | | | | | | | | |
| | | | 1 | | | | | | | | | |

CMU AND MLAT REQUESTED EQUIPMENT 1
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MLAT | TOTAL |
|------|---|--|----|-----|---------|----------|-----------|----------|---------|--------------------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI/SUB TOTAL | | |
| 215 | Ultra centrifuge with fixed and seing out rotors & vertical rotor | Hitachi 85-P-72 with RP 50 T-2, RPS 56T, RP19 | 3 | | | | | | | | | |
| 216 | Refrigerated supraspeed centrifuge | Hitachi/CR20B3 with RPR20-2, RPR12-2 | 4 | | | | | | | | | |
| 217 | High pressure automatic autoclave | Alps AC40DP | 4 | | | | | | | | | |
| 218 | Atomic absorption spectrophotometer | Shimadzu AA-680/680G with graphite furnace and atomizer GFA-4A | 1 | | | | | | | | | |
| 219 | Densitometer complete set | Pharmacia ultro scane XL laser 2 Cat.No-2222-020 | 2 | | | | | | | | | |
| 220 | Infra red gas analyser | Jasco IR-700 or Riken Rx-77 | 1 | | | | | | | | | |

CMU AND HIAI REQUESTED EQUIPMENTS LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | HIAI | TOTAL | |
|------|--------------------------------------|---|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|-----------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | SUB TOTAL |
| 221 | X-ray radiographic | Rigaku 3370E | 1 | | | | | | | | | | |
| 222 | Fluoroscopic inspection system | Jasco FP-770 | 1 | | | | | | | | | | |
| 223 | Liquid scintillation counter | Beckman LS 6000TA or equivalent | 1 | | | | | | | | | | |
| 224 | Slab gel dryer | Any model | 2 | | | | | | | | | | |
| 225 | Automatic melting point determinator | Equipped with microscope for observing the crystal being determined, Sibata S3-310s | 1 | | | | | | | | | | |
| 226 | Spray dryer | Buchi 190 | 1 | | | | | | | | | | |
| 227 | Infrared spectrophotometer | Shimadzu IR-470 | 1 | | | | | | | | | | |

CMU AND MLAT REQUESTED EQUIPMENT L F
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MLAT | TOTAL | |
|------|--|---|--------|-----|---------|----------|-----------|----------|---------|----------|------|-------|--------------------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | GROUP VI SUB TOTAL |
| 228 | Steam generator | | 1 | | | | | | | | | | |
| 229 | UV monitor | Pharmacia | 2 | | | | | | | | | | |
| 230 | Universal testing machine with temperature control and data processing | Intesco, 2001 with NEC PC9801 | 1 | | | | | | | | | | |
| 231 | Sugar analyzer | Nihon waters, to separate reducing sugars | 1 | | | | | | | | | | |
| 232 | Colorimeter | Filper magnuson agtro, E10 | 1 | | | | | | | | | | |
| 233 | Blender and mixer | Fuji PAUDAL VM-20 EM-20 | 1 1 | | | | | | | | | | |

CIB AND MIAI REQUESTED EQUIPMENT ISL
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | REQ | CMU | | | | | | MIAI | TOTAL |
|------|-------------------|--|----|-----|---------|----------|-----------|----------|---------|-------------------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP YESUB TOTAL | | |
| 301 | Computer facility | -A 32-bits word computer with 16 MB memory for programming and data storage connected to 18 terminals. The peripheral includes magnetic tape. Two of 128MB hard disks, 16 printers, 2 graphic plotter, laser printer, cartridge tape controller, 2 graphic terminals, 16 work stations -A 16 - bits word PC for word processing with complete peripherals | 2 | | | | | | | | | |

CMU AND MLAT REQUESTED EQUIPMENT L.

FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MLAT | TOTAL | |
|------|--|---|--------|-----|---------|----------|-----------|----------|---------|----------|------|-------|-----------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | GROUP VII |
| 302 | Emergency power supplies | Single phase 220V.40KVA, with automatic turn on Single phase 220V.20KVA, with automatic turn on | 1 | | | | | | | | | | |
| 303 | Vehicles for site visits: -Van -Land-Rover | Toyota Hiace, diesel 2466 cc. air conditioned 4-wheel drive, air conditioned | 2 2 | | | | | | | | | | |
| 304 | Fax-machine | Sharp FO-420 | 1 | | | | | | | | | | |
| 305 | Copying machine | -Konica corp. U-Bix series, 70 copies/min, with color copy -Standard, black and white copy sharp SF-8260 | 1 2 | | | | | | | | | | 1 |

CBI AND MIAT REQUESTED EQUIPMENT LIST
FOR RABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | REQ | CBI | | | | | | MIAT | TOTAL | |
|------|------------------|---|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|-------------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | GROUP TOTAL |
| 306 | Telephone system | Panasonic A-824, 8 outside lines, 24 inside lines including substation and 24 phones. | 1 | | | | | | | | | | |

CMU AND HIAJ REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | TED | CMU | | | | | | HIAJ | TOTAL | |
|------|--------------------------------|---|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | TOTAL |
| 401 | Precision high speed lather | Takisawa TAL 460, 7.5 kw, with all 28 accessories Takisawa TAL 600, 11 kw, with all 28 accessories | 1 | | | | | | | | | | |
| 402 | Horizontal milling machines | Osaka Kiko Co. MH - 2 P with all accessories. | 1 | | | | | | | | | | |
| 403 | Vertical milling machines | Osaka Kiko Co. Model MH - 4V.5VJ with all accessories | 1 | | | | | | | | | | |
| 404 | Precision drilling machine | Yoshida Machine Tool Co. YD2 - 55 with all accessories | 2 | | | | | | | | | | |

CMT AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| | DESCRIPTION | SPECIFICATION | CL | TED | CMT | | | | | | MIAT | TOTAL | |
|-----|-----------------|--|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|-------------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | GROUP TOTAL |
| 405 | Welding machine | Hitachi "Arc - Pair" AD - STX 300A with welding torch, torch accessories, argon gas regulator, 5 m. output cable | | 1 | | | | | | | | | |
| | | Hitachi "Arc - Pair" AD - SEZ300A with all accessories | | 2 | | | | | | | | | |
| 406 | Overhead Crane | 2½ tons min, 6 ways | | 1 | | | | | | | | | |
| 407 | Dist grinders | Hitachi PD - 150A 150 mm. (6") | | 2 | | | | | | | | | |
| 408 | Drills | Hitachi EU 1 - SH3, 13 mm. (½") | | 2 | | | | | | | | | |

C&J AND MIAE REQUESTED EQUIPMENT LIST
FOR WABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | LED | C&J | | | | | | MIAE | TOTAL | |
|------|------------------------------|--|----|-------------|---------|----------|-----------|----------|---------|----------|------|-------|-----------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | SUB TOTAL |
| 408 | High-speed cut. off machines | Hitachi. H-16B, 405 mm. (16") | | 2 | | | | | | | | | |
| 410 | Measuring instruments | BSC-30, range 0-300mm. DNC-20, range 0-200mm. 1525 MB, | | 3 2 2 | | | | | | | | | |
| | -Vernier caliper | | | 1 | | | | | | | | | |
| | -Dial caliper | | | 1 | | | | | | | | | |
| | -Outside micrometer caliper | | | 1 | | | | | | | | | |
| | -Inside micrometer | No. 50N No. 150 | | 1 1 | | | | | | | | | |
| | -Firm-joint caliper | Co-30, range 0-300mm. CI-20, range 0-200mm. | | 1 2 | | | | | | | | | |
| | -Divider | SC-15 SC-20 | | 2 2 | | | | | | | | | |

CMU AND MIAI REQUESTED EQUIPMENT LI
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MIAI | TOTAL | |
|------|---------------------|------------------------------|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|-----------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | GROUP VII |
| 411 | Mechanic set | Banzai CU - 601 | | | | | | | | | | | |
| 412 | Work bench | Banzai T - 1000 | | 2 | | | | | | | | | |
| 413 | Tool stand | Banzai TS - 31 | | | | | | | | | | | |
| 414 | Engineer's file set | Banzai F - 250S | | | | | | | | | | | |
| 415 | Bench grinders | Hitachi, KBT-10 305mm. (12") | | 2 | | | | | | | | | |
| 416 | Jig saw | Hitachi, JH-60mm. (2-3/8") | | 1 | | | | | | | | | |
| 417 | Impact drills | Hitachi, V-19 19mm. (3/4") | | | | | | | | | | | |

CMI AND MIAT REQUESTED EQUIPMENT LIST
FOR HASC ESTABLISHMENT

| ITEM NO. | DESCRIPTION | SPECIFICATION | QTY | CMI | | | | | | MIA | TOTAL |
|----------|--------------------------------|--|-----|---------|----------|-----------|----------|---------|--------------------|-----|-------|
| | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI SUB TOTAL | | |
| 418 | Bench drill presses | Hitachi, B-23 (Square table) 23mm., 400W 4P | 1 | | | | | | | | |
| 419 | Planers | Hitachi, P-40 136mm.(5-3/8") | 1 | | | | | | | | |
| 420 | Universal wood working machine | Hitachi, PU-100F | 1 | | | | | | | | |

CMI AND MIAT REQUESTED EQUIPMENT LIST
FOR HASC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | REQ | CMI | | | | | | MIAT | TOTAL |
|------|--|--|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | |
| 501 | Bench top digital multimeter 3 1/2 digit with high voltage probe | <ul style="list-style-type: none"> -28 main ranges (for Ω or a.c./d.c. V and A) -Battery/mains (220 Vac) operation -1000 $M\Omega$ input impedance (a.c. and d.c. V) -Accuracy 0.1% -True r.m.s. a.c. measurement -3 1/2 digit L.C.D. display | | 2 | | | | | | | | |
| 502 | Handheld digital multimeter 3 1/2 digit | <ul style="list-style-type: none"> -Accuracy 0.3% -3 1/2 digit L.C.D. display -Autorange selection -Single rotary switch control -2000 hrs. on PP3 battery | | 2 | | | | | | | | |

CSJ AND HIAI REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | MILC | TOTAL | |
|------|----------------------------------|---|----|-----|---------|----------|-----------|----------|---------|------|-------|--------------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | | | VI/SUB TOTAL |
| 503 | T.T.L. Logic probe | -"Touch Hold" to capture readings. -10 MΩ input resistance -Built-in pulse structure -Multi probe tip -Input threshold high: 2V ± 0.15V Low: 0.8 ± 0.1V -Max frequency 20 MHz -Operating supply 4.75 to 30Vdc. | | 2 | | | | | | | | |
| 504 | 300 MHz dual traces oscilloscope | -Standard 1 MΩ / 15pF input -10mV to 50V per div. setting -1MΩ or 50 Ω selectable -220 V. a.c. 50Hz operation -Probes set | | 2 | | | | | | | | |

CSE AND RMT REQUESTED EQUIPMENT FOR
FOR NABC ESTABLISHMENT

| DESCRIPTION | SPECIFICATION | CL | CSE | | | | | | TOTAL |
|--|--|----|---------|----------|-----------|----------|---------|----------|-------|
| | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | |
| 505 150 MHz dual traces digital oscilloscope | -0.5 ns risetime -220 Vac 50 Hz operation -100 MS/s digitizing rate -Bandwidth:DC to 150 MHz(-3dB) -1 M Ω 15pF input -Vertical accuracy ± 2% -For. clock accuracy:0.001% | 2 | | | | | | | |
| 506 100 MHz dual traces storage oscilloscope | -Input 1 M Ω /15 pF -1000div/μs writing speed -Storage time up to 1 hr. -220 Vac 50 Hz operation | 2 | | | | | | | |
| 507 Digital L.C.R. meter | -3 functions L = 0.002, .02, 0.2, 2.22, 200Ω C = 0.2, 2, 20, 200nF 2, 20, 200, 2000pF = 20, 200, 2K, 200K, 2M, 20M | 2 | | | | | | | |

CSU AND MIAI REQUESTED EQUIPMENT LINE
FOR NABC ESTABLISHMENT

| DESCRIPTION | SPECIFICATION | CL. IRD | CSU | | | | | | MIAI | TOTAL |
|---|---|---------|---------|----------|-----------|----------|---------|----------|------|-------|
| | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | |
| 508 Low voltage dual tracking power supply 0-25V, 2 amps. | <ul style="list-style-type: none"> -line voltage : 220 Vac \pm 10% 50 Hz -Load regulation $<0.01\%$ of max output for 50% load change -Short circuit and overload protection -Ripple and noise <1 mV. -Meter resolution Voltage : 0.01V , Current:0.001A | 2 | | | | | | | | |
| 509 Low voltage power supply | <ul style="list-style-type: none"> --Output impedance $<5m\Omega$ at 1kHz -0-30 V LA adjustable -Short circuit and overload protection -line voltage : 220 Vac \pm 10% 50 Hz -load regulation $<0.05\%$ -Ripple <3 mVpp -Moving coil volt and amp meters reading | 3 | | | | | | | | |

CMI AND MIAI REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | TED | CMI | | | | | | TOTAL |
|------|--------------------|---|----|-----|---------|----------|-----------|----------|---------|----------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | |
| 510 | Function generator | -Frequency coverage 0.2 Kz to 2 MHz -6 frequency ranges -Setting accuracy : better than $\pm 5\%$ on 100 Kz to 1 MHz ranges -Sine wave distortion less than 0.5% -Triangular wave output linearity better than 99% to 200 kHz -Square wave rise and fall times: <80 ns, ratio 1:1 $\pm 1\%$ to 100 kHz -I.T.L. output capable of driving 20 standard I.T.L. loads -Output impedance 600 Ω | | 2 | | | | | | | |

CSU AND MIAT REQUESTED EQUIPMENT . . .
FOR NABC ESTABLISHMENT

| DESCRIPTION | SPECIFICATION | CL | REQ | CSU | | | | | | MIAT | TOTAL |
|---|---|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|
| | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | |
| <p>Micro-system troubleshooters</p> | <ul style="list-style-type: none"> -Simple peripheral -troubleshooting -32 digit display -Keyboard data entry -Power-up self-test -Keystroke programming -Language compiler optional -Communications interface : RS-232C | 2 | | | | | | | | | |
| <p>Pulse generator</p> | <ul style="list-style-type: none"> -5 Hz to 5 MHz adjust -220 Vac operating voltage, 50 Hz -Rise and fall times : 1 ns typical -10 ns to 100 ms pulse with (cont.var.) | 2 | | | | | | | | | |

CMU AND MIAI REQUESTED EQUIPMENT TYPE
FOR NABC ESTABLISHMENT-

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MIAI | TOTAL |
|------|-------------------|---|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | |
| 513 | Frequency counter | -Frequency range: 10 Hz to 20 MHz for 1 MΩ input 15 MHz to 200 MHz for 50 Ω input -Sensitivity 20 mV r.m.s. (50 Ω), 25 mV r.m.s. (1MΩ) -Battery or line 220 Vac 50Hz operation -8 digit L.C.D. -Gate time of 0.01 s to 100s ± 10 ppm. | | 2 | | | | | | | | |

CMU AND MIAT REQUESTED EQUIPMENT LIST
FOR NAEC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MIAT | TOTAL |
|------|---------------------------------------|--|----|-----|---------|----------|-----------|----------|---------|--------------------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI SUB TOTAL | | |
| 514 | "Bench-Top" high voltage power supply | <ul style="list-style-type: none"> -Output polarity : pos. or neg, -Output range : 50-3000V. -Load current : 0-10 mA -Regulation : < 0.0025% -Overload protection -AC power : 220V 50Hz -LCD display for kV or mA selectable -SHV output connectors | | 2 | | | | | | | | |
| 515 | stabilizer 10 KVA | <ul style="list-style-type: none"> -Single phase 50 Hz ac. -in 220 V ± 10% -out 220 V ± 0.5% | | 2 | | | | | | | | |

CSE AND MIAI REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | REQD | CSE | | | | | MIAI | TOTAL | |
|------|---|--|----|--------|---------|----------|-----------|----------|---------|------|-------|-------------------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | | | GROUP VALUE TOTAL |
| 516 | Miscellaneous electronic tools set | Hoza, S-75 | | 2 sets | | | | | | | | |
| 517 | Component boxes | Hoza, B-105 | | 10 | | | | | | | | |
| 518 | Electrostatic voltmeter | Yokogawa, 2065 | | 2 | | | | | | | | |
| 519 | AC/DC digital clamp meter | Kyoritsu, 2003 | | 2 | | | | | | | | |
| 520 | Insulation tester | Kyoritsu, 3204 | | 2 | | | | | | | | |
| 521 | Soldering stations with digital readout | -220 V a.c., 50 Hz -Temperature setting and reading -40-60 watts | | 3 | | | | | | | | |

CMU AND MIAI REQUESTED EQUIPMENT LV
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | TOTAL | |
|------|------------------|--|----|-----|---------|----------|-----------|----------|---------|----------|-------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | TOTAL |
| S22 | Antenna Analyzer | <ul style="list-style-type: none"> -Bridge type -Impedance R & JX measurement -RF source 1.5-150 MHz -Resistance range : 5-450Ω -Display : 4 digit LED - Battery operate | | 2 | | | | | | | | |

CMU AND MLAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CMU | | | | | | MLAT | TOTAL |
|------|---|---|----|-----|---------|----------|-----------|----------|---------|--------------------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI/SUB TOTAL | | |
| 601 | Control environment studies facilities Phytotron | Large room phytotron consists of 4 rooms (4.0x4.0 m) with natural light. Each room has its own machinery to maintain the temperature at the desired value. The temperatures range from 9 to 40°C (day) and 6 to 30°C (night). At least six mobile trolleys (1.0x1.0 m) provided in each room. | | | | | | | | | 1 | |
| 602 | Superglasshouse | The approximate 9x15x3 m temperature-controlled glasshouse by air injection. The air may be cooled by the evaporative cooling obtained with the moist pad and fan technique. | | | | | | | | | 5 | |

CMU AND MLAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRB | CMU | | | | | | MLAT | TOTAL |
|------|----------------------------------|--|----|-----|---------|----------|-----------|----------|---------|-------------------|------|-------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VISUB TOTAL | | |
| 603 | Plant growth analysis laboratory | Daylength control provided by artificial light and automatic shutters. Big mobile bench (1.0x2.0 m) provided, at least 9 benches for each glasshouse. The approximate 20x30 m temperature-controlled room | | | | | | | | | 1 | |
| 604 | Equipments Electronic balance | Mettler, AML00 PM400 PM6000 PM16 | | | | | | | | | 2 | |
| 605 | Data interfaces (bidirectional) | | | | | | | | | | 2 | |
| | | | | | | | | | | | 2 | |
| | | | | | | | | | | | 2 | |
| | | | | | | | | | | | 1 | |

CMU AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IND | CMU | | | | | | MIAT | TOTAL | |
|------|--------------------------------------|---------------|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|--------------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | VI/SUB TOTAL |
| 606 | Forced-draught oven | size 2x2x1m | | | | | | | | | | 2 | |
| 607 | Electronic planimeter (leaf area) | | | | | | | | | | | 1 | |
| 608 | Electronic seed counter | | | | | | | | | | | 1 | |
| 609 | Seed cleaner and sieve | | | | | | | | | | | 1 | |
| 610 | Refrigerator | 12 cu.ft. | | | | | | | | | | 2 | |
| 611 | Plant material mixer/ mill | | | | | | | | | | | 1 | |
| 612 | Scintillation counter | | | | | | | | | | | 1 | |
| 613 | Freezer | Same as in 14 | | | | | | | | | | 1 | |

CSU AND MIAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL | IRD | CSU | | | | | | MIAT | TOTAL | |
|------|---|----------------|----|-----|---------|----------|-----------|----------|---------|----------|------|-------|-----------|
| | | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | SUB TOTAL |
| 614 | pH meter | eyela OGN-2000 | | | | | | | | | | 2 | |
| 615 | Quantum sensor (light meter) | | | | | | | | | | | 1 | |
| 616 | Tube solarimeter | | | | | | | | | | | 1 | |
| 617 | Meteorological equipment(complete set) | | | | | | | | | | | 1 | |
| 618 | Microcomputer | 20MB Hard disk | | | | | | | | | | 2 | |
| 619 | Image writer with cables | | | | | | | | | | | 2 | |
| 620 | Laser writer with cables | | | | | | | | | | | 1 | |

CMU AND MLAT REQUESTED EQUIPMENT LIST
FOR NABC ESTABLISHMENT

| ITEM | DESCRIPTION | SPECIFICATION | CL IND | CMU | | | | | | MLAT | TOTAL | |
|------|------------------------------------|---------------|--------|---------|----------|-----------|----------|---------|----------|------|-------|-------------------|
| | | | | GROUP I | GROUP II | GROUP III | GROUP IV | GROUP V | GROUP VI | | | GROUP VISUS TOTAL |
| 621 | Vehicles | Station sedan | | | | | | | | | 1 | |
| 622 | Vehicles | Utility 4WD | | | | | | | | | 2 | |
| 623 | Precision camera (complete set) | | | | | | | | | | 1 | |

JICA

