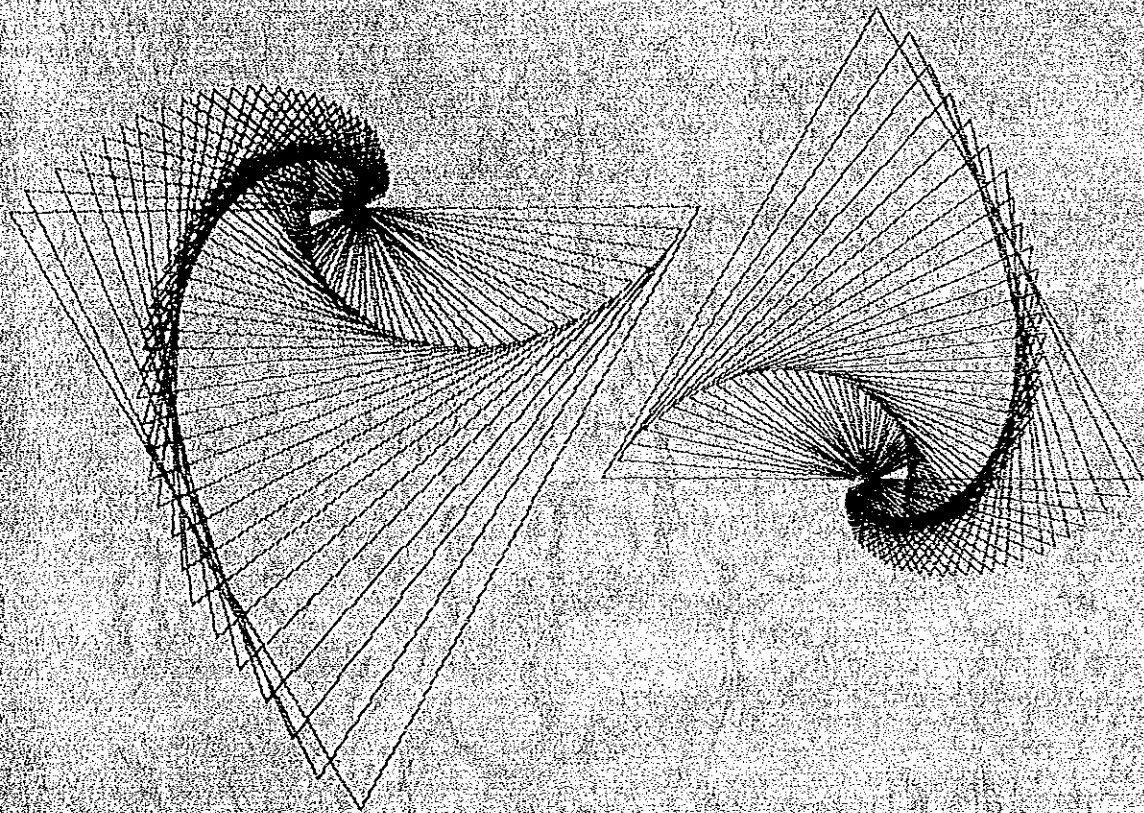


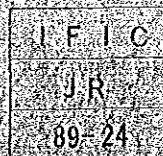
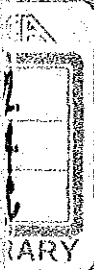
**NATIONAL WEED SCIENCE RESEARCH
INSTITUTE PROJECT**

(KINGDOM OF THAILAND)



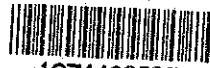
March 1989

**Institute for International Cooperation
Japan International Cooperation Agency (JICA)**



NATIONAL WEED SCIENCE RESEARCH
INSTITUTE PROJECT
(Kingdom of Thailand)

JICA LIBRARY



1074499[3]

19205

March 1989

Institute for International Cooperation
Japan International Cooperation Agency (JICA)

国際協力事業団

19205

PREFACE

The Project-type Technical Cooperation is an integrated form of cooperation whose aim is to realize technology transfer to relevant personnel of the project in the recipient country, by effectively combining such assistances as dispatch of experts, training of counterparts in Japan, and supply of equipment as required. It is intended to assure smooth and systematic implementation of technical cooperation program through planning, implementation and evaluation.

The duration of cooperation is usually about five years. When the project is actually commenced, a variety of survey teams and experts are dispatched to the recipient country, preparing work reports.

This case study of Project-type Technical Cooperation has been compiled originally in Japanese, then translated into English, based upon a number of these reports prepared at each stage of planning, implementation and evaluation of the project.

We would be pleased if it would be of some usefulness as reference material for those who are interested in our technical cooperation.

March 1989

Director
Institute for International Cooperation
Japan International Cooperation Agency (JICA)

CONTENTS

Outline of the Project	i
Map of the Project Site	iii
Outlined Schedule of the Project	v
Brief History of the Project	ix
1. REQUEST FOR THE PROJECT AND ITS INTENTIONS	1
1-1 Background and Intentions of the Request for the National Weed Science Research Institute	1
1-2 Process Taken Before the Start of the Project	3
2. STATE OF THE PROJECT IMPLEMENTATION	9
2-1 Outlines of Project Implementation in FY 1980	9
2-2 Outlines of Project Implementation in FY 1981	9
2-3 Outlines of Project Implementation in FY 1982	10
2-4 Outlines of Project Implementation in FY 1983	13
2-5 Outlines of Project Implementation in FY 1984	14
2-6 Outlines of Project Implementation in FY 1985	16
2-7 Outlines of Project Implementation in FY 1986	17
3. SUMMARIZATION AND EVALUATION	18
3-1 Cooperation Research	18
3-2 Dispatch of Experts and Their Functions	24
3-3 Granting of Machines and Instruments	25
3-4 Training of Counterpart Personnel	26
3-5 Evaluation of the Project	27
APPENDICES	
1. The Record of Discussions (R/D)	31
3. List of Main Machinery and Instruments Granted	43

Outline of the Project

The National Weed Science Research Institute Project (hereinafter referred to as the NWSRI Project) for the Kingdom of Thailand, undertaken by the Japan International Cooperation Agency (hereinafter referred to as JICA), was implemented for seven years from April 1980 to March 1987. The purpose of this project was to enhance the weed science research functions and to solve emergency weed problems in Thailand. The contents of the Project included cooperative research by dispatching experts, granting necessary machinery and equipment, and training Thai researchers.

The Project belonged to the Department of Agriculture (hereinafter referred to as DOA), Ministry of Agriculture and Cooperatives, Thailand, and the counterparts were mainly composed of the staff members of the Botany and Weed Science Division (initially, the Technical Division). The Joint Committee, which discussed the administration of the Project, met four times, and JICA dispatched ten various survey teams including a preliminary survey team. Members of the Joint Committee were directors of respective divisions of the Department of Agriculture as well as chiefs and vice chiefs of the sections in charge. The Government of Thailand participated in the administration of the Project in a positive and cooperative way.

The value of the machinery and equipment granted by JICA, including those brought by experts when visiting Thailand, amounted to approximately ¥400 million. It was highly appreciated that the Project had been provided with machinery and equipment required for basic and applied weed science research, and transferred necessary operating techniques. The points to be checked in the process of granting the machinery and equipment were 1) whether or not the provision of the accessories was appropriate, 2) whether or not the countermeasures for the incomplete and/or out-of-order machinery and equipment were quick or not, and 3) how to cope with the future maintenance and management.

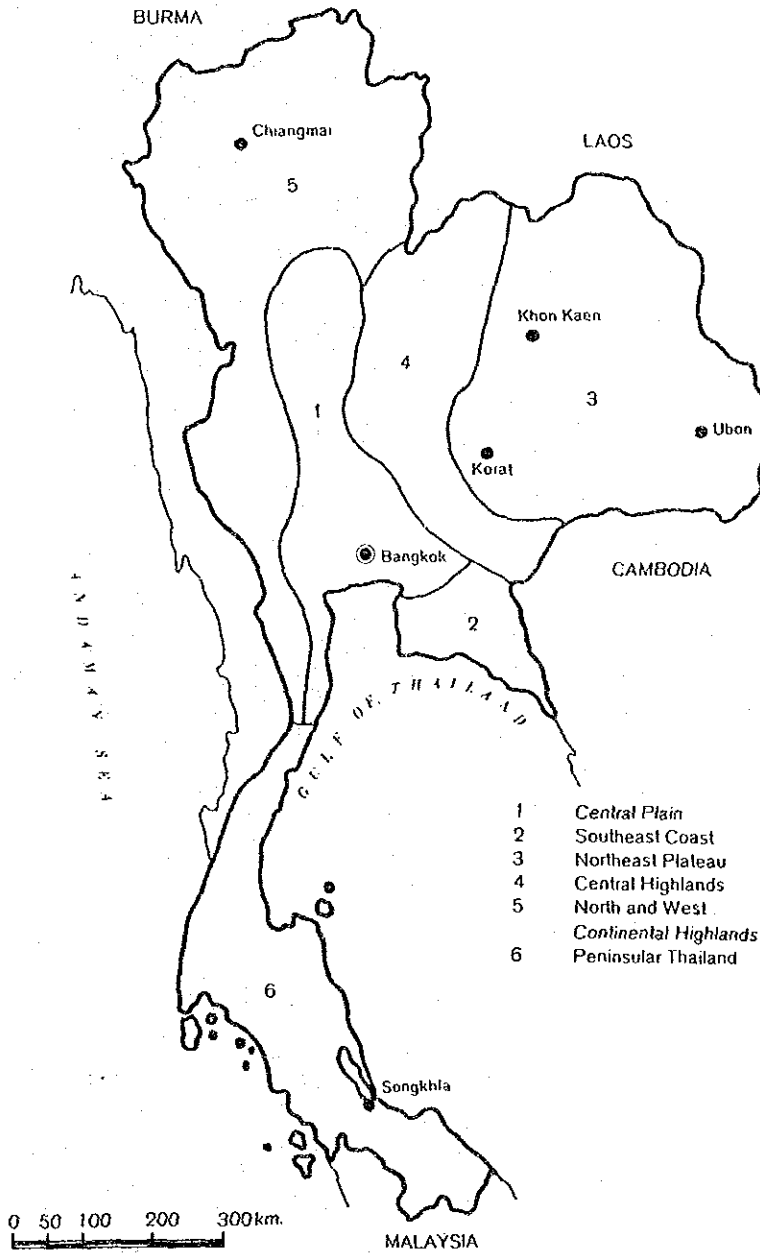
The total number of the dispatched experts was six for long terms and sixteen for short terms. In accordance with the Record of Discussions between the Japanese Implementation Survey Team and the Authorities concerned of the Government of Thailand (hereinafter referred to as R/D), the cooperative research included basic knowledge on the ecology and physiology of principal weeds for their control, weed control procedures, herbicide residues and its application, and economic evaluation of techniques. The results of the Project were published in six formal publications, five informal compilations, and 65 documents submitted to various academic circles in their respective fields.

The number of Thai counterparts who received training in Japan was seventeen, thereby the initial objective having been almost achieved. Titles which the counterparts acquired in relation to the training activities in the Project include a doctorate (Tokyo University of Agriculture) and four masters (Kasetsart University and Chulalongkorn University).

The research meetings which were held in close relation with the implementation of the Project included the Tenth Asian Pacific Weed Science Symposium (APWSS) held in 1985 at Chiangmai by the Organization Committee in which the DOA played a main role, and the Weed Seminar, which was held in 1987 under the joint auspices of the DOA and JICA. The Project was deeply involved in the APWSS. The Weed

Seminar was aimed at weed researchers and persons concerned throughout Thailand, and the lectures were given by JICA experts and researchers from the DOA.

Map of the Project Site



Outlined Schedule of the Project

Term of cooperation:
 R/D, from April 18, 1980 to April 17, 1985 F/U, from April 18, 1985 to March 31, 1987

Year	1978	1979	1980	1981	1982	1983
Dispatch of Survey Teams		Preliminary Survey Team	Implementation Survey Team	Mutual Consultation Team	Technical Guidance Team	Technical Guidance Team
Dispatch of experts	[Long-term experts]					
	Leader Weed ecology Weed control Cultivation and coordination			9		
Acceptance of trainees	[Short-term experts]		12			
			10			
			1 _____ 2 (Long-term survey researcher)	2 _____ 4 (Herbicide)	3 _____ 5 (Weed ecophysiology) 4 _____ 6 (Herbicide residues) (Weed physiology) 6 _____ 8 12 _____ 3 (Weed physiology) 11 _____ 1 (Perennial plant ecology) 3 _____ 5 (Herbicide biochemistry) 8 _____ (Crop protection) 8 _____ (Plant physiology) 4 _____ 5 (Installation of machinery)	
				3 _____ 6 Herbicide analysis	11 _____ 2 Herbicide residue analysis	Weed ecology 5 3 _____ 5 Herbicide toxicity 3 _____ inspection analysis
					Weed research procedures	

Note: Expenses and numbers of personnel are based on fiscal years, while activities shown with bold lines are based on calendar years.

Year		1984	1985	1986	1987	Total			
Dispatch of Survey Teams		Technical Guidance Team	Evaluation Team	Technical Guidance Team	Technical Guidance Team				
Dispatch of experts	[Long-term experts]								
	Leader		Leader and weed ecology		3				
	Weed ecology		5						
	Weed control	3	5		3				
	Cultivation and coordination				3				
	[Short-term experts]	5	8 (Herbicide residues)	10 (Weed ecology)	8	10 (Weed ecology)	3		
			2	3 (Agricultural economic evaluation)	4	6 (Herbicide residues)			
		8 (Weed physiology)		11	12 (Crop physiology)	10 (Maintenance of scanning electron microscope)			
		9 (Weed ecophysiology)				10	11 (Plant physiology)		
		10	12 (Agricultural machinery)			11	1 (Herbicide properties)		
						12	1 (Weed ecophysiology)		
Acceptance of trainees		4	8 Weed ecology (Master's degree acquired)	5	7 Weed ecology (Master's degree acquired)	7	Inspection		
		4	Weed control	11	5	Weed ecology	11	10	
		7	Weed ecology	1			Weed physiology	8	
			11	Herbicide analysis	10		3	Weed control	9
		6	Inspection						

Brief History of the Project

1977	Department of Agriculture, Ministry of Agriculture and Cooperatives, the Thai Government requested cooperation for NWSRI Project and the the Japanese Government started reviewing a project draft.
September 1977	The Thai Government made an official request for the preliminary survey of the NWSRI Project.
February 1979	Preliminary Survey Team was dispatched.
January 1980	A long-term researcher was dispatched.
April 1980	Implementation Survey Team was dispatched (and signed the R/D).
April 17, 1980	Project-type technical cooperation was started.
September 1980	The first leader (Dr. Noda) of expert team was dispatched.
March 1981	Technical Guidance Team for FY 1980 was dispatched.
May 19, 1981	First Joint Committee meeting was held.
March 1982	Technical Guidance Team for FY 1981 was dispatched.
March 17, 1982	Second Joint Committee meeting was held.
August 1982	The Thai side completed a two-storied laboratory building.
January 1983	The organization of the Department of Agriculture was changed—the Weed Branch moved from the Technical Division to the Botany and Weed Science Division, which consisted of two branches; Weed Science and Weed Control. These two branches were unified again in 1983.
April 1983	Technical Guidance Team for FY 1982 was dispatched.
April 12, 1983	Third Joint Committee meeting was held.
April 1984	Technical Guidance Team for FY 1983 was dispatched.
April 27, 1984	Fourth Joint Committee meeting was held.
November 1984	Evaluation Team was dispatched.
November 22 1984	Fifth Joint Committee meeting was held.
October 12, 1985	Miss Maneesa, a counterpart, acquired her doctorate at the Tokyo University of Agriculture awarded for her successful research results in the Project. A ceremony to present the doctoral certificate was held at the Japanese Embassy in Bangkok (Mr. Sugi, Head of the IFIC visited Thailand).
November 1985	Tenth APWSS International Congress was held under the auspices of the Chiangmai Department of Agriculture. The Project gave full support.
November 1985	Technical Guidance Team was dispatched.
November to December 1986	Surveys for training were effected in neighboring countries including Malaysia, Singapore, and Burma (by Japanese experts and Thai counterparts).

January 1987	Weed Seminar was held by the Department of Agriculture and JICA (at the DOA).
March 27, 1987	Farewell party for the Project was held (attended by about 300 persons).
March 31, 1987	The Project was completed.
April 1, 1987	All the experts returned to Japan.

1. REQUEST FOR THE PROJECT AND ITS INTENTION

1-1 Background and Intention of the Request for the National Weed Science Research Institute

Thailand has obtained varied degrees of success in increasing its GNP and the development/growth of its manufacturing, mining and ores, agriculture, and fisheries industries thanks to successful execution of the first, second, and third 5-year national development plans which started in 1961. The third 5-year plan (from 1971 to 1976) especially produced great socioeconomic benefits. Although the growth rate of agriculture remained low, when compared with those of other industries, productive capacity was reinforced thanks to the expansion of arable land while farmers' income increased as prices of agricultural products rose. When reviewing yields of agricultural products per Thai unit (1 ha = 6.25 Thai unit), many crops displayed a decrease while a few increased. There still remained disparity in wealth, differences in income between farmers and non-farmers, and uneven productivities among districts. The fourth 5-year plan predicted that farmers' income would increase by 6%. To attain this goal, the most practical approach was an increase in yield per Thai unit, because it was presumed that expansion of arable land was nearing its limit. It was important, therefore, to introduce techniques that would assure higher productivity. Irrigation facilities that formed a foundation for this had been gradually improved. As high-yield species and new cultivating and fertilizing techniques were introduced, serious damages caused by disease, insects, harmful animals, and weeds, were reported. It was also expected that techniques to control them would be developed. Since the size of agricultural population was decreasing, and since there were some cases in which labor intensification in agriculture was impossible, it was intensification then thought that more efficient, labor-saving techniques should be established for controlling weeds in the fields.

Weed problems in the tropical zone include those of environmental contamination, caused by aquatic weeds which prevent effective utilization of water in agricultural fields, and by naturalized and perennial weeds that grow vigorously in non-agricultural lands. Presently, their efficient control techniques are urgently required.

Research systems and facilities in Thailand, however, had been less attentive to weed science and, with this background, this project was required in an effort to see to it that such systems and facilities should be developed through the cooperation.

In the meanwhile, let's review the field of weed science, which may seem to be a narrow one, from a world-wide viewpoint.

What is weed science research? Many people in Japan too hold the misunderstanding that weed science research is research on herbicide. First of all, proper positioning and the necessity of weed science research should be promoted. Although it has been said throughout history in Japan that "agriculture looks like a fight with weeds," trends towards less personnel and smaller budgets have been invested in this research than in research activities for crop pathology and harmful insects, both of which are also concerned with protecting crops. Long ago Cramer (1967) reported that loss of crops due to weeds is no less than that caused by diseases and insects. In

response to the question "Why do people not take a serious view of weed damage?" many researchers have indicated that the symptoms are chronic and are not recognized as substantial. As herbicides were developed and labor required for weeding was reduced in the early fifties in Japan, rationalized weeding methods were requested and, to meet the request, knowledge was pursued for realizing techniques to ensure maximum benefits with minimum investment, based on the biological characteristics of weeds. It has now been recognized that weed science is required for controlling (as well as utilizing) weeds, just as botanical pathology is used for controlling diseases and applied entomology for controlling insects.

Research functions in the weed division of the Thai Government's Department of Agriculture, were remarkably delayed when compared with those in the divisions of diseases and insects. This was illustrated by the fact that the number of researchers stationed at the time of the commencement of the Project had been 15 for the weed division, compared with 200 each for the latter two divisions.

In the meanwhile, what are the weed problems that require urgent dissolution in Thailand? There are actually many problems. Thanks to the 5-year plans which were started in 1961 (especially as a result of the third 5-year plan which started in 1971), Thailand recorded great growth in GNP and GDP, while a certain degree of growth was realized in the agricultural production. However, this growth was attributable mainly to an expansion in agricultural areas based on the changing of forest lands into arable lands. Since such an expansion policy was then nearing its limit, it was felt that the "Yield per unit area should be increased" by introducing new techniques. Rationalization of weed controlling techniques was desired as part of this. For example, one area of direct-seeded rice fields in Thailand exceeded 1,000 thousand ha. It seemed, therefore, that if Gramineae weeds such as *Setaria geniculata*, *Echinochloa colonum*, and *Leptochloa chinensis*, which interfere with rices at its initial stage of growth, could be controlled in a rationalized manner, this would be key to successful crop yield growth.

The tropical environment is one in which the atmospheric temperature is high enough to allow specific weeds to grow and flourish so thickly that a state similar to environment contamination has been generated. Extremely harmful plants (against which urgent controlling measures were then required) are represented by, for example, *Mimosa pigra* which is a bush freely flourishing in rivers, channels, low lands, and marshland mainly in North Thailand, *Eichhornia crassipes*, which spread over streams and irrigation reservoirs throughout the country, and *Pennisetum* spp. which flourishes on both arable and non-arable lands almost throughout the whole country.

As industries other than agriculture developed in Thailand, on the other hand, the agricultural population flowing into them accelerated, so that labor concentration in agriculture became almost impossible. In the case of the operation of vast field areas, plantation crops, and crops such as vegetables requiring delicate technique, adoption of more labor-efficient weeding systems was inevitable, and more interest was taken in herbicides. At the same time, techniques to apply them safely were also requested.

The foregoing has detailed the background and the reasons for Thailand's submission of a request for this NWSRI Project. It was confirmed that no requests

had been made to other countries or to other organizations.

1-2 Process Taken Before the Start of the Project

1-2-1 Dispatch of preliminary survey team

Based on the background described in Section 1-1 above, the Thai Government requested that Japan dispatch a preliminary survey team to review the necessity of the project in FY 1978.

As a result, it was decided in December 1978 to dispatch a team, but due to the adjustment of schedules among survey team members, the actual dispatch of the Preliminary Survey Team, composed of Dr. Kenji Noda, Leader and four other members, was effected from February 26 to March 10, 1979.

The Preliminary Survey Team confirmed the contents and background of the NWSRI Project which were described in the request by the Thai side and surveyed the natural, social, and agricultural conditions as well as the positioning of the Project in the DOA and the relationships with departments and divisions concerned as well as with agricultural laboratories and universities in the vicinity. Based on the results of the confirmation and the survey, the Team clarified the functions of the Project on agricultural production and environmental improvement, and then submitted the following recommendation to the Governments of both countries after discussions with the persons concerned at DTEC, MOAC, and DOA.

1. It was confirmed that weed science research was vital to and a top priority of Thailand.
2. Facilities and personnel for weed science research were not sufficiently provided by Thailand as of yet, and it was appropriate that they should be developed step by step.
3. DOA should use its best efforts to obtain ordinary research expenses, personnel, and facility improvement expenses in the national budgets from 1980 and on.
4. Small-scaled grant aid cooperation should be taken into consideration step by step. It was too early for the cooperation to be carried out at present.

1-2-2 Dispatch of a long-term researcher

Based on the report of the Preliminary Survey Team, the Thai Government requested that the Japanese Government dispatch a long-term researcher in specific fields. As a result, Dr. Kenji Noda was dispatched as a long-term expert from January 16 to February 29, 1980. The objectives of the survey included 1) weed science research functions in the DOA, 2) weed science research programs on the Thai side, 3) conventional abilities of weed science researchers, 4) weed problems which should be urgently solved, 5) reconfirmation of the background of the weed project, 6) living environment for Japanese experts to be dispatched, and 7) any problems to be foreseen in implementing the Project. Dr. Noda surveyed the above-mentioned items in Bangkok, and submitted the following recommendation, including the five points listed below to both Governments. This recommendation was prepared with the approval of Mr. Kangwan Devahastin, Deputy Minister of Agriculture Cooperatives, Dr. Prakob, Director-General of DOA, and Dr. Winit, Director-General of Technical Division.

RECOMMENDATION AND IMPRESSION by Dr. NODA

What was stated above is the outline of my survey from exchange of views and discussions with the authorities and staff concerned during my limited number of days. In general, it seems to be customary to describe so-called "Recommendation" at the end of such a report based on the result of personal experiences and observations. In my way of thinking, those who are not familiar with the history and backgrounds in Thailand are not qualified to describe "Recommendation" and of course, I would not interfere the internal problems of administration system of Thai-side. The following are, therefore, to be read as the expression of personal impressions. Please recognize, however, it emerged from my sincere desire forwarding to fruitful success of NWSRI project in Thailand through effective cooperation works with Japanese experts.

- 1) My visit to NWSRI at Bangkok were three times, 1977, 1979 and this time. Only a few number of staff members met and talk with me everytime, though a considerable number of research staff have been allocated in this project. I wonder how come they are? Personally considering from information and views of as many as personnel inside and outside NWSRI, there may be exist an unfavorable management situation and/or system where all staff dislikes to get together and to do research works cooperatively in NWSRI building. That is to say, over-powered management or mismanagement system of a few personnel exists and democratic system based on the ideas of as many as research staff has been lacking so far. The above situation and/or system should be improved as soon as possible in order to get the achievement of this project.
- 2) I know a small grant aid for construction of building complex has been requested from Thai Government to Japanese Government already. However, since the cooperative works with Japanese experts and the grant aid are in charge of different section in the Ministry of Foreign Affairs in Japan, it is not officially recognized and not considered within JICA. The detail has been just shown me this time and I can not deny personally its necessity according to advancement of NWSRI project in the future. I wonder, however, whether or not such a considerably great grant aid is necessary to weed research alone at present, or whether or not the detail of it has been recognized and understood by other directorate personnel concerned NWSRI project? At first, Executive Committee of such a grant aid must be organized and should discuss it for a long time. After recognition of the Committee, the grant aid should be officially requested with correct and detailed document to Japanese Government.
- 3) Starting this project, Joint-Committee which is composed of as many as Director or representative personnel of divisions concerned to this project must be organized. Overpowered administrative system composing of a few member is likely to sometimes give demerits and it tends to expand regardless of the real needs and starts to walk by itself without taking the ideas of researching staff. Such situation may prevent the advancement of research works and development of this project.

- 4) I knew rough architecture of the second floor of the two-story experimental building has been lay out already, though being flexible. There seems to be no design for special experiment and/or purposes such as photo-techniques, scanning micro-scope herbicide analysis, computer operation, herbicide storage and so on. These should be designed, taking the ideas of researching staff.
- 5) Further, a net and glass house present is too narrow to perform basic researches by current research staff enlargement of this house appears to be greatly desirable at first.

1-2-3 Dispatch of Implementation Survey Team

Based on the survey report of the long-term researcher, the Implementation Survey Team, headed by Dr. Kenji Noda was dispatched from April 9 to 23, 1980. The Team held discussions on a draft of the Record of Discussions (R/D) which was prepared by the Japanese side. It also surveyed the whole of the project, namely, themes of research cooperation, machinery, equipment, and furniture to be granted, the scope of experts to be dispatched by Japan, the period of research cooperation, and both quantitative and qualitative phases of the Thai support system.

Programs of the Project

a) Cooperative research

The Project targeted basic and applied research on weeds for the purpose of increasing the productive capacity of crops and improving environmental contamination which had been caused by the invasion of strongly harmful weeds. The Implementation Survey Team proposed a draft on concrete research themes, the research period, and its significance, and discussed these items with the NWSRI staff as well. The draft was as shown in Tables 1 and 2 below. Item 1 covered basic research themes for which long-term cooperation was requested. Item 2, which was based on Item 1, included research of applied techniques which must be carried out concurrently with Item 1. It was necessary to repeat this type of research, at least, for two or three years. Item 3 was concerned with techniques involving herbicides whose consumption was expected to increase in the future. It covered everything from biochemical and analytical chemical bases to practical fields like screening techniques.

Item 4 suggested possibilities for treating those themes which might occur as the cooperative research advanced and themes for specific objectives.

b) Machinery, equipment, and furnishings to be granted

By referring to the survey results regarding machinery, equipment, and furniture which NWSRI possessed at that time, and as to the present state of other divisions and sections of the DOA, the Team repeated discussions with the NWSRI staff and gave them advice on the items which Japan was to grant. It seemed, when reviewing the present state of NWSRI, that basic machinery, equipment, and furniture for conducting weed science research was insufficiently provided and that this should be improved and updated in the first year of the Project. The items needed included ordinary measuring instruments, glass tools, reagents, and implements to be used for field tests.

Instruments for gas chromatography and for analyzing herbicides, electron microscopes, and other environment control units for experimental weed ecology and physiology should be granted in the second year or later by taking the available space in experiment rooms into consideration. The Team drew up a provisional list of principal machinery and equipment at the time of the survey, and fully explained to the Thai side that the contents of the list might be changed in accordance with the practical fields of cooperation by Japanese long-term experts.

c) Experts to be dispatched by Japan

Cooperative research, which the long-term experts to be dispatched by Japan would carry out in cooperation with Thai researchers, formed the main part of the Project. The types of experts were to be a leader/expert, and experts in weed biology, weed control, and herbicide. Since the number of experts in herbicide (who should be good at research procedures for herbicide residues, as well) was extremely small in Japan, it seemed that temporary experts would have to be dispatched repeatedly for short terms.

In addition to long-term experts, short-term experts were to be dispatched, as required, for specific objectives or for the purpose of complementing the research of long-term experts. The types of short-term experts who were expected at that time include:

- 1) Expert in weed taxonomy : to engage in the classification and identification of weed species which have not been identified and in research of their distribution.
- 2) Expert in economic evaluation : to engage in economic evaluation of the introduction to farmers of new weed-controlling techniques, including other techniques to assure higher yields in the production of crops as well as furnishing basic data for extension of the techniques.
- 3) Expert in ecophysiology of weed roots : knowledge on ecological distribution and physiology of weed roots is extremely important for understanding weed-controlling methods. The expert will, therefore, engage in research and guidance mainly on survey procedures.
- 4) Expert in biological control : to engage in survey and research as to the possibilities for biological control of weeds.
- 5) Expert in agricultural machinery : to engage in development of mechanical weeders appropriate to the farmers and the social conditions in Thailand, and in survey and research of ideal techniques.
- 6) Expert in statistics : to engage in guidance and research of statistical processing techniques and designing of tests in weed science research.

d) Training of Thai researchers

Very few of the Thai researchers who belonged to NWSRI had full experience with or knowledge of weed science research. Training them in Japan was one of the main objectives of the Project. Some of them were to be trained in Japan in accordance with their capability, desire, and interest, if recommended by the Thai Government.

The training period was to differ from three to ten months, depending upon training objectives and personal preference. Research fields to be offered included weed biology, weed control for rice crops, weed control for field crops, and herbicide. The trainees were to be accepted by research laboratories specialized in these fields. Training in other fields was to be carried out, as required, in accordance with the development of the Project.

Many of the NWSRI staff preferred acquisition of titles of B.S. or Ph.D. To attain this goal in the JICA training course, it was to be required that they have a background of and results in scientific research activities over a long period, and that they had reached a level at which their research would be completed by means of small amount of complementary experiments and research in the course.

The statement above outlines the survey of the Implementation Survey Team and the contents of and problems found in the discussions made at the time of the signing of the R/D. It was expected that the Project would have important impact upon our two countries within the framework of the R/D which was signed by Dr. Prakob Kanjanasoon, Department of Agriculture, Ministry of Agriculture and Cooperatives, Thailand, and by Dr. Kenji Noda, Leader of the Implementation Survey Team in the presence of Mr. Apilas Osatananda, Director General of DTEC at Bangkok on April 18, 1980.

Table 1 MASTER PLAN OF JAPANESE EXPERT DISPATCH FOR FIVE YEARS (Draft)

	Fiscal year (Japan)				
	1980	1981	1982	1983	1984
Leader	_____				
Weed biology	_____				
Weed control	_____				
Coordinator	_____				
Herbicide	_____				
or	_____	_____	_____	_____	_____
Taxonomy		_____		_____	
Economic evaluation			_____	_____	_____
Others			(flexible, 3 ~ 6 months a year)		

Table 2 THE DETAILED MASTER PLAN OF COOPERATIVE WORKS
(Draft by Team)

Item	Year				
	1st	2nd	3rd	4th	5th
1. Ecology and physiology of weeds					
1) Identification and distribution of principal weeds	A	B	B	B	B
2) Yield loss in					
direct-seeded rice	A	C	C		
field crops			A	C	C
transplanted rice			A	C	C
3) Biological characteristics of					
Gramineae weeds	A	C	C		
broad leaved weeds	A	C	C		
aquatic weeds			A	C	C
non-agricultural weeds			A	C	C
2. Weed control/management procedures in					
direct-seeded rice	A	C	C		
field crops			A	C	C
transplanted rice			A	C	C
3. Herbicide					
Herbicide residue	A		C	C	C
Herbicide physiology	A	C	C	C	
Herbicide evaluation	A	B	B	B	B
4. Others	(Be taken according to the necessity to be arisen)				

Note: A, B, and C mean preliminary, long-term, and short-term studies, respectively.

2. STATE OF THE PROJECT IMPLEMENTATION

2-1 Outlines of Project Implementation in FY 1980

The leader was dispatched in the middle of the first project year, the other two experts arrived at their posts towards the end of the year, and the machinery and equipment did not arrive at the site within that first year. The initial year of the Project ended mainly by re-confirming the Master Plan which had been agreed upon in the R/D. Main items which were effected in the first year included 1) distribution survey of weeds in Bangkok and the Central Plain in its vicinity, 2) making up a utilization plan of experiment blocks which had been constructed under the Thai budget, 3) increasing of the capacity of the water supply tower and improvement of water supply/discharge facilities by allocating an emergency budget, 4) construction of a glass net room with an area of 200 m² for growing weeds by procuring materials from local markets, since there were only one glass net room at the time when the Project started and it were too narrow for experts and counterparts to conduct full-fledged experiments, 5) preliminary survey for research of herbicides and recommendations to the DOA by Dr. Yukimoto, a short-term expert who visited Thailand in the first year of the Project, and 6) machinery and equipment equivalent to a half-year portion of the machinery and equipment budget arrived in and after August 1981 (namely, in the next project year) and this was applied to biological experiments on weeds such as germination tests. A jeep which was granted as one of the pre-project facilities was used exclusively for weed survey and for experts attending the laboratory. In FY 1980, the person in charge of administration and operation of the Project was Director of the DOA, but Dr. Paitoon Kittipong, a previous researcher, took practical charge of it. Fourteen fresh researchers who had just graduated from university participated in the Project. These researchers were responsible for their engaging in cooperative research with JICA experts and for completing experimental research on themes which had been allotted to each of them as researchers of the Weed Science Division in the Department of Agriculture.

2-2 Outlines of Project Implementation in FY 1981

In the second project year, three long-term experts were dispatched as planned, and machinery and equipment, which were to have been delivered in the first project year were delivered and installed. The Project began, for practical purposes, with operations in accordance with the R/D, guidance for the counterparts, and cooperative research of emergency problems in Thailand.

The Thai side assigned fourteen counterparts for the Project, and the operation of the Project was started in the single-story experiment block which had been constructed using the Thai budget. In accordance with the Master Plan, they engaged in the survey of major weeds in the vicinity of Bangkok and in the identification of their biological characteristics. Regarding autecology of individual species, there was an emergent problem involving a kind of a small bush, *Mimosa pigra*, which was undergoing a widespread growth in distribution in streams mainly in North Thailand.

It was entering a part of a canal and other streams near Bangkok. Priority was given to efforts to research this plant's ecological characteristics and the possibilities of controlling it using herbicides. At the same time, biological basic research was vigorously started on the distribution and control of wild rice which had recently provoked a problem in the direct-seeded rice zone of Thailand.

Regarding a two-storied experiment building which was to be constructed with the Thai budget, the external frame of half of the second floor was completed by the budget allocated for the first half of FY 1981.

In addition to the long-term experts, two short-term experts, Mr. Kozo Ishizuka (Tsukuba University) and Ms. Ayako Ito (Kyoto University) were dispatched for a term of two or three months. They carried out preliminary research on the analysis of herbicides and complementary research on the distribution of weeds in fields, respectively.

In FY 1981, large machinery and instruments such as the scanning electron microscope, gas chromatographs, and a photosynthesis unit were granted and they arrived at the site. To help establish the techniques needed to operate these units, three short-term experts, Mr. Makoto Koizumi (gas chromatography), Mr. Taku Nakamura (Ministry of Agriculture, Forestry, and Fisheries), and Mr. Fumitake Kubota (Saga University) were dispatched.

Each room in the second-story laboratory building had the same interior furniture. These facilities were rather inconvenient for installing various types of machines and instruments and were not appropriate for the execution of intended experiments. Rebuilding of the interior facilities was done in the rooms where the scanning electron microscope and the gas chromatograph were to be installed, by allocating an emergency budget. This was approved and completed in the following fiscal year.

The number of counterparts trained in Japan was three in this year.

Thai counterparts were greatly concerned with the possibility of acquiring academic titles. Prof. Baba and Prof. Nakagawa of Tokyo University of Agriculture visited Thailand to effect the necessary surveys concerning such possibilities by interviewing those counterparts who had already acquired the title of M.S. The professors made encouraging suggestions to the prospectives.

2-3 Outlines of Project Implementation in FY 1982

The Project entered its third year, and several programs were decided upon and executed. The Project was implemented, in principle, under the supervision of the Japanese Ministry of Agriculture, Forestry, and Fisheries. Since weed science research units had not been fully set up in the research laboratories belonging to the Ministry, however, it had been agreed at the meeting of the Ministries concerned that experts should be selected from universities and other organizations, as required. Since the Ministry of Education restricted the dispatch terms of its experts to short ones, those experts who were selected from Kyoto University, Tsukuba University, Utsunomiya University, and so on were dispatched as short-term experts.

The main two-story building which was constructed using the Thai budget was completed at the end of 1982, and the laboratory rooms for the experts and the counterparts were moved to that building. Vehicles, as incorporated in the machinery and equipment to be granted by the Japanese Government, were granted as planned, thus providing the tool with which weed distribution surveys could cover the whole Thai territory stretching from the northeastern region to the northern region of the country.

Ecological research of weeds of *Mimosa pigra* and wild rice, especially, made further progress. Themes for counterparts to apply for academic titles with were reviewed so that *Euphorbia geniculata*, which is one of field weeds, might be studied instead of *Striga agiatica*, which was initially to be adopted as a theme weed, because research of the former species could be completed in a shorter period as a result of field survey and inspection of documents. The former species is called *Euphorbia rophylla* in the U.S.A.

Selective tests of weed-controlling techniques and of herbicides had been carried out by that time by Thai researchers in their own field of expertise. To compile their research results in a document titled "Suggested guide for weed control in Thailand," which was expected to act as a medium for transferring techniques to the extension departments, it was agreed that each counterpart should prepare a report on the respective research results by the end of FY 1983.

Since toxicity of paraquat had then been discussed, the short-term experts, Mr. Yamada and Mr. Shigekawa, engaged in research on the toxicity of herbicides in cooperation with counterparts. They clarified a reference method for analyzing amounts contained in water. Research on biological control using phatogen was not effected in the Project, since Kasetsart University had effected a similar kind of research. The University engaged positively in identification of insects using *Mimosa*, water hyacinth, and other plants.

When a certain percentage of large-sized machines and instruments was granted to the Thai side, Thai managers preferred technical transfers in which it was limited to key persons rather than those in which techniques would be transferred to all of the counterparts. The combinations of instruments and counterparts are shown in Table 3 below:

Table 3 Key persons to whom operating techniques were transferred for principal machines and instruments granted

Name of instruments	Name of counterparts (DOA)
Warburg manometric apparatus	Miss Patcharin Miss Orasa Miss Siriporn
Microtech microscopic photographer	Mrs. Champen Mrs. Kanika
Scanning electron microscope	Mrs. Champen Mrs. Sermsiri
Photosynthesis unit and etc.	Mrs. Cha-um, Miss Siriporn
ATP photometer	Mrs. Cha-um, Miss Siriporn
Spectrophotometer IC	Mrs. Cha-um
Root/ecology survey units	Mr. Tawee Mr. Somchart
Gas chromatograph	Dr. Drateep Mrs. Chanya
Slide processor	All counterparts
Computer	Mr. Chaiyot, Miss Siriporn

The Technical Division had already been changed into the Botany and Weed Science Division, with its two subdivisions - the Weed Science and Weed Control Branches. Both branches were later re-unified into a single section of Weed Science for managerial convenience (in 1983, and it was headed by Dr. Paitoon).

As the research made progress and the instruments were efficiently employed, a considerable amount of research and experimental data was accumulated. It seemed, however, that completion of the intended technical transfer would take a long time because it was to include the planning of research programs, proceeding with experiments, compilation of data, devising of better techniques, cooperation with extension activities, and designing of future orientations.

2-4 Outlines of Project Implementation in FY 1983

As the Project entered its fourth year, it required slight modifications. Basic and applied research on *Mimosa pigra* and the cooperative research on the distribution and control of wild rice (both of which had been treated as important themes since the beginning of the Project) had been almost completed, as far as their main parts were concerned. The programs for the research were compelled to be modified, however, due to changes in the participating experts.

Mr. Kojima, a newly arrived expert, started research on the biological characteristics of perennial weeds, mainly, *Eleocharis*. On the other hand, Mr. Teruhiko Nibe, a newly arrived coordinator and long-term expert, started research on weed-controlling techniques mainly in corn-cultivating zones, insisting that evaluation of these techniques was important when transferring them to the extension departments.

Basic research made progress for controlling *Pennisetum* spp. which had been regarded as a weed causing environmental contamination. Since *Eichhornia crassipes* (water hyacinth) flourished excessively in the city of Bangkok as a result of floods, positive research was required on this species, especially, as to relationship between its flourishing and the floods. Research on water hyacinth was started in cooperation with the Weed Science Research Room of the Irrigation Dept.

As the number of glass rooms was small, a herbicide spray room with an area of 200 m² was constructed by procuring materials locally. This room was provided with dryer, warehouse, preparation, and fish breeding rooms.

The original designs of the main building were slightly modified and the reconstruction work on the interiors was carried out using an emergency budget for the rooms for the scanning electron microscope and the gas chromatograph. The former room was provided with a dark room and a preparation room, while the latter room was provided with a chemical preparation room and was prepared for the installation of two additional gas chromatographs.

It had been agreed during the discussions made at the Joint Committee meeting in the previous fiscal year that a radioisotope research facility would be installed as part of the organization of the DOA. Related machines and instruments were installed in the radioisotope laboratory of the Chemical Division. This was based on the concept that experiments on the behaviors of herbicides using radioisotopes would be indispensable for research on the operability of the herbicides. It was suggested, therefore, that a counterpart be sent to Japan for one-year training in the next fiscal year.

2-5 Outlines of Project Implementation in FY 1984

(1) Objectives of dispatch of Evaluation Team

In accordance with the R/D signed by Japan and Thailand, JICA had implemented technical cooperation for the five years from April 18, 1980 for basic and applied research on controlling and managing weeds in order to solve the weed problems then prevailing in Thailand.

FY 1984 was the final year of the Project, and JICA dispatched Evaluation Team, headed by Mr. Akira Kakimoto, Deputy Director, National Agricultural Experiment Station, Tohoku District, Ministry of Agriculture, Forestry, and Fisheries, from November 13 to 27, 1984. The objectives of the Evaluation Team included evaluation of results of research cooperation as a whole for the five years, discussion with the Thai side on a policy to handle the Project after expiration of the cooperation period, and recommendation to authorities concerned of both Governments based on its evaluation and the survey.

(2) Themes of cooperative research

The Evaluation Team summarized the results of the joint evaluation which was effected by both countries in November 1984, as follows:

Since the tests and research had been carried out in accordance with the annual programs based on the Master Plan in the R/D, an overall evaluation was effected regarding results and progress on respective themes. Prior to the joint evaluation, the Team made a preliminary evaluation by interviewing the dispatched experts and by preparing a survey list by theme, for the purpose of better understanding the contents of the guidance and instruction given by them, their progress on research themes, and the problematic points, if any.

The test and research themes were composed of six major themes, seven medium ones, and eighteen minor ones (research items). They were classified under the following six categories for implementation purposes: 1) Distribution and identification of weeds, 2) Ecology and physiology of weeds, 3) Weed control, 4) Weeds in non-agricultural land, 5) Herbicides, and 6) Others. Actual progress in and evaluation results of the respective themes were outlined as below:

1) Distribution and identification surveys of weeds

Distribution surveys were carried out in accordance with annual programs by dividing the Thai territory into the four districts: central, north, northeast, and south ones. The results of the surveys were more successful than had been expected, and it might be said that the intended technical transfer had been completed. The survey results were summarized in a pictorial book titled "Major Weeds in Thailand," 1984, using color photographs. Although there still remained some types of weed species, yet to be identified, their identification and incorporation in distribution maps would be realized by Thai counterparts under appropriate suggestion by Japanese experts. It would be necessary to request foreign experts, say, in England for identification of such weeds.

2) Ecology and physiology of weeds

This theme contained the four medium themes of Gramineae weeds, broad-leaved weeds, aquatic weeds, and Cyperaceae weeds. 1) Research mainly composed of autecological studies was conducted on three species, including, wild rice, *Echinochloa*, and *Pennisetum* spp. of the Gramineae weeds. Regarding wild rice, its distribution, germination, dormancy, and growing characteristics were clarified. Regarding *Pennisetum*, however, a full-fledged ecological survey had only been started. Since it was regarded as one of large-sized harmful weeds spreading over the whole of Thailand in recent years, continuation of technical transfer was supposed to be a necessary theme. 2) Among broad-leaved weeds, research was effected on *Euphorbia* spp. and *Sphenochlea zeylanica*. Though less knowledge was acquired regarding the latter, both physiological and ecological phases of the former were fairly well-known. New findings were confirmed as to assimilation, respiration, and transpiration characteristics, reaction for length of daytime, root system distribution, and water-absorbing properties, and the goal of the technical transfer was nearly complete. If research were to be continued for both species while clarifying the problems which must be solved, it would be expected that better results could be obtained. Since these species were covered by the research themes of a counterpart who was one of the candidates for an academic degree, attention was being paid to the results of the research. 3) *Eichhornia crassipes* was adopted as a research subject from among the aquatic weeds. Research of this species was treated as urgent, since many fishes were killed as a result of the excessive flourishing of this species in streams in the latter half of the project period. The research had, however, just reached the stage in which only an outlined survey of distribution was completed due to a delay in starting. This species was one of the most significant weeds in Thailand, often preventing vessels from passing and obstructing maintenance of canals and streams. Methods to control it were a matter of great concern in this country. Since it has a strong productive capacity, methods to utilize it as a biomass resource must be reviewed. 4) Among Cyperaceae weeds, the research was aimed at *Eleocharis dulcis* which caused troubles as a perennial weed in paddy fields. Since nothing was clarified beyond some parts of its distribution and life history, the research must be continued for this species.

3) Weed control

Regarding weed control in paddy and upland fields, research activities were being effected aiming at preparation of a weed-controlling manual for cultivation of direct-seeded rice, transplanted rice, and field crops.

4) Ecological research and control of weeds in non-agricultural lands

Research of *Mimosa pigra* was almost completed and research was turning towards the many kinds of aquatic weeds and clarification of toxicity against fishes. Research of allelopathy was also started.

5) Research of herbicides

Research of screening, action, and residues was effected regarding herbicides, and the complete results of screening were shown in the suggested guide.

Although research on the action of herbicides had not made full progress by the time of the evaluation, it was expected that it would be continued by employing such facilities as the gas chromatographs and radioisotopes.

(3) Follow-up cooperation for the Project

The Evaluation Team, headed by Mr. Akira Kakimoto, Deputy Director, National Agricultural Experiment Station, Tohoku District, Ministry of Agriculture, Forestry, and Fisheries, was dispatched in November 1984. The Team made an overall evaluation of the results of the research cooperation in the Project for the five years and discussed a policy with Thai persons in charge of the Project on how to continue it after the expiration of the cooperation period. As a result, the Japan/Thailand Joint Evaluation Team made the below-mentioned recommendation:

"The Project is to be terminated on April 17, 1985. Judging from the objectives and backgrounds described in the Master Plan of the R/D, it is necessary to continue cooperation for the research activities listed in the following table so that several research themes which are still under progress may be completed.

The Joint Evaluation Team recommended that both the Japanese Government and the Government of the Kingdom of Thailand should extend the cooperation period of the Project till the end of 1987 for the purpose of helping achieve the initial objectives of the Project as planned."

Based on the recommendation stated above, the Record of Discussions on the Extension of the Period of the Technical Cooperation for follow-up purposes was signed on March 21, 1985. The follow-up cooperation was to be implemented for two years from April 18, 1985 to March 31, 1987.

2-6 Outlines of Project Implementation in FY 1985

At the end of the first year of the extended period of the Project, the Tenth Asia Pacific Weed Science Symposium of the International Seed Science Academy was held at Chiangmai under the leadership of Dr. Tauangchit (Deputy Director of the DOA), Chairman, Dr. Yooktie (Director of the DOA), Head of the Domestic Organization Committee, and other persons related to the DOA. The experts who had been dispatched for the Project participated in the Symposium and the counterparts presented the results of the Project under the cooperation of JICA. The whole Project offered full support to the Symposium. The published results of the Project included ten themes from the cooperative research. At the same time, Dr. Noda and Dr. Harada contributed to the administration of the Symposium as adviser and member of the Organization Committee, respectively. Dr. Shibayama, Dr. Paitoon, and Dr. Harada published their research results from the Project at the Symposium. The results published at the Symposium were later published in printed form and distributed to authorities and persons concerned at home and abroad under the supervision of the APWSS and JICA, with the financial assistance of the latter.

2-7 Outlines of Project Implementation in FY 1986

The main operations in the final year of the Project included printing of all the cooperative research results and counterparts' theses for degrees which were approved in October 1985, preparation of the printed items which summarized the APWSS Symposium held in 1980 under the joint auspices of JICA and APWSS, surveying of weeds in the highlands of North Thailand including the printing of a pictorial book introducing them, and operations for concluding the whole project work over the seven-year period. Regarding research activities, short-term experts Osada and Oki engaged in survey and research of the distribution and ecology of the water hyacinth in order to contribute to the development of weed-controlling methods in Thailand. This was one of the main objectives of the extended Project. The research area was mainly South Thailand.

It was determined to construct a research facility employing radioisotopes. The facility was to be composed of a 100 m² glass room, an instrument preparation room, a dark room, and material warehouse. It was constructed as the third building near the NWSRI laboratory block. Operations were begun in the new building.

3. SUMMARIZATION AND EVALUATION

3-1 Cooperative Research

Principal objectives of a research project generally include upgrading of counterparts in the country which receives cooperation; technical transfer; and granting of machinery and instruments. They do not include such programs as participation in training and academic meetings or the holding of seminars. Since the objectives of the research project often take the form of software development, there are no direct criteria for evaluation. How much research has been presented in academic meetings as a result of cooperative research between experts and counterparts will be one of the criteria. The NWSRI Project aimed at raising the quality of weed science research, a field in which the level at the Department of Agriculture in Thailand had been extremely low. Fortunately it contained many types of basic research as seen in the R/D. Therefore, the number of theses formally published in the Weed Science Academy in Thailand, Japan, the Asia Pacific Weed Science Symposium, and so on reached 63 as shown in Table 4 below. Additionally, six books were published, while other data have been left in the form of manuals not open to outsiders. These types of data have been of great help in training Thai researchers and have been utilized as textbooks in extension and guidance activities in many fields in Thailand.

Table 4 No. of research theses published at academies, seminars, and in periodicals per year

Year	International conference	Academic meetings in Japan and Thailand	Seminars held by DOA and others	Other periodicals	Total
1981		1	2		3
1982	1	6	1		8
1983	1	7		2	10
1984	2	5	2	1	10
1985	10				10
1986		2	3	2	7
1987		6	9		15

Note : Reports by counterparts in the Annual Operation Report (written mainly in the Thai language) of the Department of Agriculture are not included in this Table.

The themes for which research was effected in the Project are listed in Table 5 below:

Table 5 Themes for tests and research, their results and evaluation, and problems left to future research

Research themes	Research items	Results of the research	Evaluation and judgment	Problems left to future research
1. Distribution and identification of weeds	(1) Distribution survey and identification (2) Clarification of ecological and morphological characteristics	The distribution survey was carried out regarding principal weeds under annual programs by dividing the whole of Thailand into the four districts: namely, central, north, northeast, and south. Almost all the programs have been completed. The general survey on germination, dormancy, and morphological and anatomical structures was completed, and the survey results were published in March 1984 in "Major Weeds in Thailand" together with those of the distribution survey as stated above.	B ◦ A ◦	(1) Identification of several species (some of Pontederiaceae and Polygonaceae) not previously identified (2) It is necessary to draw a weed distribution map and to make up for any omissions and errors by means of follow-up questionnaires.
2. Clarification of biological characteristics (autecological and physiological phases of weeds)	(1) Wild rice (2) Echinochloa (3) Pennisetum spp.	The physiological characteristics and growing properties including germination and dormancy of seeds, as well as distribution in Thailand were clarified (as reported in the Project Report No. 2). Research has clarified soil moisture requirements as well as germination and survival of seeds. Simple distribution survey was finished. Experiments on the germination of seeds and growing properties have just started.	A ◦ B ◦ D •	(1) Accurate identification of species of <i>Oryza</i> (Gramineae) and similar species and (2) establishment of wild rice controlling techniques in floating rice cultivating zones (1) Damages of paddy by weeds and (2) clarification of propagation mechanism (1) Clarification of ecology for controlling purposes as to representative species, (2) controlling methods, (3) research on utilization
2) Broad-leaved weeds	(1) <i>Euphorbia</i> spp. (2) <i>Sphenochloa Zeylanica</i>	Research has clarified the levels of damage to corn caused by weeds, the mechanisms of development related to controlling weeds, the distribution of root systems, the characteristics of assimilation, and the reaction to changing lengths of daytime. This is a weed found in paddy fields, belonging to the Campanulaceae. Research has clarified its germination and budding requirements.	C ◦ D •	(1) Clarification of relationship between soil moisture requirements and growth, (2) systematization of controlling technique, and (3) confirmation of allelopathy Similar themes as described for <i>Echinochloa</i> have been left intact, but the ecological phases of this species have been far less clarified as compared to <i>Echinochloa</i> .

3) Aquatic weeds	Eichhornia crassipes	Surveys on distribution and development were effected and it has been clarified that the same species can have several types of ecology.	D •	(1) Mechanism of propagation, (2) analysis of growth, (3) controlling method, and (4) reviewing of utilization
4) Cyperaceae weeds	Eleocharis dulcis	Research has clarified some of the life history. This is a perennial weed found in paddy fields. Propagation was found to be effected by means of subterranean stems, rhizomes, and/or seeds.	C •	(1) Clarification of types of damage, (2) clarification of requirements for forming and destroying propagation organs such as seeds and rhizomes, and (3) clarification of survival period of nutrition/propagation organs
3. Weed controlling methods 1) Cultivation of direct-seeded rice	Preparation of weed-controlling manual (guideline for instruction)	Based on the surveys and field tests effected by the Project staff, a (primary) guideline for instruction in controlling weeds was set up, and it was published in March 1984 under the title of "Suggested Guide for Weed Control in Thailand."	A •	The "Suggested Guide" should be supplemented and revised by effecting field tests and actuality surveys of farmers in the future.
2) Cultivation of transplanted rice 3) Cultivation of field crops				
4. Clarification of ecology and controlling of non-agricultural weeds	Clarification of botanical, physiological characteristics of main weeds; and ecological clarification and control of Mimosa pigra, especially	A general technical transfer was completed regarding methods of operating main machines and instruments as well as research procedures for clarifying characteristics. It was found recently that several species of non-agricultural aquatic weeds, in addition to Mimosa, are toxic for fish.	C •	(1) Establishment of technique to control Mimosa, (2) expansion of application range of the research procedures, and (3) further clarification of phenomena of allelopathy and review of potentiality for utilizing it.

<p>5. Herbicides</p> <p>1) Evaluation test</p>	<p>Preparation of weed-controlling manuals</p>	<p>Experts instructed counterparts on screening methods for herbicides, and they studied the present status and problems of the weed-controlling technique in Thailand. "Suggested guide" was prepared as stated above.</p>	<p>A ○</p>	<p>The guide will need revisions in the future as the actualities change.</p>
<p>2) Activity of herbicides</p>	<p>Selective herbicidal properties</p>	<p>Research has clarified the activity of several herbicides against Gramineae species and weeds, specifically, differences in herbicidal effects of a commonly used chemical upon assimilation and respiration among Gramineae weeds.</p>	<p>C ●</p>	<p>(1) Clarification of selective herbicidal properties of principal herbicides, (2) clarification of activity of Glyphosate, and (3) technical transfer of research procedures.</p>
<p>3) Herbicide residues</p>	<p>Residues of herbicides in soil and water</p>	<p>Research has established methods of surveying residues of diuron and bromacil in soil and of analyzing paraquat.</p>	<p>D ●</p>	<p>(1) Survey of residues in soil and water regarding the principal herbicides and (2) technical transfer of analyzing procedures and utilization of main instruments, such as radioisotope units and gas chromatographs.</p>
<p>6. Others</p>	<p>Evaluation of weed-controlling techniques for types of crops and their economic merits</p> <p>Mechanical controlling</p>	<p>Research reached a stage at which techniques were to be reviewed through the use of corn in local test fields, with the reviewing process started in 1984.</p>	<p>D ●</p>	<p>(1) Managerial and economic evaluation of weed-controlling techniques and (2) concrete appraisal based on local demonstration and tests.</p>
		<p>Research was effected to analyze the present status of the mechanical controlling of weeds. It clarified those themes which would require a survey of combined application with other controlling techniques in the future.</p>	<p>B ○</p>	<p>There are few researchers in Japan who meet the requirements, but it is necessary to furnish Thai counterparts with encouragement.</p>

Judgment

○ : Themes not to be continued
● : Themes to be continued

Evaluation

A : Actual results are more than expected.
B : Actual results are equal or similar to what was expected.
C : Actual results are slightly less than expected.
D : Actual results are considerably less than expected.

Main themes are summarized as follows:

1. Extraction of substances which cause a reaction in other plants or are toxic to fish, was surveyed as a part of physiological features of weeds. It has been found that the extraction is an action of weeds to interfere with their environment. Significant findings were obtained as to the control and utilization of weeds.
2. Autecology and physiology of harmful weeds : Ecological and physiological research was intensively carried out to provide a base for controlling significant weeds. *Mimosa pigra* was adopted as a subject weed at the very start of the Project. Basic findings for controlling this weed were obtained by clarifying the mechanism of quick invasion and the ecology of the weed, including germination of seeds, ecological characteristics of propagation, and the relationship of growth to temperature, soil, and chemical substance conditions. Research also clarified herbicides that are effective in controlling the weed. Presently, glyphosate is applied by spot-spraying.

Euphorbia geniculata is a very harmful weed for field crops in Thailand. Research clarified the mechanism by which it causes damage from a multiple viewpoint, and established the concept of the so-called "weediness syndrome." Possible methods were suggested for controlling it. During the process of researching this weed, a Thai counterpart submitted a doctoral thesis to the Tokyo University of Agriculture combining his research results in Thailand with the results of his training and experiments in Japan at that University and at the National Agricultural Research Center of the Ministry of Agriculture, Forestry, and Fisheries.

Eichhornia crassipes (water hyacinth) is a weed that caused extensive damage since long before, though damage by that species attracted popular attention only recently. Measures against this weed were requested since it was one of the causes of floods in Bangkok, which occurred almost every year. The damage was attributed to the fact that this weed flourished so excessively in canals flowing through the city and its metropolitan area that it prevented the smooth discharge of water through the canals. Control and utilization are, so to speak, "a double-edged sword." The Project engaged in ecological research of the weed since 1985, from the standpoint of both control and utilization. After the Project was completed, research on this same theme was being continued in Thailand as one of its independent research activities. Research was also carried out on *Echinochloa* spp., *Monochoria* spp. (a kind of Japanese *Monochoria*), *Sphenochlea zeylanica*, *Salvinia cucullata*, and *Pistia stratiotes*. Research on some of the species, however, was suspended when the Japanese experts returned home. Independent research was expected to be carried out through the efforts of the Thai counterparts.

3. Weed control methods : Selection tests of herbicides had been carried out by Thai researchers before the Project started. Their results were summarized in the "Suggested Guide for Weed Control in Thailand" published in 1985. It was confirmed in the Seminar in 1987 that continued research had made further progress. Although the R/D indicated paddy rice and field crops as subject crops, the above-mentioned Guide also covered fruit trees, vegetables, plantation crops, and rubber plants thanks to the cooperative work of the Thai researchers. The Guide apparently reflected the state of the whole weed-controlling techniques available in Thailand.

Meanings and preferable direction for weed-controlling activities using mechanical power were clarified under the joint research with the Agricultural Machinery Division, DOA.

Research on methods of biologically controlling weeds was once seen as an effective method that did not cause pollution. However, this objective was dropped from the direct objectives of the cooperative research under the Project. In part, it was due to the manner of the development of the Project and an insufficient preparedness in Japan. It was also partly due to the actions of Biological Control Research Center (established in Kasetsart University), which had already engaged in experiments on the main weeds in a highly motivated manner.

4. Activity and residue of herbicides : Thailand had shown a keen interest in the application of herbicides. Although herbicides were not used so much except on plantations, their volume was presumed to be near that of insecticides. There was a strong fear of the damages which residual herbicides could cause to other crops and to fish in streams, if more herbicides are used in the future. Therefore, efforts were made to obtain knowledge on the safe rationalized application of herbicides. Physiological research was effected regarding the mechanism of main herbicides, such as paraquat and triazine chemicals. Their effects on crops and their residues in water and soil were also surveyed. Since this type of research should not be ended in a short term, it was expected that it should be continued by Thai researchers over a long period after the completion of the Project.
5. Managerial and economic evaluation of weed-controlling techniques : This was required for transferring the technical results obtained through research activities to the stage of extension. Since weed-controlling techniques have been developed in close connection with labor productivity, the Project intentionally adopted them as a research theme in the latter half of the project term. Although it was planned that research was to be carried out regarding field crops, which were the to be followed by paddy crops, the research was effected only for corn in upland fields within the project term. Research of paddy crops was to be carried out by Thai side in the future. In the above-mentioned research on corn, technical and managerial surveys were effected by selecting several farmers with different productivity in the principal corn-cultivating zones. Surveys by questionnaire, based on random sampling per zone, were also carried out for the purpose of managerial and economic evaluation.

One short-term expert proposed a trial method of quantitative evaluation using a computer for cases in which more than one factor was included. The foregoing has outlined the research.

3-2 Dispatch of Experts and Their Functions

The number of experts who were dispatched for the implementation of the Project was six for the long-term and 25 for the short-term (among which two experts were dispatched two times). The number of short-term experts includes those who were dispatched for extremely short terms for the purpose of surveying the possibilities of the counterparts' acquisition of academic degrees or to supervise the installation of machines. Since not many weed specialists were available in Japan, the Ministry of Agriculture, Forestry, and Fisheries, (which was the governmental authority responsible for the Project), could not dispatch experts, especially, long-term ones from its own research organizations. Responsibility for the cooperation was therefore distributed to organizations such as universities. The Project was smoothly implemented thanks to the cooperation shown by the Weed Science Research Laboratory in the Kyoto University Faculty of Agriculture; the Applied Biological Laboratory, Tsukuba University; Agricultural Biological Laboratory, Okayama University; Weed Science Research Facility, Utsunomiya University; Crop Research Laboratory, Faculty of Agriculture, Saga University; and the Institute of Physical and Chemical Research; as well as Tokyo University of Agriculture regarding the matter of counterparts' acquisition of academic degrees. These organizations displayed positive support in accepting training counterpart personnel as described below.

The research cooperation depended mainly upon the efforts of the long-term experts (who usually stayed in Thailand for a year or longer), but short-term experts made much contribution to the development of research towards specific objectives. Since Japan had only a few experts in the research of herbicides, it was compelled to handle this matter for the whole project term by dispatching short-term experts for research of physiological phases, activity, and residues of herbicides.

Unlike construction projects in which bridges, streams, or reservoirs are built, research cooperation projects have an important role to play in bringing up "professionals." Some industrial development projects include both sides, not allowing "bringing up of professionals" to be ignored. This NWSRI Project is composed of cooperation aiming at "enhancement of the capabilities of Thai researchers," "granting of machines and instruments," as well as cooperation aiming at "technical transfer" and "cooperative research of important problems." Dispatch of experts played an important role in bringing up professionals through cooperative research.

3-3 Granting of Machines and Instruments

It seems that machines and instruments were granted to the Thai side to an extent that the cooperative research was successfully effected and that weed science research by the Thai side would be effected in the future. They were granted in accordance with the request by Thailand in principle, but in actuality they were selected in accordance with the experts' advice. Since the Project aimed at "weeds," the machines and instruments covered a wide range of science such as botanical ecology, physiology, biochemistry, agricultural chemistry, and botanical taxonomy. Such a wide range was naturally selected, since the Project mainly aimed at the improvement of basic research functions at the DOA. The fact that the required quantity of machines and instruments was concentrated in a single site in so short a period was highly valued in Japan and abroad. It was thought natural that, after completing his survey trip in Thailand, Mr. Mash, who was the representative from FAO, Rome, and a weed scientist himself, had made a proposal that Thailand should accept for training weed science researchers from all the countries throughout the world. Among twelve (or thirteen) foreign projects, including those by the UN, for the DOA, there were no other projects that put such a high priority on the machines and instruments as the JICA Project.

When comparing the progress made in Thailand by the Project with that in research laboratories in Japan, the seven years in Thailand were equivalent to 20 or 30 years in Japan. Although the Thai side preferred granting of "more" machines and instruments than "less", there was fear for this. At a joint committee meeting, one of the Thai administration staff members uttered the words, "Don't make a museum of machines and instruments." Japan must recognize this as warning common to many of its international cooperation projects. It seems that he expressed the fears of the receiving country that after completion of the Project there would be problems with maintenance and control of machines and instruments. If they could not be maintained and controlled by the Thai side, proper aftercare will be required.

The total amount of the machines and instruments granted in the Project almost reached ¥400 million, including those which were brought by the experts. When compared with projects with grant aid cooperation, however, this amount was not always large. Since a large variety of machines and instruments were granted in a limited number of years, there were some problems which should be solved in the future for the benefits of the Thai people. Typical problems are referred to as follows: 1) It is a general trend that most of the machines and instruments which Japan grants, are modern and most advanced. Developing countries, however, usually require those which are more durable than modern or hardly cause trouble, or those which can be locally repaired, if damaged. 2) Some machines and instruments included accessories which were not appropriate, not required, not complete for the purpose of the Project. Considerate treatment by those companies which have accepted orders is expected. 3) The machines and instruments are basically not granted to experts but to researchers in the receiving countries. Operation manuals should be prepared in English in addition to Japanese. In conclusion, it is expected that the machines and instruments granted should not only be effective during the project term but also be utilized for research purposes for as long a period as possible.

There is naturally a difference in technical levels between a country which receives technical cooperation and one which offers it (not a difference in levels among individuals). To realize technical development and progress in the receiving country, it seems necessary to take measures step by step. It will be more efficient for developing countries to accustom themselves to machines and instruments and to realize development of their techniques and ideas if they are granted gradually, such as in the form of primary and secondary grants.

Maintenance activities, including repair, of the machines and instruments granted in the Project required a sufficient amount of time since the Thai side could not always catch up with the required level so quickly. There were some cases in which the management expenses of the Project were applied for such purposes. The level of the Thai side has been improved to meet the requirements of the operational objectives.

3-4 Training of Counterpart Personnel

3-4-1 Training in Japan

The number of Thai counterparts who received training in Japan was seventeen, including three counterparts who received managerial training. It seems that the objectives of the counterpart-training program were met during the seven years. The experts recommended and the receiving parties requested that the training term should be, at the shortest, six months, and it was almost totally accepted for the experimental training during the period, so that the results might satisfy expectations. Although there were differences found among individuals, the training results were generally satisfactory, since the Thai authorities fully accepted the experts' advice as to selection of personnel, the period, and the facilities to receive them. It should be specially noted that the facilities which received them made full use of the experts who returned after fulfilling their term of office. It was expected, therefore, that human relationships between the Thai researchers and the Japanese facilities which accepted them would last over a long period.

3-4-2 Training in neighboring countries

In the final year of the project term, survey training in neighboring countries such as Burma, Malaysia, and Singapore was approved and effected for the purpose of deepening and complementing the results of the Project. The training was effected in those countries which had research environments and problems similar to those in Thailand and it achieved remarkable results (different from those obtained in Japan which offered them an advanced research environment), though the training in the neighboring countries was as short as ten days. This type of training should be reinforced in the future. The training results were reported in the final seminar held by DOA in 1987.

3-4-3 Acquisition of academic and other titles

JICA's project-type research cooperation systems do not cover the matter of acquisition of academic and other titles. The Thai side (especially, then-Director

of DOA) expressed preference in this matter from the very start of the Project and the Thai weed science researchers had a strong interest in it. Among the counterparts (whose number ranged from 15 to 22, depending on theme and years), there were three Ph.D.'s and seven persons with an M.S. at the start. In accordance with the Thai request, experts related to the matter of acquisition of degrees were dispatched twice from Tokyo University of Agriculture to review the possibilities for acquiring higher degrees among the persons holding an M.S. One of them was eventually approved as a Doctor of Agriculture, the first in relation to JICA projects in Thailand, by submitting to Tokyo University of Agriculture a thesis covering the results of the cooperative research and training in Japan. The reasons why the counterpart succeeded in acquiring the doctorate in the net period of four years in relation to the Project are : 1) that the theme was appropriate and that a series of experiment results contained newly discovered items while proposing a concept called the "weediness syndrome," 2) that he succeeded in obtaining the support of the Thai directors and cooperation from cooperative researchers, 3) that the experts concerned gave him positive instruction and cooperation, 4) that Tokyo University of Agriculture and the National Agriculture Research Center gave appropriate guidance to him during his training in Japan, and 5) that JICA gave him positive budgetary support including the fees for the application for the degrees, expenses to complete the thesis, and printing expenses (those persons who have acquired a Ph.D. are responsible for publishing their thesis in printed form within one year).

In addition to the above-mentioned counterpart, there were four counterparts who acquired an M.S. degree for experiments and training concerning the Project. According to the educational system in Thailand, graduates of M.S. courses will be able to acquire the title of M.S. by submitting a master's thesis, which may be based on experiments made at any location, to Universities (such as Kasetsart University and Chulalongkorn University) for approval by a competent committee of the University. The results of the Project were utilized for application under the system.

3-5 Evaluation of the Project

It may be impossible to make a correct evaluation of any project, especially those for research cooperation, unless it is reviewed over the long run. As far as the NWSRI Project was concerned, however, it was presumed that the Thai side had been satisfied in terms of hardware, namely, the granting of machines and instruments, as well as with the quantities of printed matter and documents covering training, and the research results which represented the degree of technical transfer realized. It might be said that the objectives of the Project had been met.

On the other hand, it was rather difficult to evaluate the degree of improvement in the capacity of Thai researchers. It was estimated that proper progress had been made through diversified research meetings. An ideal form of research would be such that Thai researchers could make up research programs, carry out experiments, arrange their results in a correlated manner, and make contributions to actual agriculture while making full use of the machines and instruments granted. Independent efforts

by Thai researchers must be looked forward to in the long run. In order to make the bases created by the Project more significant, aftercare activities of various kinds would be required in the future, and it would be necessary to maintain the human relationships established as well. There may have been some problems in extending the results of the Project to practical applications relating to agriculture. The DOA was an organ controlling agricultural research and had nothing to do with extension activities. This meant that the projects implemented under DOA had no responsibilities regarding extension of the techniques. In accordance with the request by the Department of Agricultural Extension, however, many of the counterpart researchers guided extension workers and farmers. It was natural that the guidance included the results of the Project. Printed matter, such as "Suggested Guide on Weed Control" and "Major Weeds in Thailand," which were produced as a result of the Project, had been used in many lecture meetings.

Regarding the efforts made by the Thai side, it should be highly valued 1) that the DOA staff showed understanding and cooperation to the Project and the counterparts had enthusiasm in implementing research, 2) that the Thai Government (especially, DTEC) nearly fulfilled its duty to bear all of the local costs for experts under the Colombo Plan, 3) that the Thai Government was quite cooperative in stationing counterparts in cooperative research and in giving conveniences to experts in survey trips, and 4) that the Thai side took an elastic posture as to budgets for repairing machines and instruments, although it is presumed that there were many cases of patched-up measures taken to repair them. The experiment buildings were constructed by the initially planned budget which was paid over several years in installments and amounted to B 28,000 thousand in total. Repair expenses were not covered so smoothly, though they should have been covered as local costs. Expenses which had been determined in advance, and those for experts which were based on the Colombo Plan, were paid, sometimes with a delay of two or three months.

APPENDICES

1. The Record of Discussions (R/D) 31
2. List of Main Machinery and Instruments Granted 43

1. The Record of Discussions (R/D)

The Record of Discussions Between
the Japanese Implementation Survey Team
and the Authorities Concerned of the Government
of Thailand on the Japanese Technical Cooperation
for the National Weed Science Research Institute Project

The Japanese Implementation Survey Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Dr. Kenji NODA visited Thailand from 9th to 23rd April 1980 for the purpose of working out the details of the technical cooperation program concerning the National Weed Science Research Institute (hereinafter referred to as "NWSRI") project in Thailand.

During its stay in Thailand, the Team exchanged views and had a series of discussions with the Thai authorities concerned in respect of the desirable measures to be taken by both governments for the successful implementation of the above-mentioned Project.

As a result of the discussions, the Team and the Thai authorities concerned agreed to recommend to their respective Governments the matters referred to in the document attached hereto.

Bangkok, THAILAND, 18th April 1980

Dr. Kenji NODA
Leader
Japanese Implementation Survey Team
Japan International Cooperation Agency
JAPAN

Dr. Prakob KANJANASOON
Director General
Department of Agriculture Ministry
of Agriculture and Cooperatives
THAILAND

In the presence of

Mr. Apilas OSATANANDA
Director General
Department of Technical and Economic Cooperation
THAILAND

THE ATTACHED DOCUMENT

I. COOPERATION BETWEEN BOTH GOVERNMENTS

1. The Government of Japan and the Government of Thailand will cooperate with each other in implementing the National Weed Science Research Institute Project (hereinafter referred to as "the Project") through basic and applied weed researches for the purpose of crop production increase and environmental improvement in Thailand.
2. The Project will be implemented in accordance with the Master Plan which is given in Annex I.

II. DISPATCH OF JAPANESE EXPERTS

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide at its own expense services of the Japanese experts as listed in Annex II through the normal procedures under the Colombo Plan Technical Cooperation Scheme.
2. The Japanese experts referred to in 1 above and their families will be granted in Thailand the privileges, exemptions and benefits no less favorable than those accorded to experts of third countries working in Thailand under the Colombo Plan Technical Cooperation Scheme.

III. PROVISION OF MACHINERY AND EQUIPMENT

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to provide at its own expense such machinery, equipment and other materials necessary for the implementation of the Project as listed in Annex III, through the normal procedures under the Colombo Plan Technical Cooperation Scheme.
2. The articles referred to in 1 above will become the property of the Government of Thailand upon being delivered c.i.f.n to the Thai authorities concerned at the ports and/or airports of disembarkation, and will be utilized exclusively for the implementation of the Project in consultation with the Japanese experts referred to in Annex II.

IV. TRAINING OF THAI PERSONNEL IN JAPAN

1. In accordance with the laws and regulations in force in Japan, the Government of Japan will take necessary measures through JICA to receive at its own expense the Thai personnel connected with the Project for technical training in Japan through the normal procedures under the Colombo Plan Technical Cooperation Scheme.

2. The Government of Thailand will take necessary measures to ensure that the knowledge and experience acquired by the Thai personnel from technical training in Japan will be utilized effectively for the implementation of the Project.

V. MEASURE TO BE TAKEN BY THE GOVERNMENT OF THAILAND

1. In accordance with the laws and regulations in force in Thailand, the Government of Thailand will take necessary measures to provide at its own expense:
 - (1) Services of the Thai counterpart personnel and administrative personnel as listed in Annex IV;
 - (2) Lands, buildings and facilities as listed in Annex V;
 - (3) Supply or replacement of machinery, equipment, instrument, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than those provided through JICA under III above;
 - (4) Transportation facilities and travel allowance for the Japanese experts for the official travel within Thailand;
 - (5) Suitably furnished accommodations for the Japanese experts and their families.
2. In accordance with the laws and regulations in force in Thailand, the Government of Thailand will take necessary measures:
 - (1) To meet expenses necessary for the transportation within Thailand of the articles referred to in III above as well as for the installation, operation and maintenance thereof;
 - (2) To exempt customs duties, internal taxes and any other charges, imposed in Thailand on the articles referred to in III above;
 - (3) To meet all running expenses necessary for the implementation of the Project.

VI. ADMINISTRATION OF THE PROJECT

1. Director General of the Department of Agriculture, Ministry of Agriculture and Cooperatives, the Government of Thailand will be responsible for the administration and implementation of the Project, and the Japanese experts will provide necessary guidance and advice on technical matters for implementation of the Project.
2. For the effective implementation of the Project, a Joint Committee consisting of the members as listed in Annex VI will be established and meet at least once a year.
3. The Committee will formulate the details of the Master Plan referred to in Annex I and the annual work plan of the Project. The details of the Master Plan and the annual work plan will be submitted to the authorities concerned of the two Governments.

VII. CLAIMS AGAINST JAPANESE EXPERTS

The Government of Thailand undertakes to bear claims, if any arises, against the Japanese experts engaged in the Project resulting from, occurring in the course of, or otherwise connected with the discharge of their official functions in Thailand except for those arising from the willful misconduct or gross negligence of the Japanese experts.

VIII. MUTUAL CONSULTATION

There will be mutual consultation between the two Governments on any major issues arising from, or in connection with this Attached Document.

IX. TERM OF COOPERATION

The duration of the technical cooperation for the Project under this Attached Document will be five (5) years from the date of signature.

ANNEX I. MASTER PLAN

1. In Thailand weeds cause severe reduction of crop production, particularly of direct-seeded rice, short-height field crops, rubber, pineapple and so on, as well as contamination in environment such as aquatics and unarable lands.
The solution of weed problem is, therefore, so important to achieve the targets of Thailand's Fourth National Development Plan. Weed Research in Thailand, however, are far behind that of diseases and pest insects in the plant protection fields. This project will be carried out at the NWSRI, Bangkok and other relevant local experimental stations, which conducts basic and applied research for weed control and/or management procedures without having its side-effects.
2. The Project will comprise the following activities;
 - (1) Research in the following;
 - (a) Ecology and physiology of principal weeds for their control
 - (b) Weed control and/or management procedures in paddy and field crops
 - (c) Control methods of weeds harmful to environment
 - (d) Herbicide residues and proper application of herbicide
 - (2) Exchange of research information, materials and reports
 - (3) Development of research capabilities of the Thai weed researchers in the field in 1) above
 - (4) Other activities to be agreed upon between the authorities concerned of the two Governments.

ANNEX II. JAPANESE EXPERTS

1. Team Leader
2. Experts:
 - (1) Weed Biology
 - (2) Weed Control
 - (3) Herbicide Biochemistry
3. Coordinator/Liaison Officer

Notes:

- (1) Short-term experts of the above-mentioned fields or others ay be dispatched when necessities arise.
- (2) Experts on herbicide biochemistry may be dispatched on short-term assignment.

**ANNEX III. LIST OF THE ARTICLES TO BE PROVIDED
BY THE GOVERNMENT OF JAPAN**

1. Equipments, instruments, tools, their spare parts and other materials for laboratory work.
2. Machineries, instruments, tools, their spare parts and other materials for field work.
3. Fertilizers, agricultural chemicals and materials for research work.
4. Audio-visual aids and related articles.
5. Books and other necessary printed matters.
6. Vehicles.
7. Other necessary equipments and materials.

**ANNEX IV. LIST OF THAI COUNTERPART OFFICIALS
AND OTHER PERSONNEL**

1. Counterpart to Japanese Team Leader (Director of Technical Division, Department of Agriculture)
2. Counterpart Researchers to the Japanese Experts
3. Assistant Researchers
4. Clerical and other personnel including a secretary, a typist and drivers
5. Field workers

ANNEX V. LIST OF LANDS, BUILDINGS AND FACILITIES

1. Lands:
 - (1) Experimental fields at NWSRI
 - (2) Other necessary fields at local experimental stations
2. Buildings at NWSRI:
 - (1) Office rooms for the Japanese Team Leader and Experts
 - (2) Laboratory rooms
 - (3) Green houses
 - (4) Store-houses
 - (5) Shed and workshop
 - (6) Car garages
3. Other necessary lands and buildings

ANNEX VI. COMPOSITION OF THE JOINT COMMITTEE

1. Chairman:
Director General, Department of Agriculture (DOA), Ministry of Agriculture and Cooperatives (MOAC)
2. Thai-side:
Director of Technical Division, DOA
Director of Rice Division, DOA
Director of Field Crop Division, DOA
Director of Horticulture Division, DOA
Director of Agricultural Engineering Division, DOA
Director of Rubber Division, DOA
Director of Foreign Agricultural Relation Division, MOAC
Representative of Budget Bureau
Representative of DTEC
Chief of NWSRI, Technical Division, DOA
Other personnel appointed by the Chairman
3. Japanese-side:
Team Leader
Experts (Long-term)
Coordinator/Liaison Officer
Representative of JICA

Note:

An Official of the Embassy of Japan may also attend the Joint Committee as an observer.

THE RECORD OF DISCUSSIONS ON EXTENTION OF THE PERIOD
OF THE TECHNICAL COOPERATION FOR THE NATIONAL WEED
SCIENCE RESEARCH INSTITUTE PROJECT

The Japan International Cooperation Agency (hereinafter referred to as "JICA"), with regard to the recommendations made by the Thai and Japanese Joint Evaluation Team which conducted the evaluation survey from November 13 to 27, 1984, had a series of discussions through the Resident Representative of JICA in Thailand, Mr. Michimoto Goto with the authorities concerned of the Government of the Kingdom of Thailand in view of the extention of the period of the Technical Cooperation for the National Weed Science Research Institute Project based on the Record of Discussions (hereinafter referred to as "R/D") which was signed in Bangkok on April 18, 1980, and ill be terminated on April 17, 1985.

As a result of the discussions, JICA and the authorities concerned of the Government of the Kingdom of Thailand agreed to recommend to their respective Governments to carry out a follow- up cooperation and to extend the technical cooperation for the above-mentioned Project until March 31, 1987 in order to attain the anticipated objectives of the technical cooperation.

Bangkok, March 21, 1985

Michimoto Goto
Resident Representative
of Japan International
Cooperation Agency

Yookti Sarikaphuti
Director-General
Department of Agriculture
Ministry of Agriculture and
Cooperatives

TENTATIVE SCHEDULE OF IMPLEMENTATION
ON THE JAPANESE TECHNICAL COOPERATION
FOR THE NATIONAL WEED SCIENCE RESEARCH INSTITUTE PROJECT




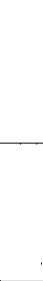
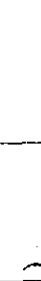

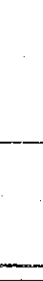
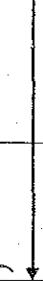

The President Representative of the Japan International Cooperation Agency in Thailand, Mr. Michimoto Goto and the authorities concerned of the Government of the Kingdom of Thailand have jointly formulated the Tentative Schedule of Implementation concerning the Japanese Technical Cooperation for the National Weed Science Research Institute Project (hereinafter referred to as "the Project") as annexed hereto.

This has been formulated in connection with the Attached Documents of the Record of Discussions of the Project signed on March 21 1985, between JICA and Thai authorities concerned on condition that the necessary budget will be allocated for the implementation of the Project and the Schedule is subject to change within the framework of the Record of Discussions when necessity arises in the course of the implementation of the Project.

Michimoto Goto
Resident Representative
of Japan International
Cooperation Agency

Yookti Sarikaphuti
Director-General
Department of Agriculture
Ministry of Agriculture and
Cooperatives

Item	Year	1985	1986	1987 3/31	Remarks
1. Biological Characteristics					
1) Gramineous Weeds	Pennisetum spp.	↕	↕	↕	
2) Broadleaf Weeds	Euphorbia spp.	↕	↕	↕	
3) Aquatic Weeds	Sphenochlea zeylanica	↕	↕	↕	
4) Chperaceae Weeds	Water hyacinth	↕	↕	↕	
	Eleocharis dulcis	↕	↕	↕	
2. Biology and Control of Non-Agricultural Weeds	Plant-physiological features of major weeds	↕	↕	↕	
3. Herbicide					
1) Herbicide Physiology	Selectivity of herbicide activity	↕	↕	↕	
2) Herbicide Residue	Residual activity of herbicides in the soil or in water	↕	↕	↕	
4. Other	Technical and economical evaluation of appropriate weeds control technology.	↕	↕	↕	

Item	Year	1985	1986	1987 3/31	Remarks
1. Assignment of Experts (Long-term Assignment) 1) Weed Biology/Leader 2) Weed Control 3) Agronomy/Coordination		  			
2. Assignment of Experts (Short-term Assignment) 1) Weed Biology 2) Weed Control 3) Herbicide 4) Others		 			About 3 personnel a year. Assignment of Experts in the field of "Others" shall be studied by the Joint Committee.
3. Acceptance of Trainees					
4. Provision of Equipment, Machinery, and Materials				 	2 or 3 personnel a year

Item	Year	1985	1986	1987 3/31	Remarks
1. Counterparts and Other Personnel		↕	↕	↕	
2. Administrative Personnel		↕	↕	↕	
3. Facilities		↕	↕	↕	
4. Local Cost		↕	↕	↕	

2. List of Main Machinery and Instruments Granted

EQUIPMENT AND MACHINERY

(Listed main equipment and machinery supplied in the fiscal years of 1980 to 1985)

1980:	No. of units
1. Window Type Airconditioner, "SANYO" SA 245	2
2. Stereoscopic Microscope, "NIKON" SMZ-10	1
3. Biophoto, "NIKON" VBD-FT-2	1
4. Refrigerator, "SANYO" MDF-230	1
5. Microbus, "MITSUBISHI"	1
6. Center Table for Experiment, MS 3600	2
7. Unit Table for Experiment	2
8. Storage Cabinet, LG-4	2
9. Storage Cabinet, LS-3	2
10. Storage Cabinet, S-20	2
11. Lab-Shelf	2
12. Draft Chamber Standard Type	1
13. Large Rotary Microtome, Model: LR 75 D	1
14. Large Freezing Microtome, Model: Goldtome CM 41	1
15. Paraffin Melting Apparatus, PM-400 II	1
16. Paraffin Spreading Apparatus, PS-51	1
17. Camera, Asahi Pentax LX	1
18. MRK Low Temp. Incubator, Cat. No. 15-96	1
19. Sunlight Style Incubator, N1-50R	1
20. Automatic Ice Maker, MRK-30G	1
21. Ball Mill, Cat. No. 18-20-Ref.	1
22. Leaf area meter, AAM-7	1
23. Electric Recision Balance, No. 510 C	1
24. Automatic Balance, SP-200 D 1	2
25. Automatic Sterilizer, No. 16-50	1
26. Dryer, MR-160	1
27. Clean Still, IS-18	1
28. Vaccum Pump Box. type BSW-150	1
29. Freezer, MDF-230 SANYO	1
30. PH Meter, HB-5 ES	1
31. Infrared Moisture Meter F-2A	1
32. O ₂ Up Tester	1
33. Culture Bath Shaker, CBS-30	1
34. High Speed Centrifuge, H-300	1
35. Slide Processor Camera, KV-3500 (National) + KV-100M	1
36. Copy Machine, RICOH DT-1500	1
37. Electric Typewriter, Hermese 808 C	1

1981:		No. of units
1.	Center Table for Experiment, ML-2400	2
2.	Center Table for Experiment, MS-2400	2
3.	Sink Cabinet, TS-D-12	3
4.	Cabinet, SG-492	1
5.	Soil Sieve Machine, SASAGAWA-d	1
6.	Plastic Boat	1
7.	Pyrheliometer, MS-800 III	1
8.	Lux Meter, NS-2	1
9.	Air Compressor, DSP-04	1
10.	Sunlight Style Low Temperature Incubator, TB-SL-3	1
11.	Microscope, NIKON (VBO-UWT)	1
12.	Ultra-histodyer, "SAKUEA" RSH-50 II	1
13.	Sunlight Style Incubator, NL-50 R	1
14.	ATP (Chem-Glow) Photometer, No. 401 + Recorder	1
15.	Rotary Vaccum Evaporator, N-1	1
16.	ACE Homogeneger, AM-11	1
17.	Freeze Dryer, FD-1	1
18.	Desolved Oxygen Meter	1
19.	Thin Layer Chromatograph, HCG-100-A	1
20.	Sledge Microtome, TA-213	1
21.	UV-Light, SL-800F	1
22.	Automatic Microtome Knife Sharpener	1
23.	Shaker, "EYELA" SS-81P	1
24.	Developer Set for Camera	1
25.	Programable Calculator, CASIO FX-9000P	1
26.	Scanning Eelectoron Microscope with Accessories "AKASHI"	1
27.	Oxygen Consumption Recorder, PO-100A	1
28.	Plant Assimilate Analyzer, ASSA-1110	1
29.	Gas Chromatograph, GC-7AGPrE	1
30.	Station Wagon, DATSUN Bluebird	1
31.	Pickup Truck, DATSUN 1600	1
32.	High Speed Centrifuge, 20PR-52	1
33.	Electronic Analytical Balance, HK-160 mettler	1
34.	Warburg Manometric Apparatus, OT-STL-18	1
35.	Recording Spectrophoto Meter, UV-240	1
36.	Homogenizer, AM-11	1
37.	Balance Table	3
38.	Slide Wall Lab. Table	10
39.	Typewriter with Thai and English elements, IBM	1
40.	Air Conditioner Split Type, FEDDER	7
41.	Air Conditioner Split Type, FEDDER	8
42.	Power Cultivator	1

	No. of units
43. Vertical Pump	2
44. Safe	1
45. Storage Cabinet, MPR-110	1
1982:	
1. Commuter, 12 seater TOYOTA Hiace	1
2. Pickup Double Cab, TOYOTA Hiace	1
3. Sink Unit Pb Boad for Chemical Experiment	2
4. Hume Hood, 1521	1
5. Dry Oven Constant Temp., 1613-SF	1
6. Auto Still, WA-72	1
7. Oxygen electrode	2
8. Sunlight Style Low Temp. Incubator, TB-SL-3	2
9. Electronic Balance, Mettler HK160	1
10. Drying Oven, Vacuum Air Bath, Type 1624-A	1
11. Low Temp. Incubator (0-10°C)	2
12. Sterrer, B-100	1
13. Centrifuge Desk, Type KN-70	1
14. Refregerated Centrifuge, R-90-23	1
15. Vacuum Pump Oil Rotary, 160-UP-D	1
16. Ultrasonic Cleaner Branson 52	1
17. Microscope, NIKON SMZ-10	1
18. Double Camera, HFM-35 DA NIKON	1
19. Laboratory Air Cleaner, LP21	5
20. Slide Transformer, KV-11FM	1
21. Water Quality Checker, U-7	1
22. Water Quality Checker, Y-7DO	1
23. Automatic Frake Ice Machine	1
24. Large Rotary Microtome, T-96-C (LR75DX)	1
25. Gravity Convention Oven, 1601-SB	2
26. Small Inculator, 0-6000 Lux	5
27. Moisture Indicator, SP-1D	2
28. Container Liquid Nitrogen, DC-30	1
29. Keeping Box for Chemical, MPR-110	1
30. Ultra Dispenser, LK-21	1
31. Evaporator of Test Tube, S-3	1
32. Low Temp. Constant Bath, 15-96	1
33. Camera with 50 mm. F1.4, NIKON FMZ	1
34. Automatic Top Loading Balance, Jupiter SP-200 D1	2
35. Semi Auto Top Loading Balance, ISHIDA Type	2
36. Refractometer	1
37. Paraffin Spreading Apparatus, SP-51	1

1982:		No. of units
38.	Low Temp. Constant Bath, TRL-101 F	2
39.	Refrigerator, 313L SP-344 NF	2
40.	Refrigerator, Whirlpool EV-150 NX	1
41.	Turn Table, RT-5	1
42.	Recorder of Thermometer	1
43.	Copy Machine, FT-4060	1
44.	Auto Printer RICOH AP 2600	1
45.	Typewriter, IBM 6713, 75	1
46.	Trace Stand, Lion S90	1
47.	Overhead Projector, HP 2450	1
48.	Microphone Speaker Set	1
49.	Automatic Book Binding Machine, 140-0010	1
50.	Paper Drill	1
51.	Paper Drill Exchange Needle (12 pcs.)	1
52.	Critical Point Dryer, HITACHI HCP-2	1
53.	Dry Ice Maker	1
54.	Print Paper Dryer	1
55.	Slide Projector, "Master Hi-Look-HR"	2
56.	Shaker, MS-1	1
57.	Oven, SO-12S	1

1983:		No. of units
1.	Laboratory Table, Model MS-70 and Duct (6 m/pc)	2
2.	Standard Gas Generator, SGGU-712	1
3.	Standard Gas Generator, SGGU-72-L2	1
4.	Standard Gas Divider, SGD-75-PC 2L	1
5.	Gas Purifier SGPU-51	1
6.	Gas Cylinder set (4 pcs.)	1
7.	Steady State Porometer, Model L1-1600-C with standard accessories	1
8.	Personal Computer set, PC-8801, PC-8822 PC-8853N, PC-8881	1
9.	Automatic Leaf Area Meter AAC-400	1
10.	Dural Range Balance, Model Mettler-AE 163	1
11.	O ₂ up Tester (300 ml)	1
12.	Electronic Top-Pan Balance, Model: EB-500-22	1
13.	Printer for above use, Model: EP-40-20	1
14.	Electronic Top-Pan Balance, Model EB-5000-12	1
15.	Electronic Top-Pan Balance, Model ED-H2000-12	1
16.	Electronic Top-Pan Balance, Model ED-H2000-13	1
17.	Electronic Top-Pan Balance, Model PC 4400	1
18.	Hydro-thermometer, Model HM 14 A	2
19.	Anemograph, SAV-25A, AC 220V	2
20.	Thermograph, ER-187	1
21.	ATP Photo-Meter, Model 2000	1
22.	Flow Type, Fish-Toxic Testing Apparatus, Aqua-Line Model KC-7N	1
23.	Ultrasonic Cleaner, Model 52	1
24.	Sieving Grader with Counter	1
25.	Oxygen Tester, Model 52	1
26.	Three-faces Meter, Model DIK-1100	1
27.	Fertility Counter	1
28.	Vacuum Pumps, 160 VP-D	1
29.	Angleroter, Model RPR 18-3 20 PR-50	1
30.	Air Compressor, DSP-04	1
31.	Rice-Planting Machine with Accessories KUBOTA NS 300-D	1
32.	Slide Projector with Accessories, ELMO AS3000A	1
33.	Camera Video Color Potable with Accessories Model KY-1900E 16	1
34.	Color Portable Video Recorder with Accessories Model CR-4400 E	1
35.	Color Video Cassette Recorder with Accessories Model CR-6060 ET	1
36.	Color T.V., 7808 ME	1
37.	16 mm. Film Projector, ELMO 16-CL	1

	No. of units
38. Liquid Scintillation Spectrometer System (1 set) TRI-CARB 14530 (R1)	1
39. Camera with Accessories, NIKON FE-2	1
40. Survey Meter, TGS-113	1
41. Power Sprayer, MARUYAMA MS 075	2
42. Semi-automatic Hand Sprayer	3
43. Flymo Mower, Model GLE-5	2
44. Air Conditioner, FEEDER Rotor-2000	1
45. Refrigerator, SHARP SJ 213	2
46. Water Filter	5
47. Table	6
48. Chain	20
49. Air Conditioner, FEEDER 165 BTU	3

1984:		No. of units
1.	Sunlight Style Low Temp. Incubators, NL-50R	1
2.	Tri-Carb Sample Oxidizer with Standard Accessories Model 306	1
3.	Draft Chamber with fan, "IKEMOTO-RIKA" Model ISA-12	1
4.	Spectro Photometer with Auto Zipper and Trans. Model U-1080	1
5.	Prefab Low Temp. Panel Form with Accessories PUC-1500 W	1
6.	Photographing System for Specimen, Model KN-821	1
7.	Illuminometer, Model NS-2 "IKEMOTO"	1
8.	Green Meter, Model SP-510 A "MINOLTA"	1
9.	Neo-Cool Aspirator with Trans. Model BP-51 "YAMATO-KAGAKU"	2
10.	Cool-Nics Thermo Bath Model CTE-30 "YAMATO-KAGAKU"	1
11.	Fraction Collectors Model SF-100 "TOYO-KAGAKU"	1
12.	Evaporator, Quick Type Model 1S-10 "TOKYO-RIKA"	1
13.	Test Tube Washer with Trans. Model GW-35 HIRAYAMA	1
14.	Detector for Mini-Radiation Model SK-100 "KANEDA-RIKA"	1
15.	Sink Cabinet, Model 1MA II-120 "IKEDA-RIKA"	1
16.	Rotary Evaporator, Model N-1 "TOKYO-RIKA"	2
17.	Centrifuge with Accessories, Model H-300 "IKEDA"	1
18.	Hemogenizer, Model AM-11 "IKEMOTO"	1
19.	Camera Lens, 500 mm F.8, "NIKON FLEX"	1
20.	Camera lens F 4.5/400 mm. SMC PEN TAX	1
21.	Microphon, MU-510	2
22.	Monitor TV, TM-P 3	1
23.	Lens for Video Camera, 14x HZ-2140	1
24.	Zoom Stereo Unit, HZ-ZS 10 U	1
25.	Focus Manual Unit, HZ-FM 10 U	1
26.	Lighting Fixture, LPL-N1-CD 250-18	2
27.	Tripod, Model 4100-18	1
28.	Tripod, Model TVT-4	1
29.	Battery Pack, DC-C19 5 pcs.	1
30.	Battery Pack, PBP-1 5 5 pcs.	1
31.	Video Tape (3/4"), KCA-60 30 pcs.	1
32.	5. 1/4" Floppy Drive Unit, PC-80S 31	1
33.	Pickup, DUTSUN Model UA 720 TUF	1
34.	Air Conditioner, FEDDER 12500 BTU	2
35.	Hand Tractor with Attachments, KD 800	1

	No. of units
1985:	
36. Hand Tractor with Attachments, K 120 C	1
37. Tiller Machine, PC-501E-46	1
38. Pen Recorder, 3056-23-type	1
39. Water Bath, CA-100	1
40. Hygrometer, AKL	1
41. Maize Moisture Meter, E-101	1
42. Grain Moisture Meter	1
1986:	
1. Rotary Evaporator with Action-Jack and Water Bath, N-1	2
2. Aspirator with 2 Aspirators & 2 m Circulation Hose (pipes: "NEOCOOL" BP-51)	1
3. Portable Water Nutrition Measure HC-1000 for AC/DC with Case	2
4. Mantle Heater for Six-run Draw, ME-467	1
5. Muffle Furnace 100-1150°C ($\pm 5\%$), FM-26 (inside size: 100 x 150 x 100 m/m)	1
6. Cold Storage Case for Medicine MPR-510, CAP, 487 L, 0-15°C	1
7. Super Poro-meter, Model LL-1600 C	1
8. Personal Plotter, FD-5301	1
9. Air Conditioner	1
1986:	
1. Cutting Mill	2
2. Water Bath	2
3. Magnetic Stirrer	1
4. pH Meter	1
5. Safety Bottle Cabinet	1
6. Drying Shelves	1
7. Handy Cart	1
8. Pocket Dosimeter	1
9. Lab Jack	1
10. Soil Moisture Meter	1
11. Sieve Shaker	1
12. Soil Mixing Machine	1
13. Vacuum Cleaner	1
14. Pocket Type EC Meter	1
15. Mini DC Stirrer	1
16. Deionizer Cartridge Type	1

JICA