第5章　プロジェクト実施運営上の問題点

第5章　プロジェクト実施運営上の問題点

(1) 本プロジェクトは、すでに4年を経過し、本年12月で予定されている期間が終了する。このため、それぞれの分野、あるいはプロジェクト全体としてどのような活動の成果が出つつあるのかが問題となる。

しかしこの点に関しては、それぞれの分野で、このプロジェクトの大きな成果といえるものが明らかにされつつある。

栽培分野についていえば、圃場での登熟期間や乾燥中における穀粒水分減少過程の追跡、その品種間差異の解明、ハスク付き乾燥法の開発、とうもろこし害虫の発生生態と汚染との関係解明、貯蔵法・貯蔵条件とアフラトキシン汚染との関係解明とその現地実証試験、作付体系と *A. flavus* 菌の発生など、収穫調製分野では、ハスクを付けたままの穂の脱粒機（Corn Sheller）の開発、貯蔵法・貯蔵条件とアフラトキシン汚染との関係解明と貯蔵施設・貯蔵法の改良、穀粒水分計の開発など、微生物分野では、菌の生態解明、環境条件と発生及び汚染との関係、蛍光発色による *A. flavus* 菌のアフラトキシン産生能分析法、ミニカラムによる簡易アフラトキシン分析法の改良、菌の発生制御法などである。

A. flavus 菌の生理・生態や、とうもろこしにおける増殖と発病、アフラトキシンによる汚染の実態等が、まだ殆ど明らかにされていない条件からスタートした研究であることを考えれば、それぞれ極めて素晴らしい活動成果といえる。

最終年度では、これらを中心にさらに進めるとともに課題を絞り込んで、成果を裏づけるデータをとることが望まれる。

(2) このプロジェクトは、タイ国におけるとうもろこしのアフラトキシン汚染を防止し、高品質生産を行うための研究プロジェクトであるが、必ずしも全ての研究が、アフラトキシン汚染防止技術に結びつかなくてもよいと考えられる。当初計画においても、(1)汚染要因の解析、(2)関係する計測機器・試験方法の改善、(3)アフラトキシン防除対策、の3項目がこの研究の中心とされている。*A. flavus* 菌やアフラトキシンに関する基礎的研究はもとより、それらに関係する研究はそれぞれ立派な成果である。ただ、各分野とも試験項目が極めて多いため、それぞれの研究が、基礎か実用化技術か、目指しているポイントがやや不明確になっている部分もある。最終年度の研究活動実施の前に、いま一度整理して進めることが望まれる。

(3) 最終年度の研究終了後、プロジェクト全体の活動報告書とは別に、研究成果だけを研究論文形式で取りまとめた「研究成果集」のようなレポートを出版することが望まれる。このためには、各分野で、*A. flavus* 菌及びアフラトキシンに関する既往の研究文献を整理する

ことが必要である。しかしながら、プロジェクトセンターには図書館がなく必要な研究文献が入手し難い状況にある。日本では文献検索は比較的容易であるので、各分野の専門家あるいは短期専門家として派遣された経験を持つものが、文献収集あるいは取りまとめにおける必要資料の収集に協力することが必要である。

(4) このことを考えると、このような海外での研究活動に対し、国内での支援体制を一層充実させることが必要なように考えられる。現在、農業分野の海外派遣あるいは海外研究活動について、農林水産省傘下では、各機関あるいは関係場所の代表（課長・企画連絡室長など）による協力組織（国内委員会）が出来ている。しかし、本プロジェクトのような研究プロジェクトに対しては、個別の支援も必要で、ＪＩＣＡ関係者、現地訪問の経験を持つ調査団経験者、長期・短期派遣専門家等で協力組織を作り、成果の取りまとめ、評価等に協力して行くことが望まれる。このような協力なくしては、膨大な研究データの整理・考察・論文作成は極めて困難ではないかと考えられる。

(5) 現在、長期専門家はそれぞれの分野に１名ずつ派遣されて、多くの研究課題に取り組んでいる。しかし、栽培、乾燥調製、微生物の各分野とも、研究の進展につれてそれぞれ解決すべき新しい問題が生じており、それらをすべてこなすことは不可能に近い。このため、短期専門家が派遣され、これを補っている。最終年度ではあるが、現地及び日本との連絡を密にし、できるだけ多くの専門家が派遣され一層の成果が上げられることが望まれる。

(6) 「タイとうもろこし品質向上計画」が計画された当初、タイ国のとうもろこしは輸出用が殆どで、これがアフラトキシン汚染問題から輸出困難となり、このＭＱＩＲＣＰが実施されるようになったと聞いている。しかしその後、タイ国のとうもろこしを巡る情勢は変化し、日本への輸出用鶏肉の生産等から、国内需要が増加してきているとのことである。このような情勢変化のなかで、本プロジェクト研究の成果をタイ国においてどのように活用するかは極めて大きな問題である。本調査団は十分な意見聴取が出来なかったが、タイ国側の積極的な活用を期待したいと考える。

(7) 農業研究活動のようなプロジェクトは、建物や施設設置のように成果が目に見える事業と異なって、成果の現れ方も遅く、内容も具体的に表現し難い面がある。しかし、多くの費用・時間・人材を活用しての協力活動であるので、シンポジウムや論文による発表の機会を作り、成果を公表するとともに、この成果が単にタイ国農業だけでなく、広く東南アジアの国々で活用されることも期待したい。

第6章　調査団所見

第6章　調査団所見

(1) タイとうもろこし品質向上計画は、タイ国の主要輸出農産物であるとうもろこしのアフラトキシン汚染を軽減し、その品質向上に寄与することを目的に、5か年計画で実施され、本年すでに4年を経過している。

このため本巡回指導調査団は、栽培、乾燥調製、微生物の各研究分野及びプロジェクト全体としての成果の評価、最終年度の研究計画、業務調整を含むタイ側への技術移転等に主眼をおいて長期専門家及びタイ国側関係者と協議した。

幸い植田チームリーダーを始めとする各長期専門家、タイ国農業局、業務調整担当、研究者、カウンターパート等の尽力により、第3章記載の通りの成果が得られつつあり、プロジェクト全体として誇り得る内容であると考えられた。

(2) 本プロジェクトのような国際共同研究においては、異なる研究分野における日本人研究者同士の協力はもちろん、相手国研究者、カウンターパート等研究補助者との協力関係が、研究の成否に大きな影響を及ぼすと考えられる。

この点、本プロジェクトにおいては、上記の大きな目的に向かって、チームリーダーの指導のもと業務調整及び、それぞれの専門家が自分以外の分野及びタイ国側関係者と密接に連絡を取り、協力してプロジェクトの推進に当っていた。このため、タイ国側との関係も極めて良好であり日本人専門家に寄せる期待と信頼も厚いものがあった。これが本プロジェクトが高い成果を上げている大きな要因と考えられた。

(3) このように本プロジェクトは、大きな研究成果を上げつつあり、これらのなかには、タイ国とうもろこしにおけるアフラトキシン汚染要因と経路の解明、ハスク付き貯蔵・乾燥法の開発、ハスク付きとうもろこし脱粒機の開発、ビニール袋貯蔵による *A. flavus* 菌の発生防止効果、蛍光発色による *A. flavus* 菌のアフラトキシン産生能分析法、ミニカラムによるアフラトキシン簡易分析法の改良等、極めて高い研究成果が含まれている。このため、新しい研究成果は、プロジェクト途中でも研究誌に発表することが望ましいと考える。

ただそのためには、前章記載の通り国内における支援が重要であり、ＪＩＣＡ関係者、巡回指導調査団・短期専門家経験者等を中心に組織を作り協力することが望まれる。これがこの成果を活かすことになる。

(4) 本プロジェクトは、日・タイ両国において多大の経費・人的資源を投じて実施されている事業であり、タイ国においてその成果の積極的な活用を期待したい。そのためには成果の啓

蒙とともに、新しい技術の導入による高品質とうもろこしの生産が農家の収入向上につながるよう、例えば価格差を設けるようにすることなども必要ではないかと考えられる。

(5) 本プロジェクトの期間延長問題については、別章記載の通りである。

もし延長することになると、日本側長期専門家の滞在期間延長や交代に問題を残すことになる。今後、日・タイ双方での詰めをお願いしたい。

(6) 今回の調査団の日程は、第1章に記載の通り13日間であった。しかしその間、延長問題の検討等にも時間を割かれた。このため、一つ一つの研究成果・最終年度の研究計画検討、本プロジェクトの基本的な研究問題等は、これに多くの時間を割いたとはいえ、なお不十分であった。この意味から、でき得ればなお2～3日の時間的余裕がほしかったと考える。

終わりに、今回の巡回指導調査団訪タイに際し、多大の配慮を頂いた植田チームリーダーを始めとする長期専門家、農業局長 Dr. Tanongchit Wongsiri を始めとするタイ国関係者、日本国大使館、ＪＩＣＡタイ事務所、農林水産省、ＪＩＣＡ本部の関係各位に対し深甚なる謝意を表する。

附　　属　　資　　料

ミニッツ

(1)　タイ側経過報告

(2)　日本側経過報告

(3)　調査団サマリーレポート

(4)　試　験　結　果

MINUTES OF DISCUSSIONS

THE MAIZE QUALITY IMPROVEMENT RESEARCH CENTRE PROJECT

The Japanese Technical Guidance Team, organized by Japan International Cooperation Agency, headed by Dr. Ryosaku Ishida, Director of Ecology Department, National Grassland Research Institute, The Ministry of Agriculture, Forestry and Fisheries of the Government of Japan visited the Kingdom of Thailand from January 14 to 26, 1991. The main purpose of the team was to discuss and review the present status of the actual implementation, based on the Tentative Implementation Programme (TIP), of the research activities for the Maize Quality Improvement Research Center Project.

During stay in Thailand, the team exchanged views and had discussions with the authorities concerned referring to the project activities, to be carried out in accordance with the Tentative Implementation Programme. As a result of the discussions, The Thai Department of Agriculture and the Japanese Technical Guidance Team came to a good understanding of the matters attached hereto.

Bangkok, January 24, 1991

Dr. Ryosaku Ishida
Leader
The Japanese Technical Guidance Team, Japan International Cooperation Agency

Dr. Tanongchit Wongsiri
Director-General
Department of Agriculture, Ministry of Agriculture and Cooperatives

Witnessed by

Mr. Seiichi Ueda
Team Leader
Maize Quality Improvement Research Centre Project (JICA)

AGENDA

FOR

THE FOURTH MEETING OF THE JOINT COMMITTEE

ON THE MAIZE QUALITY IMPROVEMENT RESEARCH CENTRE PROJECT

(at 5th Floor, Room No. 501, Department of Agriculture)

Thursday 24th January, 1991

10:00-10:05	Opening Address by the Director-General of DOA
10:05-10:10	Address by the Team Leader, Technical Guidance Team
10:10-10:15	Adoption of the proposed agenda
10:15-10:35	Progress report by Thai side
10:35-10:55	Progress report by Japanese side
10:55-11:30	Summary report by Japanese Technical Guidance Team
11:30-11:40	General Discussions
11:40-11:50	Summarization and Adoption
11:50-12:00	Closing Address by the Direction-General of DOA

CONTENTS

MEMBERS OF JAPANESE TECHNICAL GUIDANCE TEAM, JICA

Leader; Dr. Ryosaku Ishida
Agronomy; Director, Ecology Department,
National Grassland Research Institute, MAFF

Microbe; Mr. Michihiko Saito
Chief, Stored-product Microbiology Lab.,
Food Protection and Preservation Department
National Food Reserch Institute, MAFF

Post-Harvent; Mr. Tsutomu Kanaya
Chief, Seed and Seedling Division,
Nagano Station of National Livestock Breeding Center, MAFF

Coordinator; Mr. Katsuo Shoji
Staff, Technical Cooperation Division,
Agricultural Cooperation Department, JICA

I. PROGRESS REPORT

THAI SIDE

(PROJECT DIRECTOR)

PROGRESS REPORT ON THAI SIDE

I. DURATION OF PROJECT

The Department of Agriculture was supported by Technical assistance of Japanese Government, through JICA, to carry out researches in order to control Aflatoxin in Maize. The Record of Discussion was executed between the Japanese Implementation Survey Team and the authorities concerned of the Government of the Kingdom of Thailand on the Japanese Technical Cooperation for the Maize Quality Improvement Research Center Project since December 15, 1986. The duration of the project was 5 years (December 15, 1986 through December 14, 1991). Now, the project has been implemented for 4 years and 1 month and would last another 11 months before its termination.

Four working groups of the Project work closely with Japanese Experts. And now some research works had been finished but some of them need to be continued to obtain the reliable results. All the research works have to be completed before project terminates.

II. WORKING GROUP OF THE PROJECT

The Department of Agriculture issued many orders for appointment of Committee, Working Group and others since the beginning of the Project until last year as shown in this report on page I-12 to I-27. Later on DOA issued one additional Order, that is DOA No. 2211/1990, appointment of working group of the Coordinating Committee for the Maize

Quality Improvement Research Center Project (Third addition), dated July 9, 1990, appointed two members for Microbe Group which are Mrs. Warunee Premanoch and Mrs. Surang Suthirawut as shown on page I-28.

III. PROJECT STAFF

The present staff are the followings :-

1.	Permanent Officers	32 persons
1.1	Administration Group	8 persons
1.2	Post Harvest Group	6 persons
1.3	Agronomy Group	10 persons
1.4	Microbe Group	8 persons

2. Temporary Employees.

The number of temporary employees was reduced from 39 positions last year into 36 positions because of the cancellation of 3 positions of security guard under administrative group.

2.1	Administration Group	8 persons
2.2	Post Harvest Group	9 persons
2.3	Agronomy Group	10 persons
2.4	Microbe Group	9 persons

IV. TRAINING OF THAI COUNTERPART

The Department of Agriculture was provided by JICA with scholarships for Thai counterpart in training and study tour in Japan in many fields concerning researches of the Project. Since the beginning of the project in 1987 until January 1991, 12 of Thai counterparts had returned to Thailand

to work in the following fields :

- Administration	2	persons
- Post Harvest	3	persons
- Agronomy	3	persons
- Microbe	4	persons

In 1990 Japanese Fiscal Year, two,of Thai counterpart from Administrative and Post Harvest Groups are expected to leave for Japan as indicated in Progress Report of Japanese Side, page II-6.

V. BUDGET

1. Royal Thai Government Budget.

The Royal Thai Government (RTG) has provided the budget for project annually totalling 17, 891,300 bahts since the project began its implementation in 1987 Fiscal Year until the present 1991 Fiscal Year as shown in Table 1 and 2. For the 1992 Fiscal Year, the budget is now under consideration of Office of Budget Bureau. The Budget amount depends on extension period of the Project.

2. JICA Budget.

JICA provided the project budget for technical equipment, construction and others annually totalling 186,815,000 Yen (Started 1987 to 1990 Japanese Fiscal Year).

VI. THE PROJECT COMMITTEE MEETING

Since 1988 the project committee Meeting wer held as follows :

1. The Joint Committee Meeting were held on dates hereafter :

1.1 April 5th, 1988.

1.2 March 16th, 1989.

1.3 April 19th, 1990.

2. The Coordinating Committee Meeting were held on dates hereafter :

2.1 March 14th, 1988.

2.2 August 2nd, 1988.

2.3 December 22nd, 1988.

2.4 December 15th, 1989.

2.5 February 13th, 1990.

2.6 November 30th, 1990.

2.7 January 3rd, 1991.

3. The Coordinating Sub-Committee Meeting were held on the dates hereafter :

3.1 January 15th, 1988.

3.2 February 25th, 1988.

3.3 June 29th, 1988.

3.4 October 17th, 1988.

3.5 December 8th, 1988.

3.6 February 17th, 1989.

3.7 December 4th, 1989.

3.8 February 2nd, 1990.

3.9 April 5th, 1990.

3.10 July 6th, 1990.

3.11 December 28th, 1990.

4. The Working Group Meeting were held by the respective group members, when necessary.

VII. RESEARCH ACTIVITIES

Research activities were carried out mutually between Thai researchers and Japanese Experts both long-term and short-term which will be reported by Japanese Team Leader and the results appeared in page IV-A-1 to IV-M-19.

VIII. THE SURVEY OF MAIZE PRODUCTION AND MARKETING IN THAILAND

Some discussion on research work of the Maize Quality Improvement Research Centre Project, one more activity should be added to achieve project objective. This proposed activity is the Survey of Maize Production and Marketing in Thailand and objectives of this study is to analyze the maize commodity system in Thailand in order to provide some guidelines for the planning of future Thai maize policy. And justify the project activities to the present and future situation. The specific of the study are as follows :

a) To deseribe current maize production system in Thailand.

b) To investigate, in detail, the cultivation and postharvest handling of maize both at farm and market levels.

c) To estimate cost of maize production at regional level in different growing reasons.

d) To describe market structure of Thai maize and to forecast future demand for maize.

Subsequent to Coordinating and Sub-Coordinating Committee concerning the Survey of Maize Production and Marketing in Thailand. The project has requested for financial support from JICA, Tokyo based on the proposal submitted by Dr. Saran, Professor of Kasetsart University. Sub-Coordinating Committee has discussed and proposed draft of the survey items. For questionaire, Dr. Saran, is now preparing. When the final proposal is submitted, it will be passed to committee to scrutinize once again. It is hoped that agreement will be signed around January 28th, 1991.

IV. IMFORMATION CENTRE

Subsequent to JICA provision of 3 units of computer to keep all project informaton, DOA assigned this task to the Document and Research Registration Sub-Division, Planning and Technical Division. Now, the computer machines had been installed and the software to be used will be CDS-ISIS by UNESCO. The Database system is now ready for use.

X. LATEST STATUS OF THE PROJECT

The five-year project, beginning December 15, 1986 towards December 14, 1991, has been implemented for 4 years and 1 month and it would take another 11 months before its terminatation. The Coordinating Committee and the Coordinating Sub-Committee had discussed about extension of the project

and agreed to propose for extension to the 3rd Joint Committee Meeting (April 19, 1990). The resolution of the meeting required an extension for another 6 months from December 15, 1991 until June 14, 1992 for data analysis and final report preparation. Later on the working groups considered that research and administrative works could not be completed within six-month extension period so it needs to be longer in order to complete the planned works such as research work, sample analysis, data analysis, annual report and preparation of final report.

XI. TECHNICAL WORKSHOP

The discussion of Coordinating Committee on January 3, 1991 resulted in suggestion that the project was operated for long time and will be terminated in the near future. It was agreed that there should be one technical workshop before the project terminate. All concerned agencies, both private and government, would be invited. The Technical workshop is aimed to present research results and exchange knowledges and experiences among participants. The Depsrtment of Agriculture will cooperate with JICA to hold this technical workshop.

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Table 1. Conclusion of RTC Budget for The Maize Quality Improvement Research Centre Project.

(Thai Fiscal Year 1987-1992)

Item / Year	Temporary Wages	Renumeration Cost	Public Utility Cost	Civil Works & Equipment Cost	Total
1st Year (1987) (approved)	-	-	-	2,030,300	2,030,300
2nd Year (1988) (approved)	333,000	979,100	246,200	1,277,600	2,835,900
3rd Year (1989) (approved)	824,100	1,872,200	246,200	-	2,942,500
4th Year (1990) (approved)	1,259,300	2,865,200	588,000	-	4,712,500
5th Year (1991) (approved)	1,259,300	3,283,900	588,000	238,900	5,370,100
6th Year (1992) (proposed)	1,378,560	4,497,280	700,000	116,000	6,691,840
Total					24,583,140

Remarks : 1st Year = Oct. 1986 - Sept. 1987

2nd Year = Oct. 1987 - Sept. 1988

3rd Year = Oct. 1988 - Sept. 1989

4th Year = Oct. 1989 - Sept. 1990

5th Year = Oct. 1990 - Sept. 1991

6th Year = Oct. 1991 - Sept. 1992

Table 2. RTG Budget for the Maize Quality Improvement Research Centre Project.

(Thai Fiscal Year 1987-1991)

Item / Group/Section	Temporary Wages					Renumeration Cost					Public Utility Cost				
Thai Fiscal Year	1st Year 1987	2nd Year 1988	3rd Year 1989	4th Year 1990	5th Year 1991	1st Year 1987	2nd Year 1988	3rd Year 1989	4th Year 1990	5th Year 1991	1st Year 1987	2nd Year 1988	3rd Year 1989	4th Year 1990	5th Year 1991
Agronomy Section	-	93,630	224,700	318,000	318,000	-	250,000	345,500	463,500	568,500	-	35,000	-	45,000	45,000
Microbe Section	-	80,280	192,700	322,500	322,500	-	483,700	1,033,000	1,625,400	1,725,400	-	-	-	-	-
Post-Harvest Section	-	90,830	218,000	298,800	298,800	-	114,100	196,000	326,000	426,000	-	-	-	-	-
Administration Section	-	68,260	188,700	320,000	320,000	-	130,500	297,700	450,300	564,000	-	211,200	246,200	543,000	543,000
Total	-	333,000	824,100	1,259,300	1,259,300	-	979,100	1,872,200	2,865,200	3,283,900	-	246,200	246,200	588,000	588,000

Table 2. (Cont.) RTG Budget for the Maize Quality Improvement Research Centre Project.

(Thai Fiscal Year 1987-1991).

Item / Group/Section	Civil Work & Equipment Cost					Total				
Thai Fiscal Year	1st Year 1987	2nd Year 1988	3rd Year 1989	4th Year 1990	5th Year 1991	1st Year 1987	2nd Year 1988	3rd Year 1989	4th Year 1990	5th Year 1991
Agronomy Section	-	-	-	-	-	-	379,430	570,200	826,500	931,500
Microbe Section	-	-	-	-	-	-	563,980	1,225,700	1,947,900	2,047,900
Post-Harvest Section	-	-	-	-	-	-	204,930	414,000	624,800	724,800
Administration Section	2,030,300	1,277,600	-	-	238,900	2,030,300	1,687,560	732,600	1,313,300	1,665,900
Total	1,030,300	1,277,600	-	-	238,900	2,030,300	2,835,900	2,942,500	4,712,500	5,370,100

Remarks : 1st Year = Oct. 1986 - Sept. 1987
2nd Year = Oct. 1987 - Sept. 1988
3rd Year = Oct. 1988 - Sept. 1989
4th Year = Oct. 1989 - Sept. 1990
5th Year = Oct. 1990 - Sept. 1991

DOA ORDER

and

ADMINISTRATION SYSTEM

DOA ORDER

No. 341/1988

Appointment of Director for the Maize Quality Improvement Research Centre Project

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According to the Record of Discussion between the Government of Japan and the Government of the Kingdom of Thailand on cooperation for the Maize Quality Improvement Research Centre Project dated December 15, 1986, the Government of Japan extended its contribution to the Kingdom of Thailand for the mentioned project beginning December 15, 1986 through December 14, 1991 (5 years) and Department of Agriculture (DOA) appointed DOA deputy director-general for technical service as the project director. To achieve the expected goals, the Director would assume reponsible for all related matters of administration, and Dr. Tanongchit Wongsiri, Deputy Director-General for technical service was appointed the Project Director.

Effective order by February 2, 1988

(Mr. Riksh Syamananda)
Director-General of DOA

ADMINISTRATION SYSTEM

NOTE

DOA The Planning & Technical Division;
The Foreign Projects Sub-division
Title on the Appointment of The Committees of The Maize Quality Improvement Research Centre Project

To Japanese Experts

With this note, The DOA ORDERS dated on February 22, 1988 are attached hereto:

1. DOA ORDER No. 589/1988. Title on The Appointment for The Joint Committee of The Maize Quality Improvement Research Centre Project.

2. DOA ORDER No. 590/1988. Title on The Appointment for The Coordinating Committee of The Maize Quality Improvement Research Centre Project.

3. DOA ORDER No. 591/1988. Title on the Appointment for The Coordinating Sub-Committee of The Maize Quality Improvement Research Centre Project.

Mr. Vijai Nopamornbodi
Agricultural Scientist Level 7
Represented The Director of The Planning & Technical Division

JOINT COMMITTEE

DOA ORDER
No.589/1988
Title on The Appointment of The Joint Committee
of The Maize Quality Improvement Research Centre Project

Due to the Record of Discussion on the 15th of December,1986. The Government of Japan has agreed to give assistance to The Government of Thailand in the project on Maize Quality Improvement from December 15, 1986 to December 14, 1991. The Department of Agriculture (DOA) is responsible for this project combining with other government agencies.

Thus, In order to carry out the project activities effectively to achieve the expected objectives and the goal, The Joint Committee is appointed as listed:

1. The Director-General — Chairman
2. The Deputy Director-General — member
   Research Institute
   (Mr. Ampol Senanarong)

3. The Deputy Director-General member
   Technical Service
   (The Director of The Maize Quality
   Improvement Research Centre Project)
4. The Director of The Planning and Technical member
   Division
5. The Director of The Agricultural member
   Engineering Division
6. The Director of The Plant Pathology and member
   Microbiology Division
7. The Director of The Field Crops Research member
   Institute
8. The Representative from Department of The member
   Technical and Economics Cooperation
9. The representative from The Bureau of The member
   Budget
10. The representative from The Office of The member
    Civil Service Commission
11. Project Leader Japanese Side member
12. Project Coordinator Japanese Side member
13. JICA experts member
14. JICA Representative in Thailand member
15. Personnel dispatched by JICA, if necessary member
16. Mr. Vijai Nopamornbodi member & Secretary
    Agricultural Scientist Level 7
    Planning and Technical Division
17. Mrs. Saranya Busparoek member & Assist. Secretary
    Agricultural Scientist Level 6
    Planning and Technical Division
18. Mrs. Siriporn Sindhusake member & Assist. Secretary
    Agricultural Scientist Level 6
    Planning & Technical Division

The Committee will meet at least once a year and when necessity arises, and duties are:

1) To formulate the Annual Work Plan of the Project in line with The Tentative Schedule of Implementation formulated under the framework of this record of discussions.

2) To review the overall progress of the technical cooperation programme as well as the achievements of the above-mentioned Annual Work Plan.

3) To review and exchange views on major issues arising from or connection with the technical cooperation programme.

4) To consider on the appointment for the Coordinating Committee as necessary.

It is effective from now.

February 22, 1988
Mr. Riksh Sayamananda
Director-General
The Department Of Agriculture

COORDINATING COMMITTEE

DOA ORDER
No.590/1988

Title on The Appointment of The Coordinating Committee of The Maize Quality Improvement Research Centre Project

Due to the DOA order No.3294/1987 on September 24,1987 for The Appointment for The Coordinating Committee of the project for Maize Quality Improvement. The Executive Committee has considered and agreed to correct DOA order, so it is appropriated to give up the DOA order No. 3294/1987 on September 24, 1987 and newly appointed for the Coordinating Committee as follows:

1) The Deputy Director-General — Chairman
   Technical Service
   (Director of The Maize Quality Improvement
   Research Centre Project)
2) Mr. Arwooth Na Lampang — member
   Field Crops Specialist
3) Director of The Planning and Technical — member
   Division
4) Director of The Agricultural Engineering — member
   Division
5) Director of The Plant Pathology and — member
   Microbiology Division
6) Director of The Field Crops Research — member
   Institute
7) Mr. Taketoshi Yoshiyama — member
   Project Leader Japanese Side
8) Mr.Vijai Nopamornbodi — member & secretary
   Agricultural Scientist Level 7
   Planning and Technical Division
9) Mr. Takeji Seino — member & assist.secretary
   Project Coordinator Japanese Side
10) Mrs. Siriporn Sindhusake — member & assist.secretary
    Agricultural Scientist Level 6
    Planning and Technical Division

The Committee will quarterly meet or when the necessity arises and duties are:

1. To control and carry out project activities to achieve the expected objectives.

2. Giving consideration and guidance for the plan structure adjustment of The Maize Quality Improvement Research Centre Project.

3. To settle direction and plan to get funds and provisional budget from the government sector to support the project.

4. To consult and guide to the problems arised in various activities.

5. To appoint working group and coordinating sub-committee as necessary to suit the project proceeding.

It is effective from now.

February 22, 1988
Mr. Riksh Sayamananda
Director-General
Department of Agriculture

COORDINATING SUB-COMMITTEE

DOA ORDER
No. 591/1988

Title on The Appointment of The Coordinating Sub-Committee for The Maize Quality Improvement Research Centre Project

With the assistance from The Government of Japan, The Maize Quality Improvement Research Centre Project was established and effective from December 15, 1986 to December 14, 1991. The Field Crops Research Institute, The Agricultural Engineering Division, The Plant Pathology and Microbiology Division and The Planning and Technical Division participate in this project.

In order to carry out the project coordinating activities, DOA was approved to appoint for The Coordinating Sub-Committee of The Maize Quality Improvement Research Centre Project which name list is below.

1) The Director of The Planning and Technical Division — Chairman

2) Mrs. Sriwai Singhagajen — member
Agricultural Engineer Level 8
Agricultural Engineering Division

3) Mr. Makoto Kobayashi — member
Expert for Post-harvest Japanese Side

4) Mr. Narongsak Senanarong — member
Agricultural Scientist Level 8
Field Crop Research Institute

5) Mr. Teruhiko Nibe — member
Expert for agronomy Japanese Side

6) Mr. Prawat Tanboon-ek — member
Plant Pathologist Level 7
Plant Pathology and Microbiology Division

7) Expert for Microbe Long Term Expert — member
Japanese Side

8) Mr. Vijai Nopamornbodi — member
Agricultural Scientist Level 7
Planning and Technical Division

9) Mrs. Siriporn Sindhusake — member
Agricultural Scientist Level 6
Planning and Technical Division

10) Mrs. Boonluck Seetanun — member and secretary
Agricultural Scientist Level 6,
Planning and Technical Division

11) Mr. Takeji Seino — member and assist.secretary
roject Coordinator Japanese Side

12) Mrs. Permpoon Sarnthoy — member and assist.secretary
Agricultural Scientist Level 5
Planning and Technical Division

The Coordinating Sub-Committee will meet once a month and duties are:

1. Submitting the draft plan to The Coordinating Committee in the project implementation and plan for the budget management.

2. To control and coordinate in the project proceeding of The Working Group in Post-harvest, Agronomy and Microbe fields for efficiency and effectiveness.

3. To invite the participants to give some advices and information.

4. To appoint The Working Groups to give assistance to the Sub-Committee as necessary.

It is effective from now.

February 22, 1988
Mr. Riksh Sayamananda
Director-General
Department of Agriculture

WORKING GROUP

The Working Group for the project was organized by the members of Thai personnel and Japanese experts.

DOA ORDER

No. 1073/1988

Appointment of the Counterparts for the Expert of the Maize Quality Improvement Research Centre Project

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To cooperate closely with the Japanese experts provided by the Government of Japan through the Japan International Cooperation Agency (JICA), the Department of Agriculture (DOA) appointed the following officials as counterparts for the Maize Quality Improvement Research Centre Project as follows :

1. Mr. Narongsak Senanarong
   Agricultural Scientist Level 8,
   Field Crops Research Institute as a counterpart for Mr. Teruhiko Nibe, Expert for Agronomy

2. Mrs. Sriwai Singhagajen
   Agricultural Engineer Level 8,
   Agricultural Engineering Division as a counterpart for Mr. Makoto Kobayashi, Expert for Post-harvest

3. Mr. Vijai Nopamornbodi
   Agricultural Scientist Level 7,
   Planning and Technical Division as a counterpart for Mr. Takeji Seino,
   Project Coordinator, Japanese side

4. Mr. Prawat Tanboon-ek
   Plant Pathology Level 7,
   Plant Pathology and Microbiology Division as a counterpart for the Microbe Experts

The appointed counterparts will be responsible to joint consideration on the formulation of work plan and for cooporation with agencies concerning the Maize Quality Improvement Research Centre Project.

Effective by March 29, 1988

(Mr. Riksh Sayamananda)
Director-General,
Department of Agriculture
March 29, 1988

DOA Order

No.1719/2531

Title on The appointment of Assistant Director of the Maize Quality Improvement Research Centre Project.

Due to DOA order No.341/2531 dated on Febuary 2, 1988 appointed Director of the Maize Quality Improvement Research Centre Project.

In order to carry out the project activities effectively, DOA would like to appoint Director of Planning and Technical Division to be an Assistant Director of the Maize Quality Improvement Research Centre Project.

Effective as from now.

May 20, 1988.
Mr.Tanongchit Wongsiri
Deputy Director General
Acting Director General
Department of Agriculture

DOA Order

No.1720/1988

The appointment of Working Groups of the Coordinating Committee of the Maize Quality Improvement Research Centre Project.

Following the Department of Agriculture (DOA) Order subject to the appointment of the Coordinating Committee for the Maize Quality Impprovement Research Centre Project, DOA appointed four working groups for the Committee to encourage an effective implementation of the project as follows :

1 Administration Working Group (Planning and Technical Division)

1)	Director of Planning and Technical Division	Head
2)	Mr.Vijai Nopamornbodi, Agricultural Scientist Level 7	Assist.Head
3)	Mrs.Siriporn Sindhusake, Agricultural Scientist Level 6	staff
4)	Mrs.Saranya Busparock, Agricultural Scientist Level 6	staff
5)	Mrs.Boonluck Seetanun, Agricultural Scientist Level 6	staff
6)	Mrs.Permpoon Sarnthoy, Agricultural Scientist Level 5	staff
7)	Mr.Takeji Seino, Janpanese Project Coordinator	staff
8)	Mrs.Sunthree Niamgrum, Clerk 3	staff & secretary

2 Post Harvest Working Group (Agricultural Engineering Division)

1)	Director of Agricultural Engineering Division	Head
2)	Mrs.Sriwai Singhagajen, Agricultural Engineer Level 8	Assist.Head
3)	Mr.Mitri Naewbanij, Agricultural Engineer Level 5	staff
4)	Mr.Nitat Tangpinijkul, Agricultural Engineer Level 5	staff
5)	Mr.Pimol Wuttisin, Agricultural Engineer Level 4	staff
6)	Mr.Makoto Kobayashi, Janpanese Post Harvest Expert	staff
7)	Mr.Chaiwat Paosantadpanich, Agricultural Engineer Level 3	staff & secretary

3 Field Crops Working Group (Field Crops Research Institute)

1)	Director of Field Crops Research Institute	Head
2)	Mr.Narongsak Senanarong, Agricultural Scientist Level 8	Assist.Head
3)	Director of Nakhornsawan Field Crops Research Centre	staff

4) Director of Prabuddhabat Field Crops Experiment Station — staff
5) Mr.Prasop Thepayasuvan, Agricultural Scientist Level 6 — staff
6) Mr.Somrak Naradechanon, Agricultural Scientist Level 6 — staff
7) Mrs.Lily Kaveeta, Agricultural Scientist Level 5 — staff
8) Mr.Teruhiko Nibe, Janpanese Field Crops Expert — staff
9) Mr.Sompong Tongchuoy, Agricultural Scientist Level 3 — staff
10) Mr.Sukapong Wayupap, Agricultural Scientist Level 5 — staff & secretary

4 Microbe Working Group (Plant Pathology and Microbiology Division

1) Director of Plant Pathology and Microbiology Division — Head
2) Mr.Prawat Tanboon-ek, Plant Pathologist Level 7 — Assist.Head
3) Mrs.Kanjana Bhudhasamai, Plant Pathologist Level 7 — staff
4) Mr. Katsusuke Arai Japanese Microbe Expert — staff
5) Mrs.Arunsri Wongurai, Plant Pathologist Level 5 — staff & secretary

Duties of Working Groups are

1. To coordinate the planning of the performance, administration and research , follow up and collect reports to the Coordinating Committee of the Maize Quality Improvement Research Centre Project.
2. To implement the research activities of the project.
3. To carry out orders from the Coordinating Committee of the Maize Quality Improvement Research Centre Project.

It is effective from now.

May 20, 1988.
Mr.Tanongchit Wongsiri
Deputy Director General
Acting Director General
Department of Agriculture

DOA Order

No.1721/2531

Subject : The appointment of the Maize Quality Improvement Centre officers.

With the assistance of the Government of Japan to establish the Centre for Maize Quality Improvement, the Department of Agriculture appointed the following officers in order to carry out service for coordination, administration and research of project activities as effectively as possible to achieve the expected objectives and the goal.

1	Field Crops Group	
1)	Mr.Narongsak Senanarong	Agricultural Scientist Level 8
2)	Mr.Salin Phuvipadawat	Agricultural Scientist Level 6
3)	Mrs.Lily Kaweeta	Agricultural Scientist Level 5
4)	Mr.Somchai Wongsri	Temporary Employee
5)	Miss Wanna Seitung	Temporary Employee
2	Microbe Group	
1)	Miss Arunsri Wonguri	Plant Pathologist Level 5
3	Post Harvest Group	
1)	Mrs.Sriwai Singhagajen	Agricultural Engineer Level 8
2)	Mr.Mitri Naewbanij	Agricultural Engineer Level 5
3)	Mr.Nitat Tangpinijkul	Agricultural Engineer Level 5
4)	Mr.Pimol Wuttisin	Agricultural Engineer Level 4
5)	Mr.Chaiwat Paosantadpanich	Agricultural Engineer Level 3
4	Administration Group	
1)	Mr.Vijai Nopamornbodi	Agricultural Scientist Level 7
2)	Mrs.Saranya Busparoek	Agricultural Scientist Level 6
3)	Mrs.Siriporn Sindhusake	Agricultural Scientist Level 6
4)	Mrs.Boonluck Seetanun	Agricultural Scientist Level 6
5)	Mrs.Permpoon Sarnthoy	Agricultural Scientist Level 5
5	Japanese Experts	
1)	Mr. T. Yoshiyama	Team Leader, MQIRC Project
2)	Mr. T. Seino	Project Coordinator, MQIRC Project
3)	Mr. M. Kobayashi	Post-harvest Expert, MQIRC Project
4)	Mr. T. Nibe	Agronomy Expert, MQIRC Project
5)	Mr. Katsusuke Arai	Microbe Expert, MQIRC Project

Their duties are as follows :

1. To monitor and coordinate the Maize Quality Improvement Research Centre Project.

2. To take care of equipments of the Maize Quality Improvement Research Centre.
3. To provide cooperation in all project activities of the Maize Quality Improvement Research Project.
4. To look after maintenance of the Centre for Maize Quality Improvement.

Effective as from now.

May 20, 1988.
Mr.Tanongchit Wongsiri
Deputy Director General
Acting Director General
Department of Agriculture

DOA Order

No. 2837/1988

Subject : Appointment of the Maize Quality Improvement Centre Officers (Additional)

Following DOA Order No. 1721/1988 dated May 20, 1988 subject on the appointment of the Maize Quality Improvement Centre Project officers, two additonal officers are assigned to work for the project in order to improve the project effeciency as follows :

1) Mr. Prawat Tanboon-ek
   Plant Pathologist Level 7
   Plant Pathology and Microbiology Division

2) Mrs. Kanjana Bhudhasamai
   Plant Pathologist Level 7
   Plant Pathology and Microbiology Division

Effective Order by August 16, 1988.

(Mr. Riksh Syamananda)
Director-General,
Department of Agriculture

DOA ORDER

No. 4548/1988

Subject : Appointment of the Maize Quality Improvement Centre Officers (Second addition)

Following the Department of Agriculture Order, No. 1721/1988 dated May 20, 1988 and DOA Order No. 2837/1988 dated August 16, 1988 subject to the appointment of staff for the Maize Quality Improvement Research Centre Project, an additional staff is assigned to join the project in order to promote effective implementation of the project.

1) Microbe Group
   1) Mr. Suparat Kositchareonkul
      Plant Pathologist Level 3

The duties stated in DOA Order No. 1721/1988 dated May 20, 1988.

Effective Order by December 21, 1988.

(Mr. Riksh Syamananda)
Director-General of DOA

DOA ORDER

No. 4549/1988

Subject : Appointment of Working Group of the Coordinating Committee for the Maize Quality Improvement Research Centre Project (Additional)

Following DOA Order No. 1720/1988 dated May 20, 1988 subject to the appointment of working group of the Coordinating Committee for the Maize Quality Improvement Research Centre Project, two additional staffs have been assigned to join in the project activities in order to promote the project effeciency as follows :

1) Field Crops Working Group
(Field Crops Research Institute)
1) Mr. Veerawat Nilratanakul
Agricultural Scientist Level 4 member

2) Microbe Working Group
(Plant Pathology and Microbiology Division)
1) Mr. Suparat Kositchareonkul
Plant Pathologist Level 3 member

Both officers will be responsible to duties stated by DOA Order No. 1720/1988 dated May 20, 1988.

Effective Order by December 21, 1988.

(Mr. Riksh Syamananda)
Director-General of DOA

DOA ORDER

No. 3335/1989

Appointment of Member of the Working Group for the Maize Quality Improvement Research Centre Project

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Reference to DOA Order No. 1720/1988 dated May 20, 1988 and No. 4549/1988 dated December 21, 1988 appointing the Working Group for the Maize Quality Improvement Research Centre Project, DOA appointed an additional member in order to promote the project's efficiency as follows :

Microbe Working Group (Plant Pathology & Microbiology Division)

1. Mrs. Prisnar Siriacha — Member of the Working Group
   Plant Pathologist level 5

Mrs. Prisnar will be responsible to duties stated in DOA Order No. 1720/1988 dated May 20, 1988.

Effective order by September 8, 1989

(Mr. Riksh Syamananda)
Director-General of DOA

DOA ORDER

No. 2211/1990

Subject : Appointment of Working Group of the Coordinating Committee for the Maize Quality Improvement Research Centre Project (Third addition)

Following DOA Order No. 1720/1988 dated May 20, 1988 and No. 4549/1988 dated December 21, 1988 and No. 3335/1989 dated September 8, 1989 subject to the appointment of working group of the Coordinating Committee for the Maize Quality Improvement Research Centre Project, two additional staffs have been assigned to join in the project activities in order to promote the project effeciency as follow :

Microbiology Group

(Plant Pathology and Microbiology Division)

1)	Mrs. Warunee Premanoch	Plant Pathologist Level 5	member
2)	Mrs. Surang Suthirawut	Plant Pathologist Level 5	member

Both officers will be responsible to duties stated by DOA Order No. 1720/1988 dated May 20, 1988.

Effective Order by July 9, 1990.

(Montri Rumakom)

Deputy Director-General

Acting for Director - General

ADMINISTRATION STRUCTURE
of the Maize Quality Improvement Research Center Project
(Dec. 15, 1986 - Dec. 14, 1991)

JOINT COMMITTEE

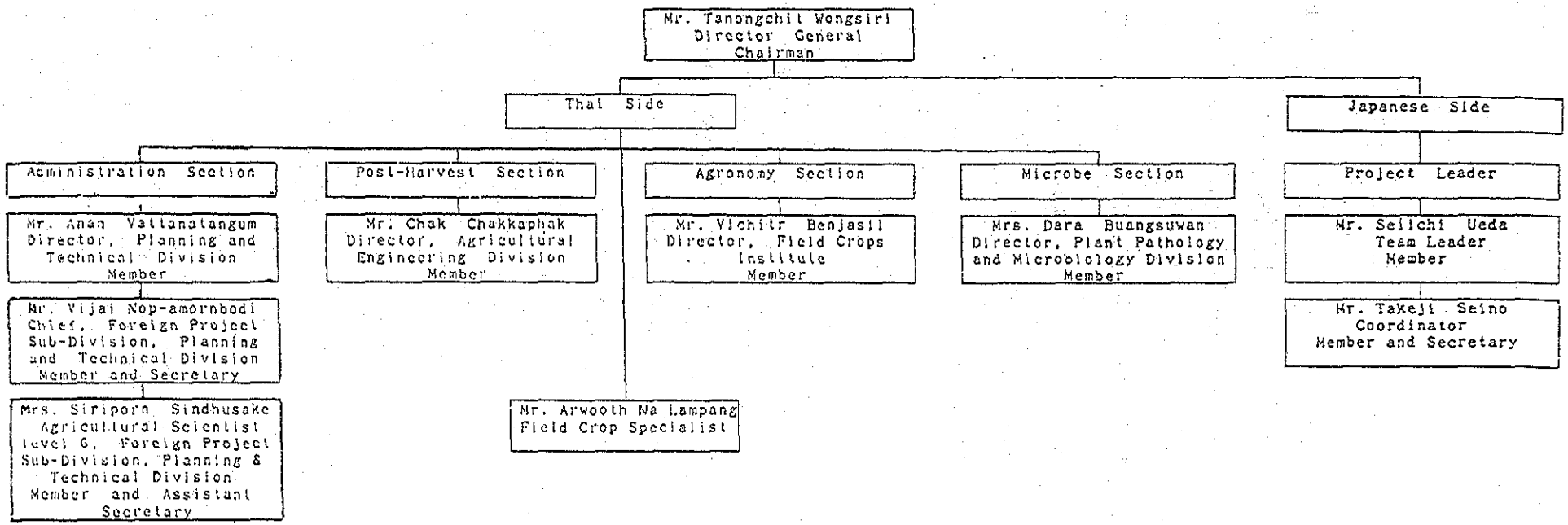
COORDINATING SUB-COMMITTEE

COORDINATING COMMITTEE

WORKING GROUP
(Permanent Officer
and
Temporary Staff)

C O O R D I N A T I N G C O M M I T T E E

March 19, 1990



Coordinating Sub-Committee

Chairman Mr. Anan Vattanatangum

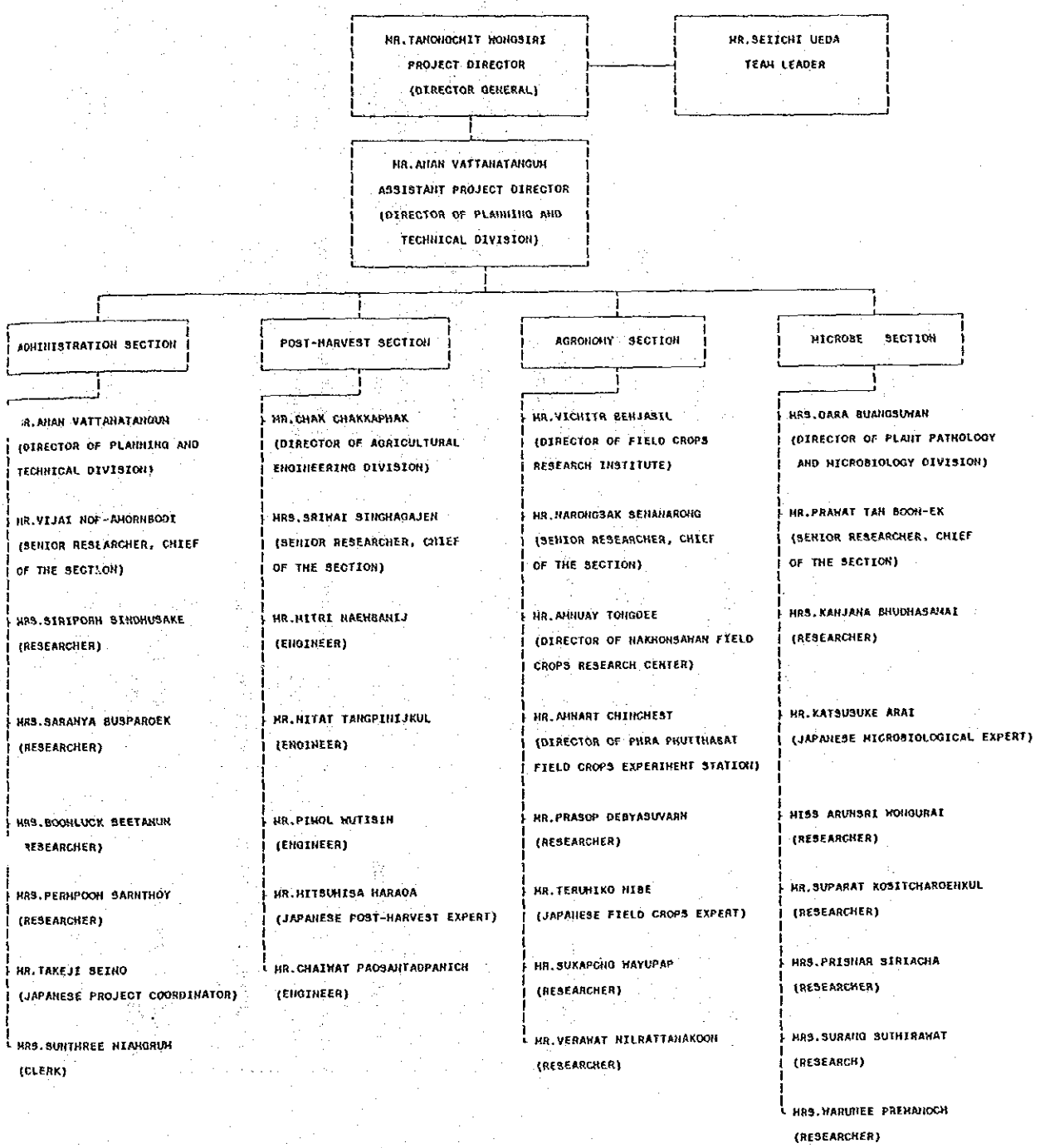
	Thai Side	Japanese Side
Post-harvest Section	Mrs. Sriwai Singhagajen	Mr. Mitsuhusa Harada
Agronomy Section	Mr. Narongsak Senanarong	Mr. Teruhiko Nibe
Microbe Section	Mr. Prawat Tan Boon-ek	Mr. Katsusuke Arai
Administration Section	Mr. Vijai Nop-amornbodi	Mr. Takeji Seino
	Mrs. Siriporn Sindhusake	
Secretary	Mrs. Boonluk Seetanun	
Assistant Secretary	Mrs. Permpoon Sarnthoy	

Representative Counterparts

	Thai Side	Japanese Side
Administration Section	Mr. Vijai Nop-amornbodi	Mr. Takeji Seino
Post-harvest Section	Mrs. Sriwai Singhagajen	Mr. Mitsuhisa Harada
Agronomy Section	Mr. Narongsak Senanarong	Mr. Teruhiko Nibe
Microbe Section	Mr. Prawat Tan Boon-ek	Mr. Katsusuke Arai
General	Mr. Tanongchit Wongsiri	Mr. Seiichi Ueda

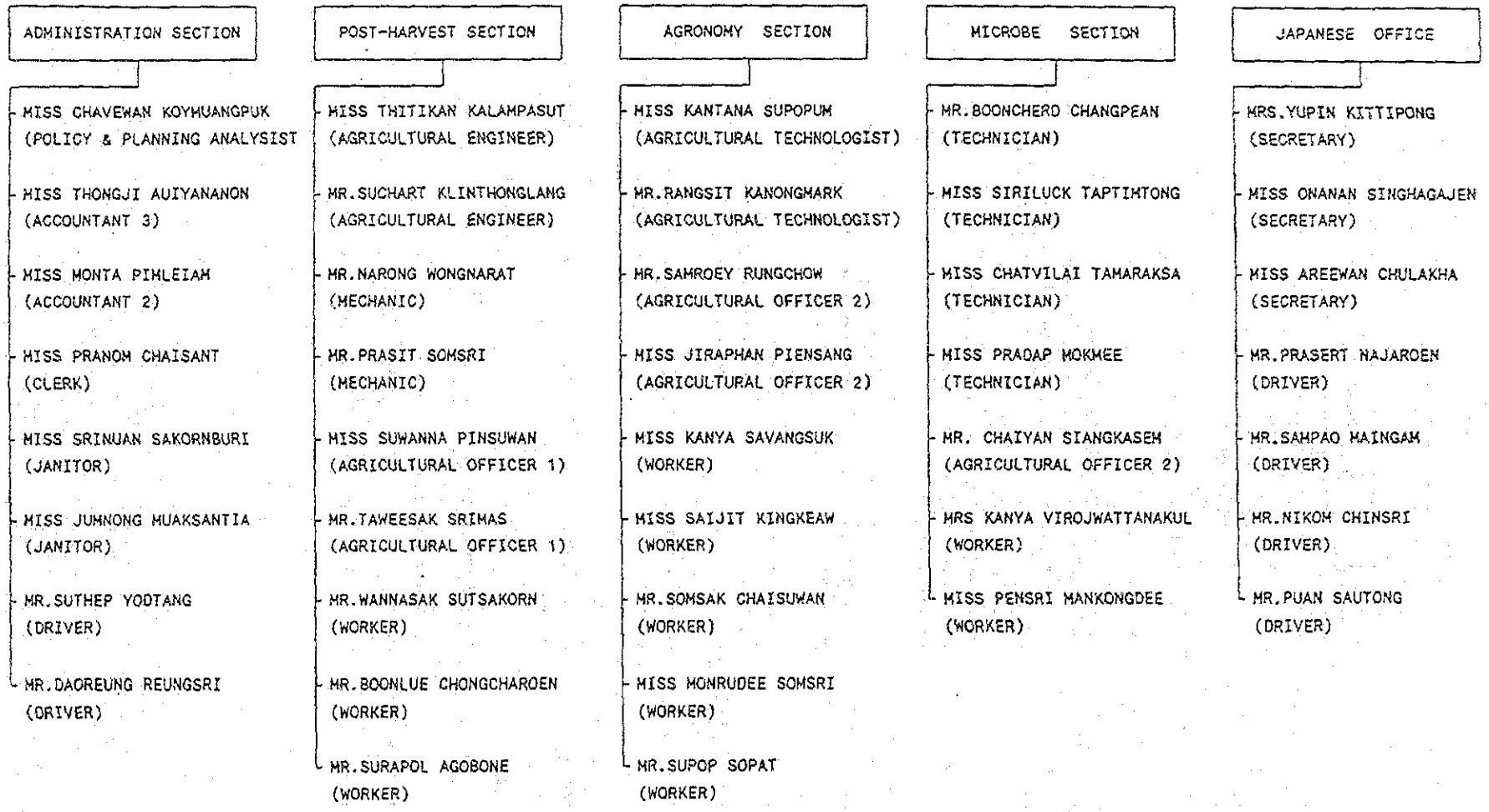
WORKING GROUP (PERMANENT OFFICER)

JANUARY 1991



WORKING GROUP (TEMPORARY STAFF)

JANUARY 1991



II. PROGRESS REPORT

(TEAM LEADER)

PROGRESS REPORT OF JAPANESE SIDE

I. Dispatch of Experts

1. Long Term Experts

Three long-term experts in 1990 Japanese fisical year have been extended their scheduled term. The terms of duty of Mr. Takeji Seino, Coordinator, Mr. Teruhiko Nibe, expert to the Agronomy Section and Mr. Katsusuke Arai, expert to the Microbe Section were extended for about one year and harf over their scheduled terms untill 14 Decrmber 1991. (refer to Annex I)

2. Short Term Experts

In the 1990 Japanese fiscal year, in order to emphasize the research activities, eight experts have been dispatched as follows ;

1) Agronomy Section ;

In this year, three short-term experts were dispatched for this section. Mr. Osamu Saito, Mr. Mikinori Tsuikiand M. Yoshimitsu Saito, those who were dispatched from October to Decemberin 1990. Dr. O.Saito's duty was evaluation of insect damage on maize in Thailand and he finished his duty and went back to Japan on December 2,1990. Mr. M.Tsuiki's duty was to formulate a simulation model of maize production at Phra Phutthabat Field Crops Experiment Station. He finished his duty and went back to Japan on December 16, 1990, on schedule. Mr. Y. Saito's duty was measurement of photosynthesis on maize, at Phra Phutthabat Field Crop Experiment Station.He finished his duty and went back to Japan on December 24, 1990 at the schedule time. (refer to Annex I)

2) Post-Harvest Section ;

In order to emphasize the research activities concerning the Post-Harvest Section, two experts were assigned. They were Mr. Yukio Azuma for corn sheller improvement from July 20 to November 3, Mr. Akira Matsuzaki for simple drying method of maize for farmers from August 21 to Nobember 18. They finished their duties and went back to Japan at the schedule time. (refer to Annex I)

3) Microbe Section;

For strengthening the study in the Microbe Research Section, three experts, Dr. Michihiko Saito and Dr. Toshitugu Tanaka and Prof. Dr. Micho Kosaki were assigned on August 20, October 4 and Dcember 4, 1990, respectively. Dr. M.Saito's duty was to study the characteristics of the Aspergillus spp.for the prevention of aflatoxin contamination of maize.

Dr. T. Tanaka's duty was to improve the simplified mini-column analysis methods of maize kernel contaminated by aflatoxin. Dr. Micho Kosaki'duty was to guide and advise for the newly developed techniques for the MQIRC. They finished their duties and went back to Japan on October 19,Nobember 27 and December17,1990 respectively. (refer to Annex I)

II. Counterpart Training

In the 1990 Japanese fiscal year, four counterparts have been selected as staff for training. Two of them finished their duties and came back to Thailand. They are Mrs. Prisnar Siriaca, Mrs. Kanjana Bhudhasamai Mr. Pimol Wuttisin, and Mrs. Boonluck Seetanun, respectiviely.

Mrs. Prisnar Siriacha, the counterpart for Microbe section, stayed at the National Food Research Institute M.A,F.F., and Tokyo University of Agriculture, for 30 days from June 30 to July 29, 1990.

Mrs. Kanjana Bhudhasamai, the counterpart for microbe studies, was staying at the National Food Research Insutitute,M.A.F.F.,for 92 days from October 30, 1989 to January 28, 1990.

Mr. Pimol Wuttisin, the counterpart for post-harvest research is going to visit at the National Grassland Research Institute, M.A.F.F., for three months, from January 28 to April 28, 1990.

Mrs. Boonluck Seetanun, the counterpart for administration, she is going to a study tour on agricultural administration and management concerning research work at several institutes in Japan for three weeks in March, 1991. (refer to Annex II)

III. Equipment, Facilities and Budget

In the 1989 Japanese fiscal year (from April 1,1989 to March 31, 1990), the total budget for technical equipments was 57,785,000 Yen (10,902,000 Bhat). Namely, the 5,226,310 Yen(986,096 Bhat) was used for the accompanied equipments with the experts, the amount of 5,700,000 Yen (1,075,472 Bhat) for the equipments arranged by JICA Head Quarter and the amount of 46,645,167 Yen (8,800,975 Bhat) for the equipments purchased in local. The list of equipments is attached to this paper.

The amount of 5,353,000 Yen (1,010,000 Bhat) was supplied for the facility constructions, which are, the storage building and extension of Annex I building, completed in October 18, 1991.

The equipments,which will be provided in the 1990 Japanese fiscal year (from April 1, 1990 to March 31, 1991), are in process of purchasing. It would estimate the total cost at 55,000,000 Yen (10,377,358 Bhat). (refer to Annex III)

IV. Project Activities

1. Mr. S. Ueda, Mr. T. Nibe, Mr. M. Harada, Mr. K. Arai and Thai counterparts concerned participated in the DOA Annual Conference held in Pattaya, from April 23 to April 26, 1990.

Mr. T. Nibe gave a presentation titled " Study of Harvesting Method, Harvesting Time and Storage Duration on Aflatoxin Occurence in Corn"

Mr. M. Harada has reported as titled of "Post-Harvest Research on Aflatoxin Contamination in Maize".

Mr. K. Arai gave a presentation titled "Relation between Water Activity (aw) and Humidity Equilibrium Moisture Content of Maize and Growth of A.flavus ".

2. Mr. T. Nibe and Thai counterparts attended to the National Corn and Sorghum Reporting Session held at Chumphon on August 14, 1990.

Mr. Prasop Debyasuvarn gave a presentation titled " Outline of the Maize Quality Improvement Research Centre Project"

Mr. T. Nibe has reported as titled " Effects of defference Harvest Methods, Moisture contains and Storage, on Aflatoxin Contamination in Maize".

3. The third field trip and spot discussion of the Four Sections were held at Phra Phutthabat Field Crops Experiment Station on January 8th, 1991.

4. Research Activities

A series of experiments has been carried out under the Tentative Implementation Program, which was confirmed at the Joint Committee Meeting on April 19, 1990. The main subjects implemented in three section are as follows ;

1) Agronomy Section

Total twelve research subjects were proposed in the agronomy section in 1990. Field experiments were started from April 16th, 1990 and there are some more materials in the field and storage. All the work will be completed in mid March 1991.

General condition for maize cropping season was not favorable due to the poor rainfall distribution after mid June to September.

Over one thousand samples of maize and soil were taken this year for aflatoxin analysis, fungi test and chemical properties.

Harvesting methods and storage was observed a tendency that with husk treatments lowered the level of aflatoxin contamination than conventional without husk as the result of last two years experience. The same treatments on farm scale trials, in general, showed similar result. However visual appearance of ear quality by fungi infection which occured by high temperature and dew condensation was raised as a problem to be improved.

2) Post-Harvest Section

Research work of this section can be categorized into four. For corn sheller improvement , three types of proto-type corn shellers are tested to select practical type. And it was proved that ear maize stored with husk can be selled by corn sheller with rasp-bar cylinder. About moisture meter, standardization of the oven method and calibration test of moisture meters were under investigation to get better correlation among measured values. Ear maize moisture meter was newly designed and calibration test is under process. For chemical treatment, sulfur dioxide treatment was conducted to fumigate from 0.5 % to 0.125 % at one time or at three days intervals. Ammonia treatment was also planned with urea decomposed by soybean. And for storage and drying, effect of modifying farmers' storage are examined to improve farmers' storage. Alowable duration to postpone drying ear maize are investigated and data for forced air drying are collected in the same experiment. And solar house drying was examined to utilize multi-layer system to increase drying capacity. Last year 288 samples was sent to microbe section for analysis of aflatoxin or of Aspergillus flavus infection.

3) Microbe Section

This section has close relations with the Agronomy and Post-Harvest researches. In 1990 crop season, 211 of maize samples for aflatoxin qualitation and quantititation 174 of maize samples and 252 of soil samples for microbiological studies were received from the Agronomy section. The Post-Harvest section sent us 288 of maize samples for aflatoxin analysis, both drying and chemical treatments.

The Microbe section carried out their six main subjects, viz. physiological and ecological study of A.flavus and analytical study of aflatoxin of maize. About 640 of samles in the field, drying and storing test were analyzed on aflatoxin, and more than 700 of maize samples were used for microbiological studies. Both the microbiological techniques and the analytical method of aflatoxin by means of mini-colum method were transfered to the junior scientist in the section.

Annex I. Japanese Experts

Experts	1st year Dec. 1986 - Dec. 1987	2nd year Dec. 1987 - Dec. 1988	3rd year Dec. 1988 - Dec. 1989	4th year Dec. 1989 - Dec. 1990	5th year Dec. 1990 - Dec. 1991
< Team Leader >					
Dr. Taketoshi YOSHIYAMA		(July 21, 1987 - Dec. 20, 1989)			
Mr. Sei-ichi UEDA				(Dec. 8, 1989 - Dec. 14, 1991)	
< Long-term Experts >					
Mr. Takeji SEINO		(May 20, 1987 - Nov. 19, 1989)		(May 20, 1990 - Dec. 14, 1991)	
(Coordinator)					
Mr. Makoto KOBAYASHI		(May 20, 1987 - Nov. 19, 1989)			
(Post-Harvest)				(Dec. 8, 1989 - Dec. 14, 1991)	
Mr. Mituhisa HARADA					
(Post-Harvest)		(Jun. 30, 1987 - Jun. 29, 1989)		(Jun. 30, 1989 - Dec. 14, 1991)	
Mr. Teruhiko NIBE					
(Agronom)					
Mr. Katsusuke ARAI					
(Microbe)			(Jul. 8, 1988 - Jul. 7, 1990)	- (Jul. 9, 1990 - Dec. 14, 1991)	
< Short-term Experts >					
* 1987 Japanese fiscal year					
Mr. Yoshiro IDEGUCHI (Eng.)		(1) Dec. 16-28, 1987	(2) Mar. 10-Jun. 17, 1988		
Mr. Hidekazu SHIMADA (Micr.)		(Jan. 11-Mar. 10, 1988)			
Mr. Yuzuru TOMIOKA (Eng.)		(Mar. 10- Apr. 8, 1988)			
* 1988 Japanese fiscal year					
Mr. Yukio AZUMA (Eng.)			(Jul. 20, -Sept. 19, 1988)		
Mr. Mikio KAMO (P-H.)			(Jul. 20, -Sept. 19, 1988)		
Mr. Nobuyoshi ISHITANI (Eng.)			(Aug. 1, -Aug. 21, 1988)		
Dr. Osamu TSURUTA (Micr.)			(Aug. 19, -Sept. 27, 1988)		
* 1989 Japanese fiscal year					
Dr. Osamu TSURUTA (Micr.)				(Jun. 18-Aug. 15, 1989)	
Mr. Mikio KAMO (P-H.)				(Jul. 6-Aug. 24, 1989)	
Mr. Yukio AZUMA (Eng.)				(Jul. 6-Nov. 5, 1989)	
Mr. Keichi INOUE (Eng.)				(Jul. 25-Sept. 24, 1989)	
Mr. Nobuyoshi ISHITANI (Eng.)				(Aug. 1-Sept. 9, 1989)	
Mr. Tetsuhisa GOTO (Micr.)				(Sept. 14-Dec. 12, 1989)	
Mr. Mikinori TSUIKI (Agro.)				(Sept. 27-Nov. 26, 1989)	
* 1990 Japanese fiscal year					
Mr. Yukio AZUMA (Eng.)					(Jul. 20-Nov. 3, 1990)
Dr. Michihiko SAITO (Micr.)					(Aug. 20-Oct. 19, 1990)
Mr. Akira MATSUZAKI (Eng.)					(Aug. 21-Nov18, 1990)
Dr. Osamu SAITO (Agro.)				(Oct. 3-Dec. 3, 1990)	
Dr. Toshitsugu TANAKA (Micr.)				(Oct. 4-Nov. 27, 1990)	
Mr. Mikinori TSUIKI (Agro.)				(Nov. 6-Dec. 16, 1990)	
Mr. Yoshimitsu SAITO (Agro.)				(Nov. 8-Dec. 24, 1990)	
Prof. Dr. Michio KOSAKI (Micr.)				(Dec. 4-Dec. 17, 1990)	

Annex II. Trainning of Thai Counterparts

Training in Japan	1st year Dec. 1986 - Dec. 1987	2nd year Dec. 1987 - Dec. 1988	3rd year Dec. 1988 - Dec. 1989	4th year Dec. 1989 - Dec. 1990	5th year Dec. 1990 - Dec. 1991
* 1987 Japanese fiscal year					
Mr. Narongsak Senanarong (Field Crop Research Inst.)	■ (Sep. 28 - Oct. 17, 1987)				
Mrs. Sriwai Singhagajen (Div. of Agric. Engineering)	■ (Sep. 28 - Oct. 17, 1987)				
* 1988 Japanese fiscal year					
Mis. Arunsri Wongurai (Div. of Plant Pathology and Microbiology)		■■■ (May 16 - Sep. 15, 1988)			
Mr. Sukapong Vayuparp (Phra. Field Crop Exp. Stn.)		■■■ (Jun. 20 -Oct. 21, 1988)			
Dr. Maitri Naewbanij (Div. of Agri. Engineering)		■■ (Oct. 2 - Nov. 30, 1988)			
Dr. Vijai Nopamornbodi (Administration)			■ (Mar. 6 - Mar. 21, 1989)		
* 1989 Japanese fiscal year					
Mr. Suparat Kositchareonkul (Div. of Plant Pathology and Microbiology)				■■■ (Jan. 14 - Apr. 17, 1990)	
Mr. Prasop Depayasuvan (Phra. Field Crop Exp. Stn.)			■■ (Jul. 10 - Sep. 2, 1989)		
Mr. Chaiwat Paosantadpanich (Div. of Agri. Engineering)			■■■ (Oct. 30 -Jan. 28, 1990)		
Mrs. Siriporn Sindhusake (Administration)				■ (Mar. 5 -Mar. 28, 1990)	
* 1990 Japanese fiscal year					
Mrs. Prisnar Siriacha (Div. of Plant Pathology and Microbiology)				■ (Jun. 30 - Jul. 29, 1990)	
Mrs. Kanjana Bhudhasamai (Div. of Plant Pathology and Microbiology)			(Oct. 15, 1990 -Jan. 15, 1991) ■■■		
Mr. Pimol Wttisin (Div. of Agri. Engineering)				(Jan. 7 - Apr. 20?, 1991) □□□	
Mrs. Boonluck Seetanun (Administration)					(scheduled) □

■: attended, □: schedule

Annex III. Budget

Equipment (budget)	1st Year Dec. 1986 - Dec. 1987	2nd Year Dec. 1987 - Dec. 1988	3rd Year Dec. 1988 - Dec. 1989	4th Year Dec. 1989 - Dec. 1990	5th Year Dec. 1990 - Dec. 1991
1987 Japanese Fiscal Year					
(General)	5,000,000 ¥				
1987 Japanese Fiscal Year					
1) General					
2) Agronomy Section	7,603,000 ¥				
3) Poat-Harvest Section	12,435,000 ¥				
4) Microbe Section	6,392,000 ¥ (provided)				
1988 Japanese Fiscal Year					
1) General		1,360,000 ¥			
2) Agronomy Section		12,670,000 ¥			
3) Poat-Harvest Section		13,140,000 ¥			
4) Microbe Section		16,100,000 ¥ (provided)			
1989 Japanese Fiscal Year			57,785,000 ¥		
1) General			4,382,000 ¥		
2) Agronomy Section			16,543,000 ¥		
3) Poat-Harvest Section			20,662,000 ¥		
4) Microbe Section			16,198,000 ¥		
1990 Japanese Fiscal Year				55,000,000 ¥	
1) General					
2) Agronomy Section					
3) Poat-Harvest Section					
4) Microbe Section					
1991 Japanese Fiscal Year					35,000,000 ¥
Total	31,530,000 ¥	42,500,000 ¥	57,785,000 ¥	55,000,000 ¥	35,000,000 ¥

Local cost borne by Japan in Japanese fiscal year 1987, Baht 3,060,000. for repairing water reservoir, in 1988 Baht 484,500. for modification of the laboratory at Phra Phutthabat Field Crops Experiment Station and in 1989 Baht 1,010,000 for roof expansion and storage building was provided.

Ⅲ. SUMMARY REPORT

(1991. 1. 24)

(JAPANESE TECHNICAL GUIDANCE TEAM)

SUMMARY REPORT OF THE JAPANESE TECHNICAL GUIDANCE TEAM FOR THE MAIZE QUALITY IMPROVEMENT RESEARCH CENTRE PROJECT

The Japanese Technical Guidance Team for the Maize Quality Improvement Research Centre Project (hereinafter referred to as "the Project") organized by Japan International Cooperation Agency, headed by Dr. Ryosaku Ishida, visited the Kingdom of Thailand and stayed for 13 days from January 14 to 26, 1991.

The purpose of the team was to review and evaluate on the present situation of the project activities, based on the Tentative Implementation Programme which was agreed at the Joint Committee Meeting in April 19, 1990.

During stay in Thailand, the team exchanged views and had discussions with the authorities concerned referring to the project activities.

This is a summary report related to the results of the discussions:

A. Research Activities

The main findings and assessments obtained by the three sections are summarized as follows:

1. Agronomy Section

1)Varietal comparison of maize kernel moisture and its variation according to different times of harvest.
Cord No.I-1-(1)-A,G (1988-1990), AG/I/90

Three varieties, Suwan 1(SW1), Suwan 3(SW(3) and Nakhon Sawan 1(NS1) were utilized for the study. SW1 was repeated for three years, SW3 was for two years and NS1 was the first year.
Similar trend of moisture decrease and the variation were observed. SW1 and NS1 were especially close result on their moisture change.

2) Long term study on the relationship of the environmental conditions that cause aflatoxin incidence in maize.
Cord No.I-1-(1)-B, E, G, J-(b), AG/II/90

Planting was started on April 16 and ended on September 1 for eleven times at 2 weeks interval. Growth condition in 1990 was poor on rainfall, it was enough rain on mid May to early June and on early to late October. Study is still continuing.
On this study, a short term expert Mr. Tsuiki described the plant growth and dry matter accumulation on cultivation in rainfed and irrigated condition.

(3) Effect of different harvest methods, moisture conditions and storage periods on aflatoxin contamination in maize.
Cord No.1-1-(1) -H, G, AG/III/90
Moisture decrease on the condition of with husk(+H) and without husk(-H) was decreased almost same manner, however the maximum difference was observed larger as 2.6% compared with 1.5% of last two years.
Aflatoxin contamination level were less on in +H treatment than -H except on 115 days harvest that some +H showed higher level, however the difference was small.

(4)Effect of plant density and nitrogen application on aflatoxin contamination.
Cord No. I-1-(1) -D, AG/IV/90

Agronomy and aflatoxin contamination were under data processing for summary.

(5) Effect of crop rotation on Aspergillus spp. in the soil.
Cord No.I-1-(1) -C, B, AG/V/90

The experiment is still continue at the field.

(6) Effect of nitrogen regarding prevention of aflatoxin contamination by the inoculation method.
Cord No.I-1-(1) -D, AG/VI/90

Infection of A.flavus by the methods of inoculation were significant different, 1.5%, 4.5% and 63.1% of treated ear were infected on control, silk channel and pin bar methods.
Total aflatoxin level on 0kgN, 10kgN, 20kgN and 30kgN were 2369ppb, 1293ppb, 1375ppb and 129ppb respectively. The response of contamination level to nitrogen level was not significant statistically.

(7) Identification of insects and the type of damage they inflict on the maize kernel.
Cord No.I-1-(1) -F, AG/VII/90

Insect type appeared in the field corn was obtained as last year and seasonal pattern of appearance was recognized.
Insect trap by pheromone for moth of corn stem borer also showed a pattern and probably two seasons was recognized in one corn crop season.
A.flavus infected moth was around 50%, 20% were carrying A.niger and 70% had another fungi on their body. Insects trapped by pit fall tap on the ground was carrying A.flavus as high as 70%, however insects were not properly identified yet.
Damaged ear by insect and other cause was gradually increased from 20 days after 50% silking to harvest as last year.
A.flavus infection in and on the kernel was studied. None of A.flavus was observed inside the kernel and average of damaged ear and trace of damaged ear was higher infection than sound ear on the surface of kernel.

(8) Evaluation of insect damage that occurs under field condition.
Cord No. I-1-(1) -F, B, AG/VIII/90

Insect count on the corn plant was shown effect of insecticide on some insect such as corn leaf aphid lady bird beetle appeared in the early growth season.
Low percentage of damaged ear by insect was observed at harvest.
Fungus infection in the insecticide applied plot was 46%, 60% and 24% on damaged, trace and sound ears, in control plot was 100%, 90% and 42% respectively.
Aflatoxin is under the analysis process.

(9) Relation between environmental factors and fungi infection.
Cord No. I-1-(1)-A, AG/IX/90

Sample of air taken from AG/II/90 plot at different corn growing time were under data summarize.

(10) Basic agronomical study for development the simulation model of maize productivity and its quality
Cord No. I-1-(1)-B, E, G, J-(b) AG/XI/90

Maize plant growth on dry matter accumulation was collected from four planting times in each part of the plant. Summary was reported by Mr.Tsuiki. Farther data processing is undergoing.
In relation to this study, photosynthesis and respiration measurement was trained by Mr.Saito.
Meteorological data was not yet obtained due to equipment was not available on time.

(11) Large scale practices on concerning harvest methods and aflatoxin occurrence in maize.
Cord No. I-3-(1)(1990-1991) AG/XII/90

Three location at farmers around the station were selected. Amount of maize stored and structure and size of stores were varied farm to farm.
Temperature in the each treatment storage on with husk was increased by the size of storage, especially at initial two weeks. storage on without husk was no significant difference among the farms.
Grain moisture content were decreased almost same manner in the three locations.
The level of Aflatoxin contamination in the three were 600ppb in maximum, although there was one exception. Contamination between treatments in two locations were always low at with husk. Two observation on opposite results were obtained, however the difference were very small.
Fungi on the surface of kernel were not significant response to the treatments. A.flavus inside kernel were found less in locational average at three locations.

(12)Reduction of A.flavus infection and aflatoxin production by potassium application
Cord No. I-1-(1)-D AG/XIV/90

A.flavus infection on pin bar inoculation method was almost 100%. Aflatoxin contamination and other data are under the process.

2. Post-Harvest Section

<Corn sheller improvement>

1) Corn sheller improvement (1990-1991)
Code No. II-3-(2)-A

Two types of cylinders were selected according to the 1989's experiment and one cylinder was modified. Sample maize was prepared into four levels of moisture contents(18, 22, 26 and 30%) and was shelled at four different speeds(5, 7.5, 10 and 12.5 m/sec.) respectively.

Ratio of brekage was lower than last year at moisture content of 18,22 and 26%. Data are under analysis. From these three proto-type cylinders, one are to be selected to design improved corn sheller.

2) Analysis of the relationship among mechanical damage to kernel, machinery design, operational condition and moisture content of maize (1988-1989)
Code No. II-3-(2)-A

In 1988 four types of practical shellers were examined their efficiency. According to this experiment, seven types of cylinders were fabricated and effects of the types of cylinders, mechanical design, operational conditions and moisture content of maize on mechanical damage of kernels were investigated.

3) Study on the relationship between damage on kernel, kernel moisture content and aflatoxin contamination (1988-1990)
Code No. II-1-(2)-B
Related code No. III-1-(2)

This experiment was conducted in 1988 without inoculation and it resulted that all samples were contaminated specially at 22% moisture content, after 14 days storage.

In 1990, Manually shelled and inoculated maize with various moisture content(18,22,26,30%) was mixed with impurity (3% of crushed cob) or damaged maize (3%) and was stored under humid condition.

A. flavus infection and aflatoxin contamination were inspected during 14 days storage.

<Moisture meter improvement>

4) Improvement and development of moisture meter (1989-1991)
Code No. II-2-(2)

Resistance type moisture meter,"CD-2L" was modified to have an electrode for ear maize. Two types of electrodes, knife blades and pliers, were tested and plier type was selected. But it did not show high coefficiency between determined values by this meter and CTR-160, a single kernel moisture meter, in 1989.

In 1990, another type of electrodes was fabricated adjusted for kernel arrangement of ear maize. To delete dispersion of determined values, data are compared with moisture content of corresponding part of the ear determined by oven method.

Data are under process.

5) Calibration test of established moisture meters (1988-1990)
Code No. II-2-(2)

In 1988, three moisture meters were selected for calibration test among meters in current use; they were CTR-800, Dole model 400 and Grainer. Grainer was rejected because of low performance and four meters were tested in 1989; they were CTR-160, Dole model 400, Digital grain moisture meter (KU) and Multi grain portable. But they showed lower performance.

In 1990, same meters were calibrated again to determine moisture content of Thai maize in different varieties, "Suwan 1", "Suwan 2", "Suwan 3" and three hybrids from different locations. Effect of tempering were investigated to obtain higher correlation.

Data are under process.

6) Standardization of standard oven methods (1988-1990)
Code No. II-2-(2)

Several methods to determine moisture content of maize were compared and calibrated each other. Effects of pre-drying or grinding were investigated to standardize or to shorten simple methods, and 4 hours 130°C whole kernel method was chosen as a simplified measurement.

In 1990, effects of absolut hummidity, drying time and tempering were investigated to standardize this oven method.

Data are under process.

<Chemical treatment>

7-1)Urea treatment of maize to control Aspergillus spp. and so prevent aflatoxin contamination (1988-1991)
Code No. II-3-(2)-C-(a)

Urea treatment was applied for safe, simple and economical method of ammonia treatment.

Laboratory scale experiment was conducted to determine suitable concentration or conditions concerning fungus growth and discoloration. Two methods, soaking and evaporating, are tested in farmers' scale treatment.

Three treatments, soaking in closed container or in open container and control, are compared during six weeks' storage in farmers' scale. Ammonia concentration profile was similar in both open and closed system but increased a little bit quicker in closed system. Yeast and fungus growth and discoloration were observed during and after storage.

This experiment has not yet been conducted in 1990.

7-2)Sulfur dioxide supplemented storage of high moisture maize (1989-1990)
Code No. II-3-(2)-C-(a)

In 1989 sulfur cake was prepared from sulfur, coconut fiber, burnt rice husk and starch at the ratio of 100:10:10:50. In 1989, ear maize samples of about 650 kg were fumigated with 0.05% of sulfur dioxide by sample weight and stored for six weeks. One was treated at one time and another was fumigated at one week intervals devided into three times. Discoloration was not observed.

In 1990, ear maize was fumigated at one time or in 0.5, 0.25 and 0.125% at three days intervals. We fabricated a small burner with a chimney. Small corn cribs with 650 kg of ear maize were covered with plastic on thier side walls and with gunny sacks on their tops. And the chimney was inserted into their centers. Cribs were covered overnight after treatment. Mold infection, aflatoxin contamination and residue of sulfur dioxide were inspected before and after treatment.

Mold growth was observed in 0.125% treatment. Ear maize was severly infected at 0.5% treatment.

8) Ammonia and sulfur dioxide supplemented ambient air drying of high moisture maize in Thailand (1988-1990)

Code No. II-3-(2)-C-(a)

In 1989, each 500 kg of shelled maize was stored in a flat bed dryer with ambient air flow at the rate of 1.0 m^3/min. For TAP(trickle ammonia drying process), 0.5% sample weight of ammonia was supplemented at the rate of 15 l/min. at one time or divided in three times at three days intervals. For TSDP(trickle sulfur dioxide drying process), 0.5% sample weight of sulfur dioxide was obtained by burning sulfur cake and treated at one time.

In TAP, mold was observed at both treatment. At three time treaent, discoloration was not observed so much, but more mold was detected. In TSDP mold was observed two or three days after treatment.

This year, this experiment has not yet been conducted.

<Storage and drying>

9) Estimation on increase of damaged kernel ratio during handling (1988-1991)

Code No. II-1-(2)-C-(a), II-1-(2)-B-(c)

In 1989, freshly harvested ear maize was (1) not selected, (2) selected by farmers and (3) selected by researchers. All ear maize samples were kept in gunny sacks and stored for seven days on a pallet under natural environment. Ratio of infected ears during storage were (1) 4.2%, (2) 35.4% and (3) 45.1% respectively. We concluded that even a small scratch on seed coats could induce A. flavus infection.

In 1990, freshly harvested ear maize was to be classified into six levels of damages and were to be stored to evaluate effect on aftoxin contamination during storage.

This experiment has not yet been conducted.

10) Study of the improvement of storage facilities for farmers (1988-1991)

Code No. II-3-(2)-C-(c)

In 1989, experimental models of corn cribs with elevated and not elevated floor (2.6m(D) X 2.6m(W) X 1.8m(H)) were constructed and each 5.1 tons of ear maize with 29% of kernel moisture content was stored. During one month storage, a heat spot was observed in each storage. And darying rate was a little bit faster in elevated floored corn crib.

In 1990, two experimental models of corn cribs with and without modifcation were compared to evaluate the effect of modification. Temperature and humidity profiles are observed for two months.

Mold infection seems to be severer in the crib without modification. Data are under process.

11-1)Development of simple drying methods (1989)

Code No. Ⅱ-3-(2)-B-(b)

Two types of drying units were designed, equipped with solar heat collecting chamber and diesel engine. In the drying experiment supplying engine exhaust heat, drying rate was high enough but engine exhaust gas also flew into drying chamber to make maize kernel dirty. Construction cost should be reduced for farmers' extention.

11-2)Development of simple drying methods-2

Research on drying ear maize with vinyl plastic house (1990)

Code No. Ⅱ-3-(2)-B-(b), Related Ⅲ-1-(2)

Two types of plastic houses, open-single layered and closed-three layered, were fabricated. Freshly harvested ear maize of hybrid was stored in plastic houses in 20 cm depth and stored for three weeks.

Fourteen days are enough to dry maize from 27.7% to 14% even on the lowest layers.

12) Allowable duration for delayed drying in the post-harvest process of maize (1989-1990)

Code No. Ⅱ-1-(2), Related Ⅲ-1-(2)

In 1989, each 360kg of ear maize Suwan 1 harvested at three levels of moisture contents was kept in a flat bed dryer for 0, 1, 2, 3, 5, 6, 7, 9 and 14 days and then dried by forced ambient air. Aflatoxin contamination was a little bit higher after drying than before, but still in low levels. These seem to explain this result that (1) this experiment was conducted during winter(dry) season and (2) that samples were not coverd during storage.

In 1990, this experiment was conducted during rainy season. After storing ear maize in gunny sacks for 0, 1, 3, 6, 9 and 14 days, samples are dryed with forced ambient drying.

Ambient air conditions, moisture content profiles are recorded to examine relationship with aflatoxin contamination and to simulate drying process of ear maize.

3. Microbe Section

1) Aspergillus flavus infection and contamination in the field.
Code No. III-1-(3),3-1-1

A.flavus infection and contamination for maize in the field have been studied. Maize was planted in the test field of Phra Phutthabat Field Crops Experiment Sation on June ,1990. Leaf, stem, tassel, silk, husk, cob and kernel were taken and plated on agar media to examine A.flavus infection ten times from after planting until harvest. Silk seems to have important role of the infection of A.flavus in the field. Silk contamination and infection may lead A.flavus to contaminate kernel inside the cob, remain on the suface and ready to infect the kernel in favorable condition.

2) Studies on A.flavus infection and aflatoxin contamination during sun dry in the middleman scale and laboratory scale.
Code No. III-1-(3), 3-1-2

Sun dry experiment has been carried out in a middleman scale and laboratory scale in 1990 maize season at Phra Phutthabat. Data of middleman scale are now under processed. Laboratory scale experiment have been carried out on four duplicates, with three different thickness of maize grain layers in 1, 3 and 4 cm. Weather condition in the first and second experiments was quite fair, and drying was accomplished without problem. In third and fourth experiments, drying was interrupted for 2 or 3 times during the period due to unfavorable thunder storm. There was no increase of A.flavus infection in first and second experiments. However, in the third experiment, high A.flavus infection was observed in the sample of 4 cm thickness after 19 hour drying. Aflatoxin analysis is now under going.

3) Identification of aflatoxin-producing ability of A.flavus by coconut powder agar and coconut cream agar.
Corde No.Ⅲ-1-(3), 3-2-1

Coconut powder agar and coconut cream agar were tried to identify the aflatoxin-producing ability of A.flavus isolated from maize, soil and air. Selected 12 A.flavus strains known aflatoxin producing ability were used for the experiment. Three non aflatoxin-producing strains of A.flavus and one low type did not show any fluorescent illuminant under the UV light, 365 nm. Six aflatoxin-producing strains showed fluorescent illuminant more or less. However, there were two exceptions in aflatoxin producing type. Some differences were observed in fluorescent color between A.flavus strains, especially G1 producing type which showed bright fluorescent color.

4) Studies on the population of A.flavus and aflatoxin content in ear Caize stored with and without husk in the farmer's cribs.
Corde No.Ⅲ-1-3, 3-2-2

To know the effect of storing condition in farmer's crib for ear maize with and without husk, A.flavus contamination and aflatoxin content were studied. A.flavus population in maize with husk was lower than that

without husk. There are some diffences in fungus infection between size and type of crib. Clear differences were found in aflatoxin content between maize with and without husk. Aflatoxin content in maize with husk is lower than that without husk. Some differences in aflatoxin contamination were observed among three cribs which may be due to the crib structure.

5) The simple and rapid method for detection of aflatoxin in maize.
Improvement of the mini-column method for the aflatoxin content in Maize.
Code No. Ⅲ-1(3), 4-1-1

Modified mini-column method packed with alumina, Florisil and silica gel to detect aflatoxin in maize was developed. The mini-column (ID 4mm× 15cm) was packed with 4 cm of alumina oxide, followed by 1 cm of Florisil and 6 cm of silica gel. 50 gr of ground maize sample was extracted with chloroform-methanol(97:3) using Ultra-sonicator. After extraction, a thimble filter paper was set in beaker for filtration, and the mini-clumn put to the extract then developed to the top. After developing, aflatoxin was detected under 365 nm UV light with fluorescent band. The detection limit of the method employed was 10 ng/g(ppb) for aflatoxins. It is enough for screening procedure of aflatoxin analysis.

6) Control of A.flavus and aflatoxin contamination of high moisture content maize in anaerobic condition.
Code No. Ⅲ-1-(3), 5-1-1

Anaerobic conditon in plastic bag has an effect to control growth of A.flavus especially in high moisture content of maize. In this year, large scale experiment was attempted and examined microbiologically.
Total fungi in the plastic bag sample was gradually decreased and reached to 3 % in one week, and maintained same level for 4 weeks. A.flavus contamination was little increased from 0 to 10 % within 2 days, then decreased to 1 % level after 4 days, and maintained 4 weeks. On the other hand, population of some lactic acid bacteria and yeast increased during storage. They may have some role in inhibiting the growth of A.flavus and other fungi.

B. Tentative Plan for the Project Activities in the 1991 Japanese Fiscal Year

1. Assignment of Japanese Experts

The schedule for the assigned period of Japanese experts is shown in Annex I, of the Progress Report. (Japanese side)

1) Long Term Experts

At present, five experts scheduled under the R/D and Tentative Schedule of Implementation (TSI) have been assigned. Three of them was extended their assigned period last year.

2) Short Term Experts

The short term experts requested for the project are listed below, JICA will dispatch the experts, considering the requests from Thailand, budget, and so on.

a) Microbe Section < Aspergillus spp. ecology, 3 months >
b) Microbe Section < Aflatoxin analysis, 3 months >
c) Agronomy Section < Photosynthesis, 3 months >
d) Agronomy Section < Simulation, 3 months >
e) Agronomy Section < Insect damage & Control, 4 months >
f) Post-Harvest Section < Improvement of corn sheller, 5 months >
g) Post-Harvest Section < Moisture meter for ear maize, 2 months >
h) Post-Harvest Section < Improvement of drying method, 3 months >

2. Training of Thai Counterparts in Japan

The schedule for the training of Thai counterparts, is shown in Annex II, of the Progress Report (Japanese Side). The counterparts in the fields below are requested for training. JICA will accept the counterparts for training, considering the requests from Thailand, budget, and so on.

a) Agricultural Engineering Section < one person, 3 months >
b) Post-Harvest Section < one person, 3 months >
c) Microb Section < one persons, 1 months >
d) Planning and Technical Division < one person, 3 weeks >

3. Provision of Equipment

Equipment worth 35 million Yen will be requested for the project as shown in Annex III, of the Progress Report (Japanese Side). JICA will provide the equipment, considering the request from Thailand, budget, and so on.

4. Research Plan

The Main subjects which will be studied in the 1991 Japanese fisical year are as follows:

< Agronomy Section >

1) Varietal comparison of maize kernel moisture and its variation according to different times of harvesting.
Code No. I-1-(1) -A, G (1988 - 1991)
2) Study on the relationship between environmental conditions and aflatoxin incidence in maize.
Code No. I-1-(1) -B, E, G, J-(b) (1988 - 1992)
3) Effect of plant density and nitrogen application on aflatoxin contamination in maize.
Code No. I-1-(1) -D, (1988 - 1991)

4) Effect of crop rotation on Aspergillus spp. in the soil.
Code No. I-1-(1) -C, B (1988-1991)
5) Effect of nitrogen regarding prevention of aflatoxin contamination by the inoculation method.
Code No. I-1-(1) -D (1989 - 1991)
6) Identification of maize insects and the types of damage they inflict on the maize kernel.
Code No. I-1-(1) -F, B (1989 - 1991)
7) Evaluation of insect damage that occurs under field conditions.
Code No. I-1-(1) -F, B (1989 - 1991)
8) Relation between environmental factors and fungi infection.
Code No. I-1-(1) (1989-1991)
9) Large scale practices on concerning havest methods and aflatoxin occurence in maize.
Code No. I-3-(1) (1990 - 1991)
10) Basic agronomical study for developing the simulation model of maize productivity and its quality.
Code No. I-1-(1) -B, E, G, J -(b) (1990 - 1992)
11) Reduction on A.flavus infection and aflatoxin production by potassium application.
Code No. I-1-(1) -D (1990-1991)
12) Feasibility study of storage conditions for ear maize quality.
Code No. I -3-(1), (1991)
13) Identification of insect as a vector of A.flavus under the field condition.
Code No. I -1-(1), (1991)

< Post-Harvest Section >

1) Corn sheller improvement.
Code No. II-3-(2)-A (1990-1991)
2) Study on the practical operation of in-stored drying.

2-1. Study on the improvement of storage facilities for farmers.
Code No. II-3-(2)-C-(a) (1989-1991)
2-2. Simple drying method-3.
Study on the ambient and heated air drying in farmers' storage.
Code No. II-3-(2)-B and II -3-(2)-C-(c) (1991)

3) Evaluation of ambient air and heated air drying.
Code No. II-3-(2)-B-(b) (1991)
4) Study on moisture determination of maize.

4-1. Performance test of newly developed moisture meter for ear maize.
Code No. II-2-(2) (1988-1991)
4-2. Moisture determination by oven methods.
Code No. II-2-(2) (1991)

5) Study on the sulfur dioxide treatment in farmers' storage.
Code No. II -3-(2)-C-(a) and II -3-(2)-C-(c) (1991)

< Microbe Section >

1) Correlation between cultural practices and aflatoxin contamination.
Code No. III-1-1-(1)

2) Correlation between post-harvest storage/processing and aflatoxin contamination.
Code No. III-1-(2)

3) Physiological and ecological studies on A.flavus including the infection routes.
Code No. III-1-(3)

3-1. Studies on the infection routes of A.flavus and aflatoxin contamination during pre- and post-harvest of maize.

3-1-1. Studies on the growth and aflatoxin production by A.flavus various strains from maize, air and soil in maize field.

3-1-2. Study on population of A.flavus, aflatoxin contamination and moisture content of maize in middleman drying yard.

3-1-3. Changing of chemical property and aflatoxin formation in maize.

3-1-4. Changing of physical property and aflatoxin formation in maize.

3-2. Physiological and ecological studies on A.flavus in Thailand.

3-2-1. Study on the population of A.flavus and the amount of aflatoxin from various age at havesting time.

3-2-2. Study on contamination of A.flavus from insect damaged cob.

4) Development of simple and rapid analytical method of the aflatoxin content in maize.
Code No. III-2-(1)

4-1-1. Improvementof the mini-column method for the aflatoxin content in maize.

5) Aflatoxin prevention by controlling A.flavus.
Code No. III-3-(3)

5-1-1. Control of A.flavus and aflatoxin contamination of various moisture content of maize in anaerobic condition.

5-1-2. Effect of anaerobic condition to the growth of A.flavus.

5-1-3. Population dynamic of microorganism involved in maize stored in anaerobic condition.

C. Others

1) It is necessary that the research activities on the prevention of aflatoxin contamination concerned would be continued, and all the facilities and the equipments would be in the Centre or the Station in the future.

2) One year extention of the Project was requested by the Project, and an idea of PhaseII was discussed among the Thai Department of Agriculture, the Japanese experts and the Japanese Technical Guidance Team.

It is our pleasure to say that the relationship between Thai side and Japanese side is well established and the project runs successfully. We hope that both side will continue mutual cooperation in order to promote this project. Lastly, we appreciate your kind cooperation during our stay in Thailand.

Annex I. Research Implementation Plan

ITEMS	1st Year (Dec. 1986 -- Dec. 1987)	2nd Year (Dec. 1987 -- Dec. 1988)	3rd Year (Dec. 1988 -- Dec. 1989)	4th Year (Dec. 1989 -- Dec. 1990)	5th Year (Dec. 1990- Dec. 1991)
1. Analysis of contamination factors					
(1) Correlation between cultural practices and aflatoxin contamination	■	■■■■■■■■■■	■■■■■■■■■■	A-1) 2) 3) 4) 5) 6) 7) 8) 9) 11) & 12) M-1) ■■■■■■■■■■	□□□□□□□□
(2) Correlation between post-harvest storage/processing and aflatoxin contamination	■■	■■■■■■■■■■	■■■■■■■■■■	P-7) M-2) ■■■■■■■■■■	□□□□□□□□
(3) Characteristics of <u>Aspergillus flavus</u> relating to aflatoxin contamination		■■■■	■■■■■■■■■■	M-3) ■■■■■■■■■■	□□□□□□□□
2. Improvement of test technoligy					
(1) Improvement of sample and rapid analytical methods of aflatoxin detection		■■■■	■■■■■■■■■■	M-4) ■■■■■■■■■■	□□□□
(2) Improvement of simple moisture meter		■■■■■■	■■■■■■■■■■	P-2) ■■■■■■■■■■	□□□□□□□□
3. Countermeasures to prevent aflatoxin					
(1) Improvement of cultivation practices		■■■■■■	■■■■■■■■■■	A-2) 3) 5) 10) & 12) ■■■■■■■■■■	□□□□□□□□
(2) Improvement of post-harvest practices		■■■■■■	■■■■■■■■■■	P-1) 3) 4) 5) & 6) ■■■■■■■■■■	□□□□□□□□
(3) Aflatoxin prevention by controlling <u>A. flavus</u>.		■■■■■■	■■■■■■■■■■	M-2) ■■■■■■■■■■	□□□□□□□□

Remark: Abbreviation of each section indicates as follows; A: Agronomy, P; Post-Harvest, M; Microbe.
The numbers with parenthesis regard as the subject number in "4.Research Plan"

Ⅳ. ABSTRACT OF THE EXPERIMENT RESULTS

AGRONOMY SECTION

(1991. 1. 24)

THE MAIZE QUALITY IMPROVEMENT RESEARCH CENTER PROJECT

AG/III/90
Effect of Different Harvest Method, Moisture Conditions and Storage Period on Aflatoxin Contamination in Maize
Code No. I-1-(1)-H, G (1988-1990)

Background
Conventional farmer's harvesting method that removes ear from plant after husking then piling the product on the ground. The products will be collected in the gunny-bag then kept under the house or their storage facility.
On the process of conventional method, possibility of physical damage on the kernel surface to allow A.flavus invasion into the kernel was raised.
Harvest with husk was considered as the way to prevent the problem.
The trial has been conducted since 1988. The results of the last two years showed that the average aflatoxin level were always lower at with husk treatment and safety storage period(<20 ppb) were 2 - 6 weeks longer by with husk than without husk.

Material and Method
The trial was conducted as the same material and the method carried out in 1988 and 1989 as following.
Suwan 1 variety was planted in one rai(1600 sq.m) plot with the standard cultivation practice by spacing of 75cm between rows and 50cm between hills with 2 plants per hill, fertilizer application was 10 kgN per rai after thinning at 2 weeks after planting.
Harvest was practiced at 95(H1), 105(H2) and 115(H3) days after planting. Treatments at harvest was that ear was harvested without husk(-H) as conventional farmer's practice and with husk(+H) method which was the way to hold and break the ear-shank then removed the ear with some internal husk. Harvested ears were separated for storage from standing plants and lodging plants for each treatment plots.
The ear harvested was kept in gunny-gag and placed in the storage in the station.
Samples were taken at harvest(S1) and 2 weeks(S2), 4 weeks(S3) and 8 weeks(S5) after harvesting. The samples were proceeded to examine for A.flavus and aflatoxin at harvest and for only aflatoxin at 2, 4 and 8 weeks. Moisture content of grain was measured every sampling time.

Result
-Agronomical observation
Prior to the harvests, some agronomical observation was carried out.
Husk cover by 1 as the best to 5 as the worst of CIMMYT method for H1, H2 and H3 harvest were 1.852, 1.949 and 1.968 on +H and 1.551, 1.904 and 2.015 on -H in average.
Average no. of insect damage per plot were 155(H1), 148(H2) and 153 on +H and 142, 124 and 175 on -H.
Estimated yield level were 870.1(H1), 799.1(H2) and 681.5(H3) on +H and 731.7(H1), 823.8(H2) and 656.7(H3)kg/rai on -H.
Moisture content at harvest measured by Stainlite moisture meter at H1, H2 and H3 were 31.3, 25.7 and 22.1% on +H and 30.9, 26.4

and 22.1% on -H in average.
Average grain moisture content and it's difference between treatments during the storage periods on three harvesting times were shown in Figure 1.

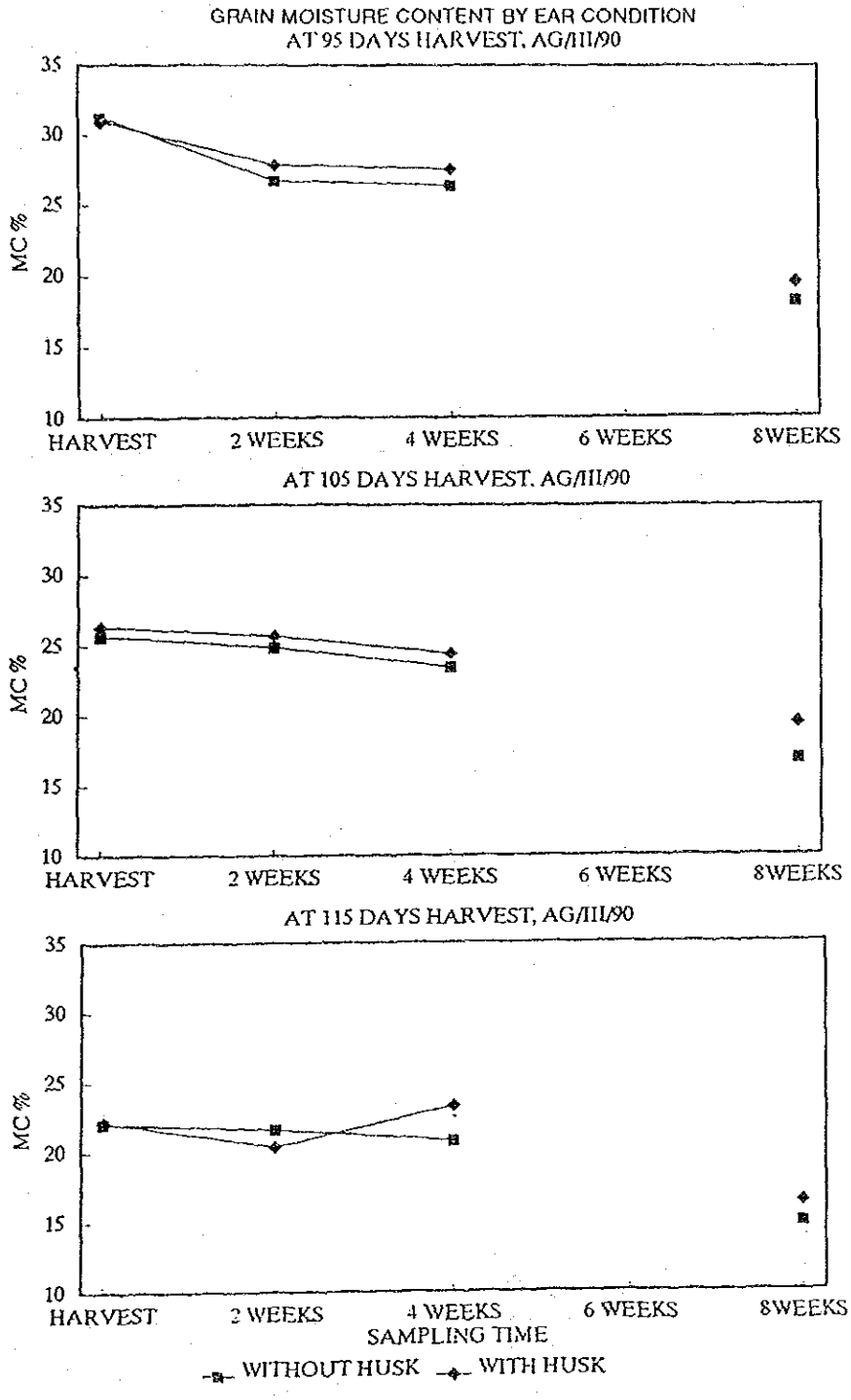
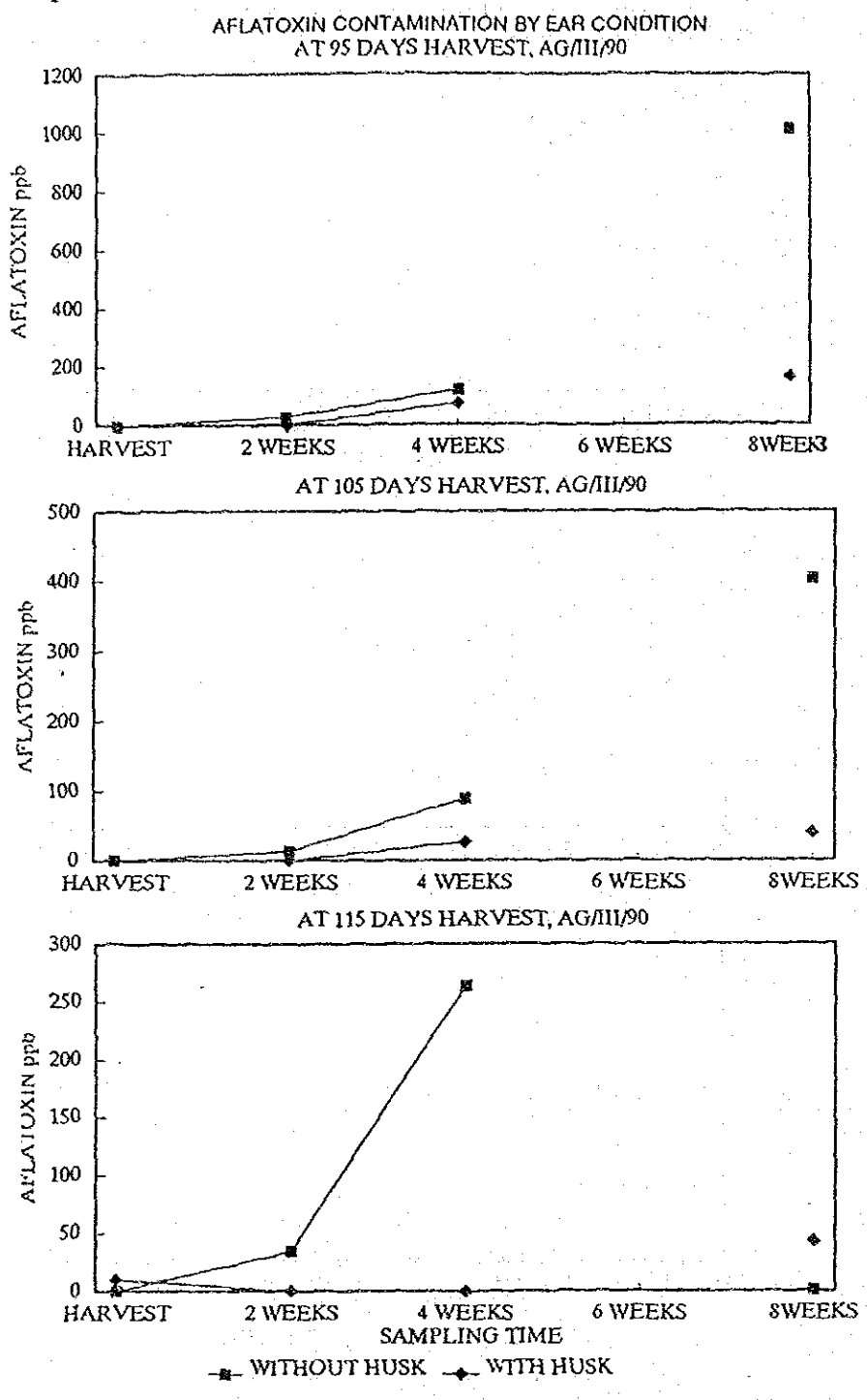


Figure 1: Grain moisture content and it's difference between treatments from at harvest to 8 weeks in the store

Level of initial moisture content in this year was lower than last year which were around 33, 29 and 25% on +H and 33, 29 and 25% on -H for H1, H2 and H3. However the difference between +H and -H were larger in this year compared with last year that maximum difference was 1.5% instead of 2.6% this year.
Total aflatoxin contamination level in average across replications was compared in Figure 2.



Figre 2: Aflatoxin contamination in the different harvesting time and during the storage period

Overall contamination level in 1990 was varied , however the maximum contamination was 1010ppb and was 416.5ppb in 1989.
Safety storage period which is less than 20ppb was considered as the criteria to determine. The period on the both treatments were shorter than that of the last year. Safety period on +H were 2, 2 and 4 weeks and on -H were 0, 2 and 0 weeks in H1,H2 and H3.
+H treatments were lower contamination level than -H in general, although there are two exceptional cases in H3 harvest on S1 and S5 samples. There were always lower on +H than -H and +H were around 95% lower contamination level of -H when toxin was observed last year.

AG/VI/90
Effect of Nitrogen Regarding Prevention of Aflatoxin Contamination by the Inoculation Method
Code No. I-1-(1)-D (1989 - 1990)

Background
Nitrogen application has effected to high maize yield in Thailand. A report in the USA was that higher level of nitrogen application resulted lower aflatoxin contamination level. Nitrogen application will make extra profit for farmers by this study not only high yield but also lower aflatoxin contamination.

Materials and Method
Nitrogen treatment plots were arranged 16.5m X 5m by spacing of 0.75m between rows and 0.5m between hills with plant stand of 2 plants per hill.
Soil samples were taken before planting for chemical analysis to determine nitrogen application and nitrogen application were calculated from the result of analysis.
Other cultivation practices were carried out as the standard method.
Inoculation was done at 2 weeks after 50% silking by silk channel method with 10cc of 10^6 A.flavus concentration and pin bar method, control was set always adjacent to inoculations. Each treatment were applied at 5 rows in every nitrogen plots. Inoculation in the treatment row was applied 5 hills in the 14 hill row.

Summary of Result
Infected ear by A.flavus on the inoculation methods is shown at Table 1. Average infected ear on inoculation methods were 1.5, 4.5 and 63.1% on control, silk channel and pin bar respectively. Compare with the last year, control and silk channel were almost the same level of infection percentage which were 0.4 and 3.9%. Pin bar method was employed from this year, the level of infection was satisfactory in order to compare toxin contamination.

AVERAGE INFECTED EAR %					TOTAL HARVESTED EAR				
N	C	S	P	AVG	N	C	S	P	AVG
0	2.8	7.8	72.9	27.8	0	50	45	51	48.7
10	1.5	1.7	55.9	19.7	10	55	61	59	58.3
20	1.7	3.9	64.5	23.4	20	62	53	53	56.0
30	0.0	4.6	59.1	21.2	30	57	60	57	58.0
AVG	1.5	4.5	63.1	23.0	AVG	56.0	54.8	55.0	55.3

N: Nitrogen Application Level(kg/rai)
C: Control
S: Silk Chanel Method
P: Pin Bar Method

Table 1: percentage of infected ear and total harvested ear

Aflatoxin contamination on the treatments is shown at Fig. 1. There was no contaminated on control plot, and there was only no nitrogen plot contaminated at 19ppb. On pin bar plot, the highest level of contamination was observed at no nitrogen plot at total 2369ppb and the lowest was at 30kgN plot at 129ppb. However the difference among the contamination levels in the nitrogen plots was not significant.

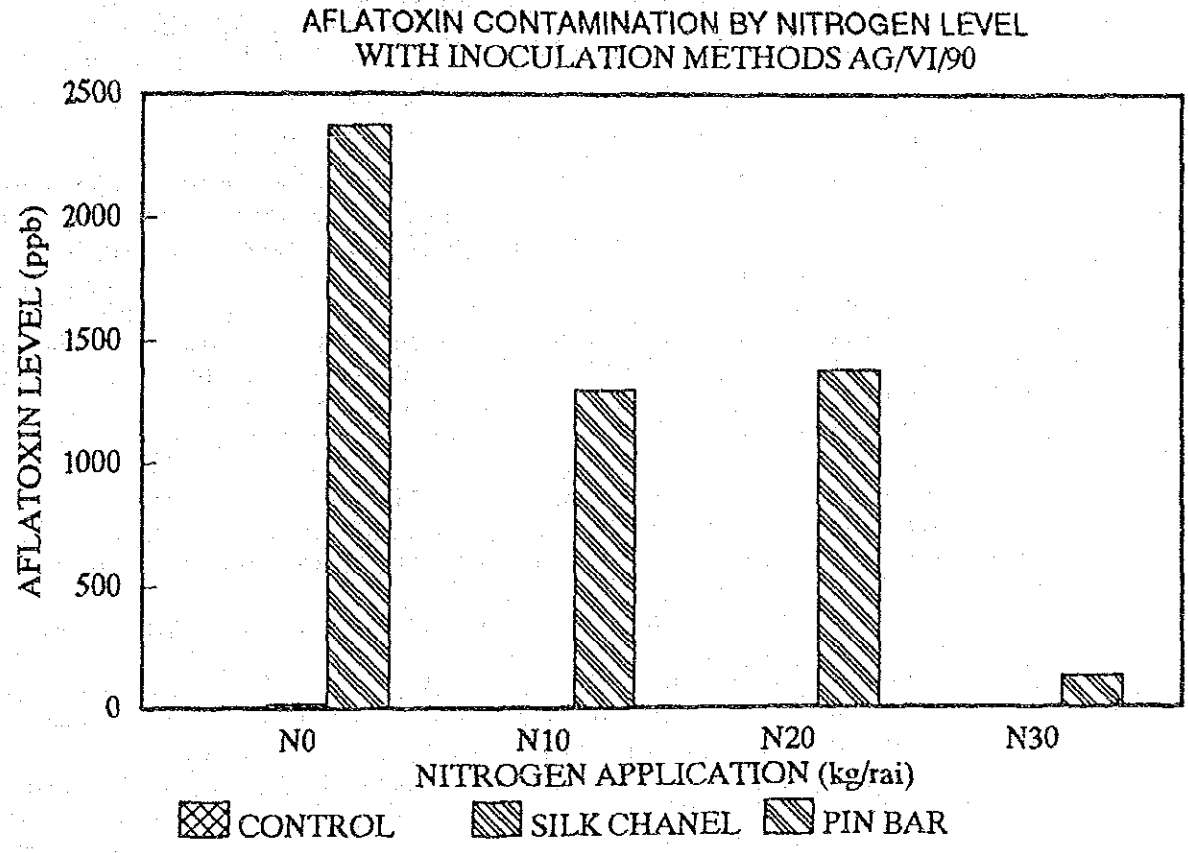


Fig. 1: Aflatoxin contamination on nitrogen levels and inoculation methods.

Yields estimated from harvesting 3 border rows were 213.5, 488.3, 681.8 and 771.8 kg/rai on 0, 10, 20 and 30kgN/rai plots respectively.

AG/VII/90
Identification of Maize Insects and Types of Damage They Inflict on the Maize Kernel
Code No. I-1-(1)-F, B

Background
A. flavus causes aflatoxin in the maize. Invasion of the fungus is not clearly explained yet, however an insect plays an important role on it. And also some different types of damage such as a bite, a hole and a trace of insect more under the pericarp on the kernel are recognized in maize. Identify kinds of insects or types of kernel damage will make clear the role of insect on the fungus invasion and aflatoxin occurrence.

Materials and Method
Plot was arranged in 1 rai(40m x 40m) with the standard cultivation practices. Suwan 1 variety was planted in the spacing of 0.75m between rows and 0.5m between hills with 2 plants per hill. Thinning, weeding and fertilizer application were practiced in the same day at two weeks after planting.
Pheromone traps were set at 5 points in the field and trapping was started from May 25th, 1990. Moth and other insect in the trap were counted twice a week and plated on culture media to check fungi infestation on the body. Pheromone was changed every 45 days.
Pit fall traps were set on the ground at 10 points in the field with ground corn as feed. Trapping was started in July 2nd, 1990 and plating was carried out. Feed in the trap was changed whenever necessary.
No. of insects on the corn plant was counted twice a week starting from 41 days to 90 days after planting.
100 ears were taken once a week from 75 days to 134 days after planting or 20 days to 80 days after 50% silking as the sample for examining ear and kernel damage and fungi infestation . Ear was separated for damaged ear observed trace of damage and non-damage ear, then kernel samples were taken for fungi infestation from damaged kernel from damaged ear, sound kernel from damaged ear and sound kernel from non-damaged ear.

Summary of Result
Number of insect on the corn plant were counted twice a week from July 10th to August 28 as shown at Table 1. Corn leaf aphid appeared almost similar period as last year. Corn stem borer started to observe around 10 days later and longer period this year than last year. Corn ear-worm appeared about a week later than last year and observed longer period.
Moth of corn stem borer was trapped by pheromone trap and its number and other insect were shown at Fig 1. During the corn growing period at least 2 times of moth stage of corn stem borer was observed at planting time to silking time as the first season and before physiological maturity to harvesting time as second season.
Percentage of moth carried fungi were 50.2% for A.Flavus, 20.1% for A.niger and 74.6% for other fungi during the corn growing period. Fungi on the other insects trapped in the pheromone were

carrying 32.5% for A.flavus, 19.6% for A.niger and 76.2% for other fungi. Moth were carrying A.flavus more than other insect. Insects trapped in the pit fall trap were not identified properly yet, however their A.flavus carrying rate by plating were as high as 70.7% in average.

No. of damaged ear, damaged trace ear and non-damaged ear in the sample at different growth period is shown at Fig. 2. Sampling was started from around 20 days after 50% silking. Portion of damaged ear and damaged trace ear at grain filling period were less and gradually increased. Neither A.flavus nor A.niger were observed at early sampling. None of fungi inside kernel were observed. A.flavus on the kernel surface of averaged damaged ear infected more than non-damaged ear. However between sound kernel and damaged kernel from damaged ear was not significant different.

	MONTH	DAY	A	B	C	D	E	F	G	H	I	J	K	L	M
1	JUL	10	0	19230	0	0	0	0	0	0	0	57	9	61	0
2	JUL	13	0	31566	0	0	0	0	0	0	0	101	2	0	6
3	JUL	17	0	54297	0	6	1	0	0	0	13	252	1	48	1
4	JUL	20	0	968	0	0	0	0	0	0	2	147	1	31	0
5	JUL	24	0	45	0	0	0	0	0	0	0	99	1	30	0
6	JUL	27	0	0	0	0	0	0	0	0	0	81	0	48	6
7	JUL	31	0	0	0	0	0	0	2	4	0	46	0	40	1
8	AUG	3	0	1	0	1	6	0	8	2	0	9	2	28	0
9	AUG	7	0	0	0	0	0	0	1	0	0	16	1	29	3
10	AUG	10	0	0	0	0	6	0	15	1	0	5	0	11	1
11	AUG	14	0	0	0	0	2	0	1	0	0	7	1	8	0
12	AUG	17	0	350	0	0	3	0	18	0	0	15	0	26	0
13	AUG	21	0	0	0	0	2	1	0	0	0	11	6	7	1
14	AUG	24	0	0	0	0	3	0	21	0	0	6	1	1	0
15	AUG	28	0	0	0	0	2	0	7	0	0	1	0	1	0
TOTAL			0	106457	0	7	25	1	73	7	15	853	25	369	19

A: Common name = Corn Thrips
Scientific name = Franklinella williamsi Hood
(Family : Order) = (Thripidae : Thysanoptera)

B: Common name = Corn leaf aphid
Scientific name = Rhopalosiphum maidis (Fitch)
(Family : Order) = (Aphididae : Homoptera)

C: Common name = Rose beetle
Scientific name = Adoretus compressess Weber
(Family : Order) = (Rutelidae : Coleoptera)

D: Common name = Egg of corn stem borer
Scientific name = Ostrinia furnacalis (Guenee)
(Family : Order) = (Pyralidae : Lepidoptera)

E: Common name = Larvae of corn stem borer
Scientific name = Ostrinia furnacalis (Guenee)
(Family : Order) = (Pyralidae : Lepidoptera)

F: Common name = Egg of corn ear-worm
Scientific name = Heliothis armigera Hubrer
(Family : Order) = (Noctuidae : Lepidoptera)

G: Common name = Larvae of corn ear-worm
Scientific name = Heliothis armigera Hubrer
(Family : Order) = (Noctuidae : Lepidoptera)

H: Common name = Corn armyworm
Scientific name = Mythima separata
(Family : Order) = (Noctuidae : Lepidoptera)

I: Common name = Green stink bug
Scientific name = Nezara viridula (L.)
(Family : Order) = (Pentatomidae : Hemiptera)

J: Common name = Lady bird beetle
Scientific name =
(Family : Order) =

K: Common name = Froghopper or Spittle bug
Scientific name = Callitetrix versicolor F.
(Family : Order) = (Ceropidae : Homoptera)

L: Unknown

M: Unknown

Table 1: Insect Count on the Corn Plant

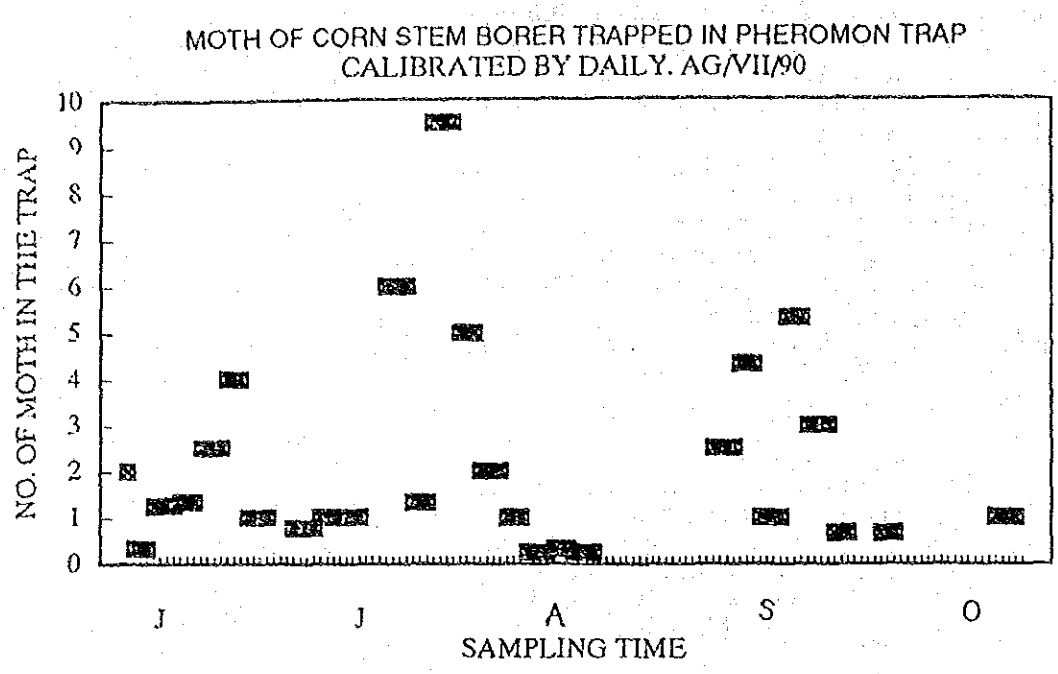


Fig. 1: Traped Moth of Corn Stem Borer

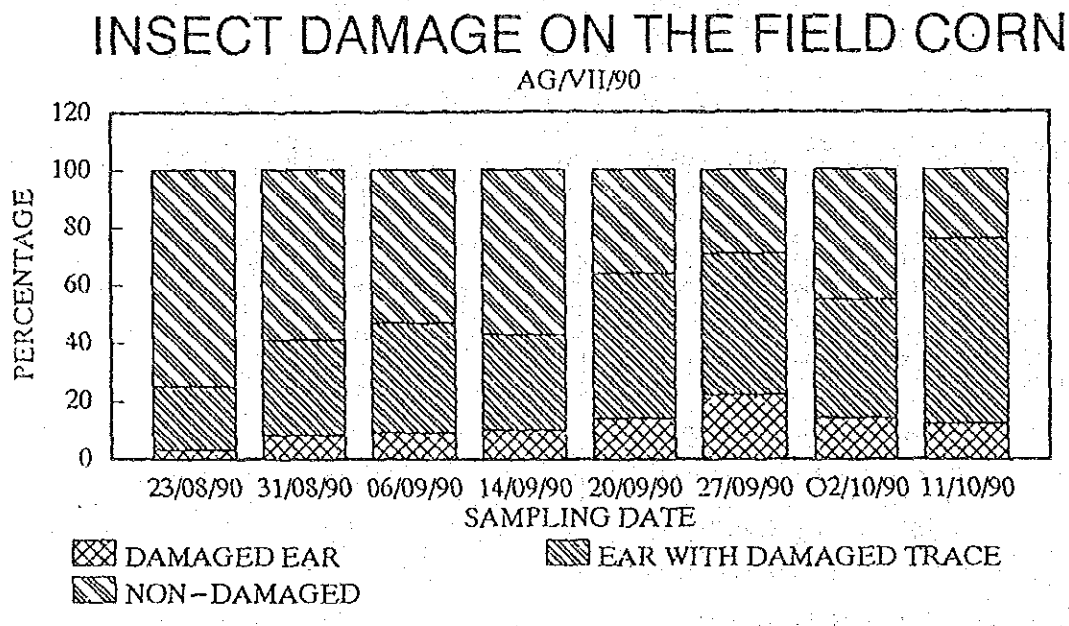


Fig. 2: Insect Damage on the Ear at Field Condition

AG/VIII/90
Evaluation of Insect Appearance and Its Damage that Occurs under Field Conditions
Code No. I-1-(1)-F, B

Background
It was considered that insect damage were important factor for A. flavus infection on aflatoxin occurrence. Ecology of insect in the maize production field is an essential factor to understand the situation of maize plant and the fungus infection.
Insects appearance in the maize field vary depend on a kind of insect and season. There are some insecticide recommended for maize, although maize farmers do not use it generally in Thailand due to economical reason.

Materials and Method
Plot was set 40m X 40m(1 rai) and planted by spacing of 0.75m between rows and 0.5m between hills with 2 plants per hill. Suwan 1 variety was planted with the standard cultivation practices. Thinning ,weeding and fertilizer application were done at 2 weeks after planting.
Treatment plots for Tr. A(furadan application) and Tr. B(control) were set at 5 locations by 20 rows X 20 hills and treatments were applied in it.
Granular type of carbo furadan was applied in the whorl at 4 weeks after planting.
Insect counts on the corn plant were carried out twice a week from July 10th to August 28th.
Harvest was practiced in October 12th and samples for fungi infection and aflatoxin contamination at harvest and 2 weeks after harvest were taken after separating ear to damaged, trace of damaged(unknown damage on the ear) and non-damaged.

Summary of Result
Insect count on the corn plant is shown at Table 1. Tremendous effect of furadan for corn leaf aphid and lady bird beetle were recognized, however for corn ear worm and some others were not. Corn stem borer's larvae and corn ear-worm's larvae appeared later than last year and stayed longer this year.
Ear condition at harvest is shown at Table 2. About 80% of planed density was obtained at harvest. More than 20% of rotten ear which was due to lodging plant was observed.
Damaged ear in average were 9.2% and 6.1% on Tr.-A and Tr.-B , however no significant different was recognized. Trace damaged ear were 34.5% on Tr.-A and 25.9% on Tr.-B and different was significant at 5% level. Non-damaged ear were 36.0% and 41.8% respectively and there was no significant.
Fungi infection at harvest was checked on surface and inside kernel. A.flavus was observed 46%, 60% and 24% on damaged, trace and non-damaged in insecticide plot. In the control plot, 100%, 96% and 42% of kernel was infected. However there were not significant different in both between treatment plots and among the ear conditions.
Aflatoxin from the samples at harvest and 2 weeks after harvest are under the analysis process.

HARVEST DATE: 12/10/90

PLOT A: FURADAN APPLIED IN WHORL

SAMP	MONTH	DAY	A	B	C	D	E	F	G	H	I	J	K	L	M
1	JUL	10	0	27	0	0	0	0	0	0	0	6	12	21	0
2	JUL	13	0	273	0	0	0	0	0	0	0	1	3	35	0
3	JUL	17	0	105	0	0	0	0	0	0	0	4	1	75	1
4	JUL	20	0	25	0	0	0	0	0	0	0	11	1	149	0
5	JUL	24	0	0	0	0	0	0	0	0	0	49	2	110	0
6	JUL	27	26	0	0	0	0	0	1	0	1	22	2	0	44
7	JUL	31	0	0	0	0	0	0	3	1	3	4	3	9	2
8	JUL	3	0	0	0	0	1	0	4	0	0	1	0	8	0
9	AUG	7	0	0	0	0	1	0	5	0	0	3	1	2	0
10	AUG	10	0	0	0	0	1	0	10	0	0	3	0	3	0
11	AUG	14	0	0	0	0	1	0	2	1	0	0	1	3	0
12	AUG	17	0	0	0	0	0	0	10	0	0	1	0	8	0
13	AUG	21	0	0	0	0	0	0	0	0	0	1	0	5	0
14	AUG	24	0	0	0	0	0	0	12	0	0	0	0	1	0
15	AUG	28	0	0	0	0	1	0	11	0	0	0	0	1	0
TOTAL			26	430	0	0	5	0	58	2	4	106	26	430	47

PLOT B: CONTROL

SAMP	MONTH	DAY	A	B	C	D	E	F	G	H	I	J	K	L	M
1	JUL	10	2	2788	0	0	0	0	0	0	0	5	3	32	0
2	JUL	13	0	16519	0	1	0	0	0	0	0	42	1	51	0
3	JUL	17	0	4755	0	0	0	0	0	0	0	51	3	181	0
4	JUL	20	0	560	0	0	0	0	0	0	0	66	2	36	5
5	JUL	24	0	120	0	0	0	0	0	0	2	88	0	54	1
6	JUL	27	3	2	0	0	0	0	0	0	0	35	8	0	12
7	JUL	31	0	1	0	0	0	0	0	0	1	14	2	7	0
8	JUL	3	0	1	0	0	2	0	1	0	1	4	2	9	0
9	AUG	7	0	3	0	0	0	0	3	0	0	2	3	5	0
10	AUG	10	0	1115	0	0	2	0	11	0	0	4	0	1	0
11	AUG	14	0	50	0	0	2	0	1	0	0	0	0	3	0
12	AUG	17	0	4	0	0	4	0	10	0	0	6	0	6	0
13	AUG	21	0	0	0	0	1	0	0	0	1	5	3	2	0
14	AUG	24	0	0	0	0	1	0	2	0	0	2	0	2	0
15	AUG	28	0	0	0	0	8	0	5	0	0	0	0	0	0
			5	25918	0	1	20	0	33	0	5	324	27	389	18

NOTE

A: Common name = Corn Thrips
Scientific name = Franklinella williamsi Hood
(Family : Order) = (Thripidae : Thysanoptera)

B: Common name = Corn leaf aphid
Scientific name = Rhopalosiphum maidis (Fitch)
(Family : Order) = (Aphididae : Homoptera)

C: Common name = Rose beetle
Scientific name = Adoretus compressess Weber
(Family : Order) = (Rutelidae : Coleoptera)

D: Common name = Egg of corn stem borer
Scientific name = Ostrinia furnacalis (Guenee)
(Family : Order) = (Pyralidae : Lepidoptera)

E: Common name = Larvae of corn stem borer
Scientific name = Ostrinia furnacalis (Guenee)
(Family : Order) = (Pyralidae : Lepidoptera)

F: Common name = Egg of corn ear-worm
Scientific name = Heliothis armigera Hubrer
(Family : Order) = (Noctuidae : Lepidoptera)

G: Common name = Larvae of corn ear-worm
Scientific name = Heliothis armigera Hubrer
(Family : Order) = (Noctuidae : Lepidoptera)

H: Common name = Corn armyworm
Scientific name = Mythima separata
(Family : Order) = (Noctuidae : Lepidoptera)

I: Common name = Green stink bug
Scientific name = Nezara viridula (L.)
(Family : Order) = (Pentatomidae : Hemiptera)

J: Common name = Lady bird beetle
Scientific name =
(Family : Order) =

K: Common name = Froghopper or Spittle bug
Scientific name = Callitetrix versicolor F.
(Family : Order) = (Ceropidae : Homoptera)

L: Unknown

M: Unknown

Table 1 : Insect Count on Corn Plant

Insect Damage
Harvest Date 12/10/90
Damage Ear: insect damage on the kernel
Rotten ear: rotten or germinated due to lodging or other

PLOT A: FURADAN APPLIED IN WHORL

PLOT	Tr.	Harv. Ear	Damage Ear	Damage Trace Ear	No Damage Ear	Rotten Ear
1	A	334	16	81	137	100
2	A	350	18	113	131	88
3	A	331	32	126	110	63
4	A	314	57	112	92	53
5	A	335	30	142	129	34
TOTAL		1664	153	574	599	338
AVG		332.8	30.6	114.8	119.8	67.6
%			9.2	34.5	36.0	20.3

PLOT B: CONTROL

PLOT	Tr.	Harv. Ear	Damage Ear	Damage Trace Ear	No Damage Ear	Rotten Ear
1	B	319	14	72	125	108
2	B	312	12	70	128	102
3	B	317	19	82	138	78
4	B	315	12	81	165	57
5	B	342	41	111	115	75
TOTAL		1605	98	416	671	420
AVG		321	19.6	83.2	134.2	84
%			6.1	25.9	41.8	26.2

Table 2: Ear Damage Conditions at Harvest Time

AG/XII/90
Large Scale Practices on Concerning Harvest Method and Aflatoxin Occurrence in Maize
Code No. I-3-(1) (1990-1991)

Background
Previous study in the project concerning harvest methods and storage by following to the harvesting practices to compare conventional harvesting method which remove husk at field and harvest with husk was carried out in 1988 and 1998.
The result in both years showed similar tendency on aflatoxin contamination that ear harvested with husk was always lower than conventional method during the storage period, although the contamination level in 1989 was much lower than 1988.
Prior to recommend this technology to maize farmers, several research items to confirm its efficiency was required. Practical size of operation was raised to approve the effect of new method at farmer's level. Socio-economical factor was taken into consideration in this study.

Material and Method
Three maize growing farmers were selected around the station. Harvested and stored maize at three farms were as follow;

Farm 1:
planted area; 25 rai
planted date; May 24-27,1990
harvested date; September 5-7, 1990
variety; Suwan 1
stored maize; +husk - 8764.9kg with husk
-husk - 8723.5kg without husk
size of store; 4.3m(W)X5.5m(D)X2.0m(H). 2.15X5.5X2.0/tr.
material; wood(both floor and wall)
structure of store; separated from residence. space under the floor is 70cm. roof is zinc roofing.

Farm 2:
planted area; 18 rai
planted date; May 23, 1990
harvested date; August 29-30, 1990
variety; Hercules 40(Ciba Geigy)
stored maize; +husk - 4801.1kg with husk
-husk - 3966.0kg without husk
size of store; 8.7m(W)X2.6m(D)X1.9m(H). 4.35X2.6X2.0/tr.
material; bamboo(both floor and wall)
structure of store; separated from residence. space under the floor is 35cm. roof is zinc roofing.

Farm 3:
planted area; 30 rai
planted date; May 27, 1990
harvested date; September 12-13, 1990
variety; Hercules 40(Ciba Geigy)
stored maize; +husk - 4579.8kg with husk
-husk - 5280.1kg without husk

size of store; 5.1m(W)X2.2m(D)X1.9m(H). 2.55X2.2X1.9/tr.
material; bamboo(both floor and wall)
structure of store; under the house. space under the floor is 25cm.

Observation items:

1. temperature - measured at 5 points in the bulk of each treatment and ambient temperature.
2. co2 - measured by Gas Tech co2 detector at 3 points in the treatments at Farm 1 for the initial ten days.
3. fungi - taken sample from harvest to 10th week of storage by 1 week interval. density was examined on the surface of kernel and inside the kernel.
The work was done by microbe section.
4. aflatoxin - taken sample from harvest to 10th week of storage by 1 week interval.
Toxin detection was done by microbe section after screening by BGYF and extraction at station.
5. kernel moisture content - measured at the same time of aflatoxin sampling
6. volume of harvest - volume change by harvest with husk was estimated at each location.
7. harvest work efficiency - harvesting speed was estimated between with husk harvest and conventional harvest.

Summary of Result

Temperature range across 5 sensors inside the storages were shown at Fig.1. The level of temperature at three location were varied among the location and between treatments. The range of temperature at with husk storage was in the higher than of the without husk at three locations. The levels of temperature range on with husk were the highest at the largest storage of Farm 1 and the lowest at the smallest of Farm 2 and the changes during the storage period were large which were high at initial 2 weeks and gradually decrease to the end of the period. Difference between maximum and minimum were also large at initial period and gradually became smaller. The levels on without husk were not significant different and its change during the storage were small. Temperature ranges of maximum and minimum were small during the period at three locations.

A.flavus, A.niger, F.moniliforme, P.funiculosum and other fungi were examined infection ratio from 100 kernel on the surface and inside the kernel every week from harvest to 9th week of storage as shown at table 2. Surface fungi was plated on the culture media directly and inside fungi was plated after surface sterilization.

Aflatoxin producing A.flavus on the kernel surface at three locations varied their infection levels as location average 43%, 92% and 67% at Farm 1, 2 and 3 respectively. However A.flavus inside kernel on location average were 4.5%, 4.3% and 2.3% at Farm 1, 2 and 3 and their difference between +H and -H were 3.4%, 4.7% and 4.2% lower on +H than -H. A.niger also showed similar result, although infection level were different. F.moniliforme and P.funiculosem on surface sterilization showed also similar trend in the treatment average. On the other fungi, Botryodiplo-

dia sp. concerned its serious effect to kernel quality which pericarp changes color into dark and endosperm changes into greenish. Its was observed most of sampling time at three locations.

Results of aflatoxin analysis at three locations are shown at Fig. . Average aflatoxin contamination on with husk in three locations were 66.5, 93.8 and 119.9 ppb at Farm 1, Farm 2 and Farm 3 respectively, though reverse results were observed at 6 week and 10 week at Farm 2. And on without husk were 179.9, 267.5 and 273.3ppb respectively. Average deduction by harvested and stored with husk were 37.0%, 35.1% and 43.9% at Farm 1, Farm 2 and Farm 3.

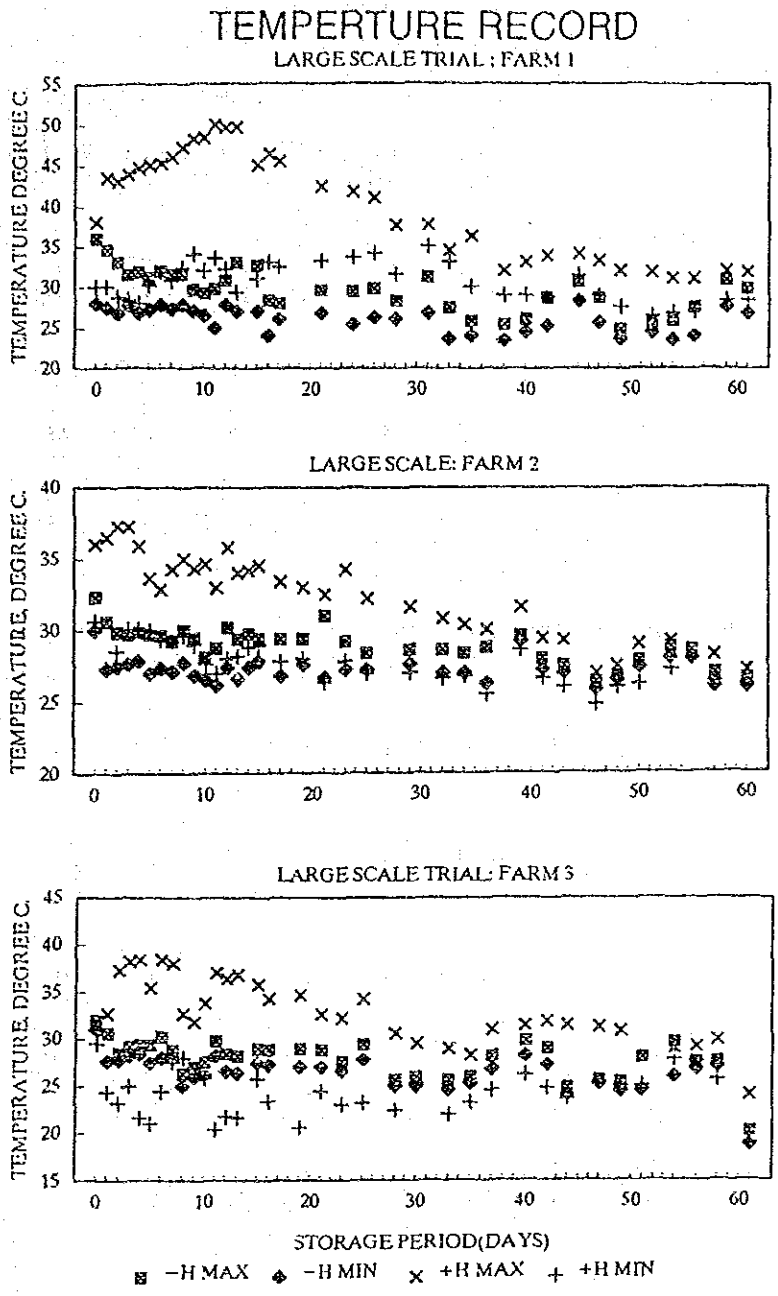


Fig. 1 : Temperature Range in the Storage Across Five Sensors

Table 1 : Fungi Infection at Harvest and Storage

RESULT OF LARGE SCALE FARMER : FARMER NO. 1 AG/XII/90
NO = kernel no washed: surface fungi
WASH = 1% NaOCl 1 min. surface sterilization: penetrated fungi

Date	06/09	13/09	20/09	27/09	04/10	11/10	18/10	25/10	01/11	08/11	
Period	harves1	-week2	-week3	-week4	-week5	-week6	-week7	-week8	-week9	-week	AVG
TOTAL Aflatoxin(A+B)(%)											
+H	0	1	6	3	35	78	116	27	30	369	66.5
-H	3	3	40	150	94	162	128	310	351	558	179.9
A.flavus(%)											
NO											
+H	77	54	70	62	24	2	62	20	88	4	46.3
-H	60	16	70	72	12	42	32	46	48	8	40.6
WASH											
+H	-	4	8	2	2	2	2	2	4	2	2.8
-H	-	10	4	-	-	28	6	2	4	8	6.2
A.niger(%)											
NO											
+H	29	100	74	100	100	100	100	100	100	100	90.3
-H	56	98	100	100	100	100	100	100	100	100	95.4
WASH											
+H	-	2	10	-	-	4	-	-	-	4	2.0
-H	-	4	6	2	2	6	2	4	6	16	4.8
F.moniliforme(%)											
NO											
+H	17	-	-	-	-	-	-	-	-	-	1.7
-H	3	-	-	-	-	-	-	-	-	-	0.3
WASH											
+H	15	12	24	4	-	4	-	-	4	-	6.3
-H	12	24	24	36	16	8	36	14	28	18	21.6
P.funiculosum(%)											
NO											
+H	18	2	12	40	46	26	-	-	-	-	14.4
-H	49	16	4	32	50	40	-	-	-	-	19.1
WASH											
+H	15	12	24	4	-	4	-	-	4	-	6.3
-H	12	24	24	36	16	8	36	14	28	18	21.6
OTHER FUNGI(%)											
NO											
+H	-	4	10	-	-	22	28	24	12	44	14.4
-H	1	4	6	-	2	4	88	20	14	40	17.9
WASH											
+H	-	4	12	26	22	42	14	34	38	12	20.4
-H	4	46	10	8	24	10	2	13	15	42	17.4

RESULT OF LARGE SCALE FARMER : FARMER NO. 2 AG/XII/90
NO = kernel no washed: surface fungi
WASH = 1% NaOCl 1 min. surface sterilization: penetrated fungi

Date	30/08	13/09	20/09	27/09	04/10	11/10	18/10	25/10	01/11	08/11	
Period	harvest	-week2	-week3	-week4	-week5	-week6	-week7	-week8	-week9	-week10	-wee AVG
TOTAL Aflatoxin(A+B)(%)											
+H	0	0	58	60	140	325	84	22	63	280	103.2
-H	0	55	134	279	909	294	551	329	254	138	294.3
											35.07
A.flavus(%)											
NO											
+H	98	46	58	48	2	4	4	24	-	78	36.2
-H	47	6	58	68	60	4	12	10	14	64	34.3
WASH											
+H	4	-	2	-	4	-	2	2	-	6	2.0
-H	1	30	8	6	2	-	2	-	4	14	6.7
A.niger(%)											
NO											
+H	27	100	100	100	100	100	100	100	100	98	92.5
-H	99	30	90	100	100	100	100	100	100	100	91.9
WASH											
+H	1	4	2	2	6	2	2	8	4	-	3.1
-H	3	24	12	4	8	4	8	14	-	4	8.1
F.moniliforme(%)											
NO											
+H	-	2	-	-	-	-	-	-	-	-	0.2
-H	-	-	-	-	-	-	-	-	-	-	0.0
WASH											
+H	5	-	-	14	4	-	-	2	4	26	5.5
-H	11	14	9	18	14	8	8	12	10	20	12.4
P.funiculosum(%)											
NO											
+H	-	-	-	50	52	34	-	-	-	-	13.6
-H	5	-	-	66	66	32	-	-	-	-	16.9
WASH											
+H	5	6	12	40	22	14	18	4	16	16	15.3
-H	8	38	40	66	64	38	32	46	22	26	38.0
OTHER FUNGI(%)											
NO											
+H	1	4	-	-	6	10	78	26	34	30	18.9
-H	2	8	2	-	2	8	102	36	24	44	22.8
WASH											
+H	3	10	14	6	12	10	12	10	10	28	11.5
-H	2	6	8	4	12	10	10	24	12	12	10.0

RESULT OF LARGE SCALE FARMER : FARMER NO. 3 AG/XII/90
NO = kernel no washed: surface fungi
WASH = 1% NaOCl 1 min. surface sterilization: penetrated fungi

Date	13/09	20/09	27/09	04/10	11/10	18/10	25/10	01/11	08/11	15/11	
Period	0-week1	-week2	-week3	-week4	-week5	-week6	-week7	-week8	-week9	-week	AVG
TOTAL Aflatoxin(A+B)(%)											
+H	0	22	18	121	290	78	124	15	22	509	119.9
-H	3	23	63	237	437	326	258	587	268	531	273.3
A.flavus(%)											43.871
NO											
+H											
-H	28	56	70	68	98	98	100	-	42	44	60.4
WASH	94	98	92	46	86	78	100	100	30	28	75.2
+H											
-H	-	-	-	-	-	2	-	-	-	-	0.2
-H	8	6	8	4	-	-	2	6	4	6	4.4
A.niger(%)											
NO											
+H											
-H	100	86	98	100	84	92	88	100	100	100	94.8
WASH	76	98	100	100	100	100	98	54	100	100	92.6
+H											
-H	16	2	-	-	-	-	-	-	-	-	1.8
-H	4	4	2	-	2	4	2	-	-	4	2.2
F.moniliforme(%)											
NO											
+H											
-H	-	-	-	-	-	-	-	-	-	-	0.0
WASH	-	-	4	-	-	-	-	-	-	-	0.4
+H											
-H	26	8	-	10	2	-	4	-	4	-	5.4
-H	16	36	36	40	6	8	16	-	6	-	16.4
P.funiculosum(%)											
NO											
+H											
-H	3	14	-	32	16	10	10	32	10	18	14.5
WASH	4	-	18	32	24	4	24	14	10	24	15.4
+H											
-H	6	10	10	32	30	26	13	18	24	12	18.1
-H	6	14	18	28	26	28	38	18	36	20	23.2
OTHER FUNGI(%)											
NO											
+H											
-H	-	10	10	2	10	50	8	6	10	10	11.6
WASH	8	6	6	-	12	36	10	8	10	4	10.0
+H											
-H	-	10	10	10	10	10	10	12	10	10	9.2
-H	4	6	20	6	10	12	10	12	18	12	11.0

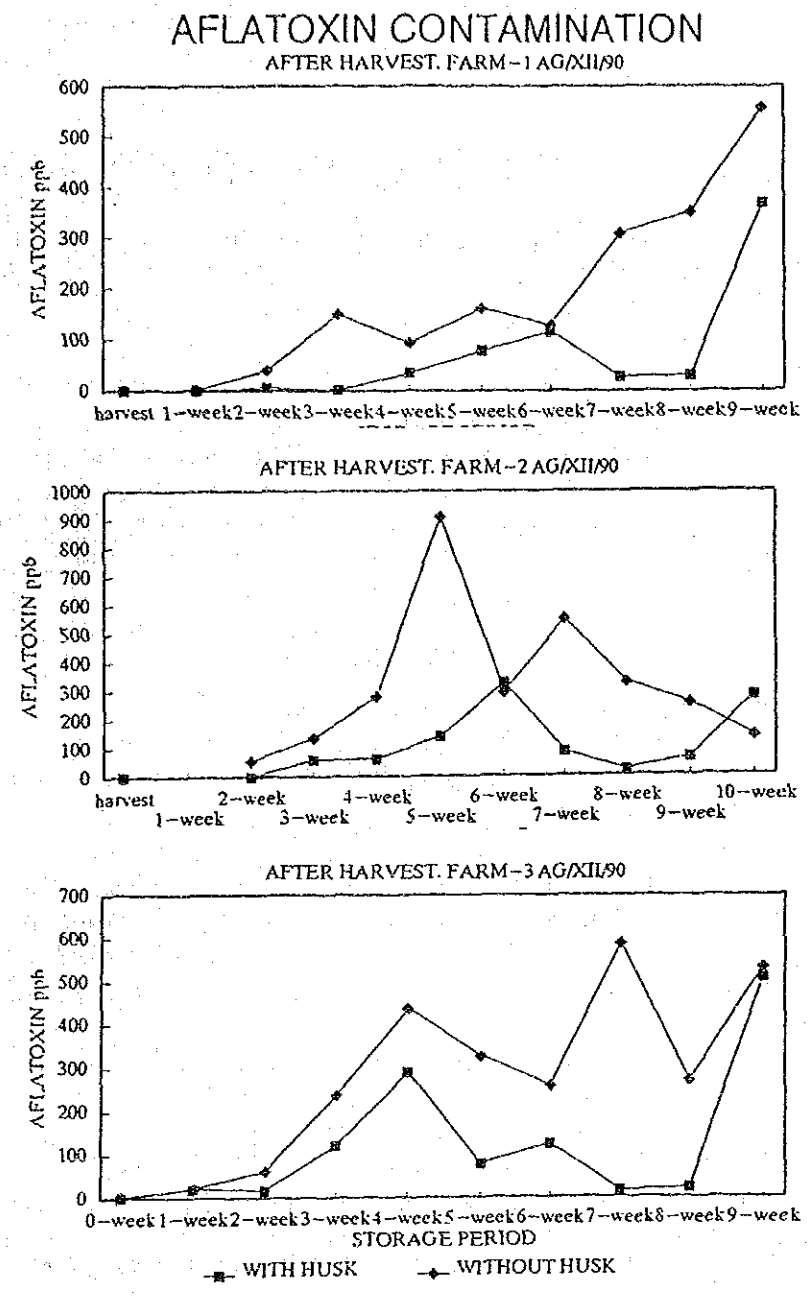


Fig. 2 : Aflatoxin Contamination at Three Locations During the Storage.

IV. ABSTRACT OF THE EXPERIMENT RESULTS

POST HARVEST SECTION

(1991. 1. 24)

THE MAIZE QUALITY IMPROVEMENT RESEARCH CENTER PROJECT

II Post-Harvest Section

Corn sheller improvement (1988-1991)
Code No. II-3-(2)-A (II-1-(2)-B-(a)&(b))

Objectives

This experiment was conducted to clarify the relationship among the type of cylinder, machinery design, operationel conditions, moisture content of maize and mechanical damage of kernels, to select practical type of improved corn sheller from three proto-tyoes for high moisture maize.

Methods and Procedures

Three types of proto-type cylinders (rectangular spike tooth with drum, spike tooth with drum and spike tooth with cage cylinder) and one reference type (plate tooth cylinder) were tested to evaluate their efficiency at MQIRC. Ear maize samples of Suwan 1 and Suwan 3 were prepared to have different moisture content of 18,22,26 and 30%, and were shelled at four different peripheral speeds ranging from 5.2 to 12.7m/s. Ratio of broken or damaged kernels, power consumption and brakage of cob was investigated.

Suitable arrangement including operational conditon are to be investigated on cleaning part. Effect of aif flow rate, bibration speed feeding rate is to be analysed concerning cleaning performance.

Results

Ratio of breakage was lower than last year' experiment at 18, 22 and 26% of moisture content. Ratio of brakage incresed rapidly at moisture content of 30%. Spike tooth with cage cylinder showed lowest breakage of the level of 7%, and we might select this type if we should. We need more analysis to conclude, for, 7% of breakage is still in a high level and spike tooth with drum cylinder also is not so bad.

Trial sheller with rasp bar cylinder drum showed good performance at shelling ears stored with husk. Ratio of brakage was below 4% at peripferal speed of 10 or 12.5 m/s, and it might be lower than last year' result shelling without husk if compared with corresponding one. The ratio of breakage was a little lower when shelled after 30 days' storage than 60 days'.

For furthur analysis, we asked a favor of Mr. Azuma, short term expert of this field.

Problems and Future Plans

It is not clear why they showed low performance at moisture content of 30%. It might be assumed (1) that variety had some effect on breakage for Suwan 3 was used only for this treatment or (2) that only this sample had some specific properties. The method determining ratio of breakage seems to have no problem, for we have been conducting this experiment for three years in succession.

For 1991's plan, one type of cylinder is to be selected for performance test of improved corn sheller for high moisture maize.

Fig.1 Spike Tooth Cylinder (Cage Type with 5 Angles)

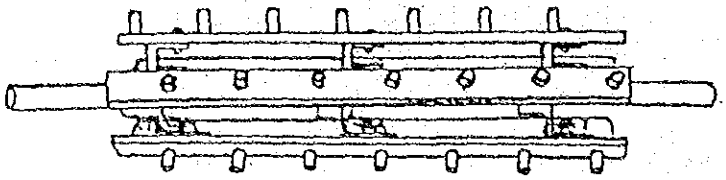


Fig.2 Rectangular Spike Tooth Cylinder (Drum Type)

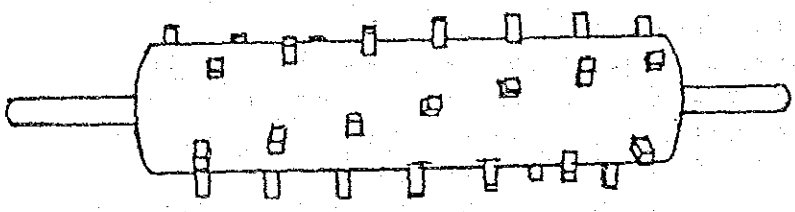
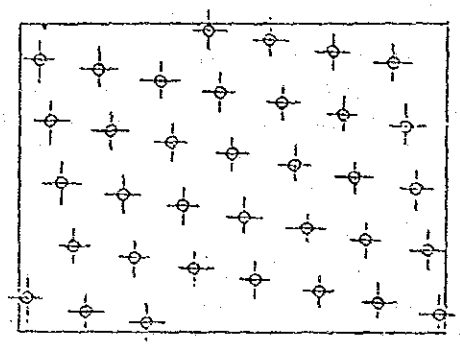
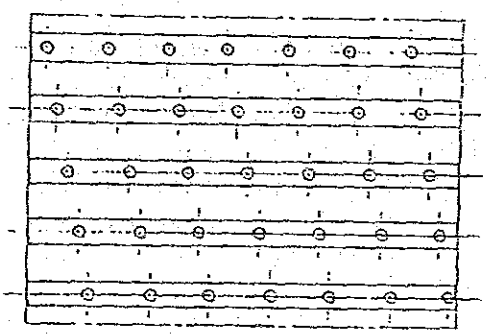


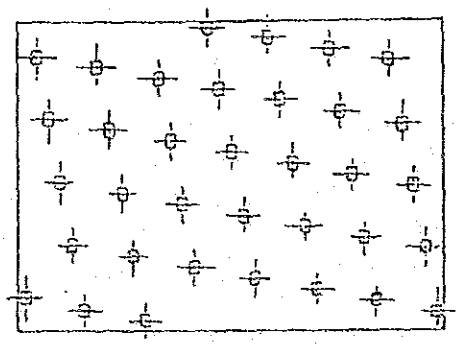
Fig.3 Develpoment of Cylinders (Tooth Arrangement)



Spike Tooth Cylinder (Drum Type)



Spike Tooth Cylinder
(Cage Type with 5 Angles)



Rectangular Spike Tooth Cylinder (Drum Type)

Study on the relationship between damage on kernel, kernel moisture content and aflatoxin contamination.(1988-1990)
Code No. II-1-(2)-B

Objectives

This experiment was conducted to investigate the effect of broken kernel and impurity mixed in intact kernel on aflatoxin contamination during storage period.

Methods and Procedures

Manually shelled ear maize sample, variety Suwan 1, were prepared to have four different ratio of brakage and impurity as following percentage of 0:0 (controle and innoculated), 0:3, 3:0 and 3:3. Moisture content of the samples were 18, 22, 26 and 30%. Each sample was weighed 1kg and packed in perfolated plastic container covered with cotton clothes and stored in a high humidity cabinet arranged at random. All samples were inoculated with A. flavus previously except for 0:0 controle.

Mold infection was inspected for 0:0, innoculated and controle, on the 0, 1st, 3rd, 5th, 7th, 10th and 14th day. Aflatoxin contamination was examined on the 0, 3rd, 7th and 14th day.

Results

Analysis of mold and aflatoxin contamination is under processing.

All samples except for 18% moisture content could be observed to be infected.

Problems and Future Plans

Improvement and development of moisture meter. (1989-1991)
Code No. II-2-(2)

Objectives

This research was conducted to develop an moister meter for ear maize in Tailand.

Methods and Procedures

Two types of plier type electrodes were fabricated applied to "CD-2L", a resistant type moisture meter.

Twelve samples of ear maize, "Suwan 1", "Suwan 2", "Suwan 3" and three hybrids, are collected from different locations to be dried into 10 different moisture levels and were measured by ear maize moisture meters.

To delete dispersion of data, meters were calibrate by oven methods from three parts of ears.

Results

Experiments are under processing.

Problems and Future Plans

1) Even a slight difference of measuring point results in a big dispersion of determined value.
2) Electrodes shoul be modified to be easy to deal with.
3) Electric circuit should be modified to indicate calibrated values.

Calibration test of established moisture meters. (1989-1990)
Code No. II-2-(2)

Objectives
This investigation was conducted to calibrate moister meters in practical use for Thai maize.

Methods and Procedures
Twelve ear maize samples, "Suwan 1", "Suwan 2", "Suwan 3" and three hybrids, are collected from different fields. Samples were shelled by hand and prepared to have seven to nine different moisture contents according to their initial moisture contents.

Determined moisture contents by four moisture meters, "CTR-160", "Dole model 400", "Multi-grain portable" and "Digital grain moisture meter" (KU), were compared with the standard oven methods. Moisture contents were determined one, two and three days later from sample preparation to eveluate the effect of tempering for each moisture meter.

Results
Data are under processing.

Problems and Future Plans

Standardization of the standard oven methods. (1989-1990)
Code No. II-2-(2)

Objectives

This investigation was conducted to standerdize oven method of Thailand in this project.

Methods and Procedures

(1) Effect of absolute humidity was investigated between Thai and US climates. Both in Thai and US ambient with 4hr 130°C 5g are calibrated by 72hrs 103°C with 15g of whole kernel in US ambient.
(2) To evaluate the effect of drying time, calibration lines were compared among 4hrs, 5hrs and 6hrs for Thai ambient.
(3) To confirm that tempering has little effect in 4hrs methods, data measured on 2nd and 3rd day are compared with those on 1st day.

Results

Data are under processing.

Problems and Future Plans

Microwave oven method might be available for simplified oven method.

Urea treatment of maize to controle Aspergillus spp. and so prevent aflatoxin contamination. (1988-1991)
Code No. II-3-(2)-C-(a)

Objectives

This experiment was conducted to develop urea treatment methods of maize without discoloration for preventing aflatoxin contamination.

Methods and Procedures

Ear maise is stuck in a storage and a container of urea solution mixed with soybean solution are placed in the center for three weeks. For another treatment ear maize is dipped in urea solution and soybean emulsion for short time and also stored for three weeks.

Results

Not yet conducted.

Problems and Future Plans

It is difficult to get rid of discoloration at effective concentration and it reduces values of the commodity.

Remainder of urea or soybean might affect the quality of maize.

Ammonia can decompose aflatxin and this can be applied for self-consumption if the induced chemical from aflatoxin dose not work as an carcinogen again.

Sulfur dioxide supplemented storage of high moisture maize. (1988-1990)
Code No. Ⅱ-3-(2)-C-(a)

Objectives

This experiment was conducted to investigate effects of sulfur dioxide on storage of ear maise.

Methods and Procedures

For pre-test, each 400kg of ear maize was fumigated by 0.5, 0.25, 0.125 and 0.0625% of sulfur dioxide respectively. According to this experiment, each 650kg of ear maize was stored in a small corn crib and was treated with 0.5% sample weight of sulfur dioxide at one operation or 0.5%, 0.25% and 0.125% sample weight of chemical treatment at interval of three days.

During this experiment, mold infection and aflatoxin contamination was detected on the 0, 1st, 3rd, 6th, 9th and 12th day of storage.

Results

Mold infection seems to be severer at 0.5% treatment than control after sixteen days storage.

Intermitent treatment of 0.5% samples showd good preservation and others showed slight mold infection.

After treatment, sulfur dioxide remains from 300 to 500 ppm (some showed 700) and it decreased during storage, but no remainder was detected in 0.125% treatment.

Problems and Future Plans

Sulfur dioxide treatment can be combined with drying.

Ammonia and sulfur dioxide supplemented ambient air drying of high moistur e maize in Thailand. (1988-1990)
Code No. II-3-(2)-C-(a)

Objectives

This experiment was conducted to evaluate the potential of TAP (trickle ammonia drying process) and TSDP (trickle sulfur dioxide drying process) in Thai maize.

Methods and Procedures

Not yet conducted.

Results

None.

Problems and Future Plans

This method should be applied for shelled maize, because ear maize has big air gaps and most part of chemicals are lost in vain.

Estimation on increase of damaged kernel ratio during handling.(1988-1990)
Code No. Ⅱ-1-(2)-C-(a) and Ⅱ-1-(2)-B-(c)

Objectives

This experiment was conducted to investigate the effect of pre-storage quality of ear maize on aflatoxin preventation during storage period and to estimate the effect of rejecting damaged ear maize on aflatoxin preventation.

Methods and Procedures

Freshly harvested ear maize was classified into six levels of damages through selecting procedure:(1) intact, (2) scratch on sead coat, (3) mechanical damage during and before harvest, (4) insect, (5) A. flavus infection and (6) mold infection except for A. flavus.

All ear maize samples were innoculated and were kept in gunny sacks and stored for 14 days buried in ear maize stack. During and after storege, all the samples were inspected concerning the relationship among damages, A. flavus infection and aflatoxin contamination.

Results

This experiment has not yet been conducted.

Problems and Future Plans

This experiment can provide a analytical point of view for the infeçtion route of A. flavus, but it may not be practical if we could make recommendation for farmers according to the result of this experiment.

Study of the improvement of storage facilities for farmers. (1988-1991)
Code No. Ⅱ-3-(2)-C-(c)

Objectives

This experiment was conducted to clarify the effect of modification in farmers' storage during ear to improve farmers' storage facilities.

Methods and Procedures

Experimental models of two elevated-floor corn cribswith capacity of 5 tons (2.6m x 2.6m x 1.8m (D x W x H)) were constructed, one of which was fitted with three tunnels made by bamboo cage inside. Each storage was equipped with temperature sensors at 0, 20, 60, 100 and 120 cm above floor of the storage at 30 cm intervals. And humidity was measured everyday at 9 points of each storage.

Aflatoxin contamination was detected from sample kept in the net bag in iron cage from 15 points at each sampling.

Results

Data are under analysis. Modified storage seems to be better but not to be enough for preventing aflatoxin contamination.

Problems and Future Plans

It seems not to be enough drying stored ear only by modification of storage when ambient conditions are not so good.

Forced air or heated air could be applied to accelerate drying speed.

Simple drying method-2
Research on drying ear maize with vinyl plastic house (Solar heat drying). (1990)
Code No. II-3-(2)-8-(b)

Objectives

This experiment was conducted to develop a simple and low cost methods of drying ear maize by using solar radiation effectively.

Methods and Procedures

Two types of plastic house, open-single-layerd and closed-three-layered, were fabricated to determine effect of sun drying. Freshly harvested ear maize of hybrid was stored in plastic houses in 20cm depth, and was stored for three weeks.

Temperature and humidity profile of environment and inside the houses, solar radiation and air flow rate was recorded. Aflatoxin contamination was determined during and after storage.

Results

Ten days are enough to dry maize up to 14% in the middle and top layers and fourteen days are enough even in the bottom layer.

Aflatoxin analysis is under process.

Problems and Future Plans

Drying rate was not equal among layers.

To utilize collected heat, small fan can be installed at the bottom of the house for exhaustion.

Allowable duration for delay of drying in the post-harvest process of maize. (1989-1990)
Code No. II-1-(2)-(C-(c))

Objectives

This experiment is conducted to know the allowable delay of drying concerning aflatoxin contamination, and to get basic data for simulation of ambient air drying for ear maize.

Methods and Procedures

Ear maize samples of Suwan 1 were stored in gunny sacks for 0, 1, 3, 6, 9 and 14 days before drying. After storage, samples were dried in flat bed dryers with forced ambient bed drying untill they get to their equilibrium moisture content. Temperature profiles at the bottom and top layer of ear maize and ambient and outlat air, relative humidity profiles of ambient and outlet air were measured. Samples were extracted to determine moisture content twice a day. Aflatoxin contamination was determined before and after drying.

Results

Drying rate was rather high, because of enough air flow. Drying rate and the profiles of temperature relative humidity would be shown later. But samples for moisture determination was not enough.

For furthur details, data are under analysis.

Problems and Future Plans

Extracted samples showed big dispersion of moisture content because of the difference of moisture contents among ears.

To know the better tendancy of moisture content transition, total weight of samples should be weighed.

IV. ABSTRACT OF THE EXPERIMENT RESULTS

MICROBE SECTION

(1991. 1. 24)

THE MAIZE QUALITY IMPROVEMENT RESEARCH CENTER PROJECT

Aspergillus flavus infection and contamination in the field

Code No. III-1-(3). 3-1-1

A. flavus infection and contamination route on maize are not well studied in Thailand. However, in the previous work in 1989, considerable A. flavus infection and contamination on the parts of maize plant were observed. Also, A. flavus contamination in shelled maize kernel was increased as compared to before shelling. Hence, this subject was continued to reconfirm the fact that observed in last year.

Material

Maize for the investigation was planted in the test field at Phraphthabat Field Crops Experiment Station on 11th June, 1990. Samples, such as leaf, stem, tassel, silk, husk, cob and kernel, have been taken periodically after 8 weeks growing stage.

Each samples were aseptically cut into 200 pieces. A hundred pieces were directly plated on DRBC medium, 5 pieces/petri dish. The other 100 pices were surface sterilized with 2 % NaOCl, rinsed twice with steril water and plated on DRBC medium, 5 pieces/petri dish.

At the same time, air and soil sample (10 cm depth) were taken from the field. All these samples were incubated in ambient temperature (28~30 ℃) and fungi were observed after 3~5 days.

Results and discussion

Leaf : Leaf showed almost no infection during plant growth. Surface contamination varied from 1~23 %, but no clear tendency in which growing stage that A. flavus accumulated.

Stem : Stem showed almost no infection during plant growth. High population of 11~47 % was found in 60 and 53 days after planting.

Tassel : Tassel showed almost no infection during flowering, only 1 % infection was found in 74 and 102 days growing stage. Surface contamination ranges from 0~22 %. High accumulation of A. flavus was found during 53~80 days old plant.

Silk : A. flavus was always found to infect silk at every sampling time start from young green silk to yellow, brown and very old dried silk. Highest percentage of infection of 7~10 % found in brown silk during 67~88 days old plant. Very dried silk had less infection of 3% during 88~102 days growing stage. High accumulation of A. flavus was found around 70~90 days growing stage and highest percentage of contamination was 29 %.

Husk : Infection on husk was rarely found during/since 80 days plant growth of planting, but increased when maize become mature. Highest percentage of infection of 13 % was found in 102 days old plant. Highest surface contamination is 34 % and high accumulation of A. flavus was found around 80 days after planting.

Cob : Maize cob from 60 days until 119 days growing stage were sampling. There was no infection of A. flavus inside the tissue. Surface contamination was not found in young cob. The contamination was around 10~14 %starting from 88 days growing stage untill 119 days.