PRELIMINARY SURVEY REPORT
ON
THE INDO-JAPANESE JOINT AGRICULTURAL RESEARCH PROGRAM

February 1971

Overseas Technical Cooperation Agency

CONTENTS

I. BACKGROUND OF RUDIMENTARY SURVEY

1. Survey in Relation to Joint Agricultural Research Project in India

In December 1970, Tropical Agriculture Research Center, Ministry of Agriculture & Forestry of the Japanese Government, commissioned Dr. Shiro Okabe, Chief, 5th Laboratory of genetics, National Institute of Agricultural Sciences, to conduct a preliminary survey in relation to the proposed joint research project in India. While in India Dr. Okabe met with Mr. T. P. Singh, Deputy Minister for Food, Agriculture, Community Development and Cooperation, Mr. J. C. Mathur, Additional Secretary in charge of Foreign Aid and Technical Cooperation, Dr. B. P. Pal, Director General of ICAR, and Dr. M. S. Swaminathan, Director of the Indian Agricultural Research Institute and exchanged views on the proposed joint research. As a result, it became clear that the Indian Government had a growing interest in the project and was looking to research cooperation from Japan. They seemed to have a strong desire for joint research, particularly in the field of; (1) plant physiology and biochemistry, (2) plant disease and insect pests, and (3) agricultural implements. During the meeting Mr. T. P. Singh requested the Japanese delegates to make a study on the advisability of concluding a general agreement on agricultural research cooperation and establishing an agricultural research cooperation committee.

2. Draft Plan of Joint Agricultural Research Project in India

In 1971, Overseas Technical Cooperation Agency (OTCA) worked out the following draft plan of the joint agricultural research project in India.

As a result of discussions on the subjects of research cooperation on the basis of the draft plan with staffs of the Tropical Agriculture Research Center playing a central role, it was decided to work out detailed plans on the following two subjects.

1) Plant physiology and biochemistry.
2) Plant disease and insect pests.

After careful reviewing of plans on these subjects presented by experts, a plan of "Joint research project for the establishment of forecasting methods

for the outbreak of rice diseases and insect pests "prepared by plant protection scientists was adopted as the primary subject. A plan of "Joint research project on plant physiology and biochemistry" presented by plant physiologists was selected as alternative subject.

3. Preliminary Meeting for Deliberation of the Joint Agricultural Research Project in India

A preliminary meeting was sponsored by OTCA on August 5, 1971 with the participation of officials concerned of the Ministry of Foreign Affairs and the Ministry of Agriculture and Forestry. Following articles were discussed.

"Planning a Joint research project in India".

1) Background and circumstances
2) Concrete measures for project planning
3) Future work schedule
4) Relations to the four existing centers

At this meeting the plan of "Joint research project for the establishment of methods of forecasting outbreak of rice diseases and insect pests in India" was adopted as a final plan of the project on the basis of OTCA's draft plan, and an explanation was made on main points of the plan. This plan calls for cooperation in the research for forecasting the major outbreak of rice diseases and insect pests which have been serious in India for these several years, and for establishing proper techniques for the protection of rice from these threats.

More frequent outbreak of rice diseases and insect pests is expected in India in the future, as a result of diffusion of new varieties of rice and application of chemical fertilizer. The technique of forecasting outbreak of diseases and insect pests is urgently needed in that country.

As a matter of fact, forecasting of rice diseases and insect pests has been in effect in five norther states since 1970 under administrative guidance, and patrolling of the area has already begun in these states. This measure was taken after the need of forecasting the outbreak of diseases and insect pests was recognized following the outbreak of Tungro in 1969.

It is needles to say, that the technique of forecasting outbreak of diseases and insect pests can be established only through continuous research work over a long period of time. The key point of the proposed research project for the establishment of methods of forecasting is that, Japan with its long years' experience and achievements in this field, can readily extend co-operation to India in promoting research.

After deliberation of the above plan, it was agreed at the Joint meeting that the plan would be presented to Deputy Minister Mr. T. P. Singh who was scheduled to visit Japan shortly. It was also agreed at the meeting that rudimentary survey mission is to be sent to India in the coming October, if necessary.

The nature of four existing Centers (agricultural extension centers) is different from that of the proposed research project. In order to realize the anticipated results from the proposed research project, it is desirable to assign experts to Centers to conduct field research in well arranged fields using the accumulation of data at the Centers. On this point, there is a question regarding coordination between the project and the operating policy of the Centers. In this connection, OTCA made it clear that it was almost impossible to link the four existing centers with the proposed research project.

The question of plant diseases and insect pests has been brought up as a result of bitter experience at these centers. For this reason, activities of the centers and research work should be linked together fundamentally. In reality, however, decision has been made to separate the two functions for various reasons. This certainly deals a hard blow to the proposed research project.

Views were exchanged also on the advisability of concluding a general agreement between India and Japan on agricultural cooperation, and of establishing a Joint committee, but no conclusion was drawn at that stage.

4. Visit of Mr. T. P. Singh, Deputy Minister for Food & Agriculture to Japan

A proposal was made to Deputy Minister Singh who was on a visit to Japan on August 15, 1971 to discuss the Joint research project in India. At the same time, the following text was presented to him as a concrete plan of the project.

(1) Purpose: With the improvement of rice production technology, the control of disease and insect pests has become increasingly important. For example, improved high-yielding variaties require liberal application of fertilizers for a full manifestation of their yield-potential As a high level of fertilizer application induces more disease and insect pests, it is essential to adopt adequate control measures against the pests in order to stabilize increased rice production.

In the sense that any countermeasures for pests can be made in an efficient and economical way only when the outbreak of the pests - when, where, and in what magnitude they will occur - is well forecasted, the pest-forecast serves a basis for the pest control.

The purpose of this project is to establish the methods of forecasting the outbreak of major rice disease and insect pests in India.

(2) Operation: Ecology of cycle, population dynamics, alternate hosts, mode of hibernation, in relation to climatic edaphic and cultural conditions, and other aspects related to the outbreak of pests such as biochemical changes in insect metabolism, will be investigated with major pests in India like rice stemborer, gall midge, leaf hopper and bacterial leaf blight disease.

Upon this, Deputy Minister Singh approved the proposal in a way but expressed his desire for more extensive agricultural cooperation from Japan. He also requested strongly Japan's cooperation in the promotion of horticulture in India.

5. Draft plan of "Joint Research Project for the Establishment of Methods of Forecasting Outbreak of Rice Diseases and Insect Pests"

The opinion to the effect that cooperation should be extended to India to solve various problems concerning plant protection by assigning experts on a long-term basis, and not by means of the mere patrolling of the area and survey trip, was expressed in the report by experts on plant protection who had participated in the travelling guidance group of the Indian Agricultural Extension Center every year since 1963.

Outbreak of rice diseases and insect pests in India is spontaneous and unforeseen in most cases. For example, the outbreak of gall midge in Orissa

State in 1962 caused a great deal of damage to 75,000 ha. of land on the down-stream of Hirakud dam. The yield of crops at the Indo-Japanese Demonstration farm at Sambalpur, which was just established that year, dropped sharply because of gall midge. Guidance and cooperation extended by Japan at the time of violent outbreak of rice bacterial leaf blight in the following year 1963, gave a vivid impression to the research institutes in India. In 1967 the outbreak of paddy borer was reported in the area centering around Agricultural Extension Center at Khopoli. The outbreak of this insect was reported for three consecutive years in the entire state of Maharashtra. As a result, State Government requested Japanese expert assigned to the Agricultural Extension Center to provide guidance on the technique of forecasting outbreak of paddy borer. Outbreak of Tungro virus disease in paddy fields in the basin of the Ganges River in 1969 done a great deal of damage to the rice crop of new variety developed by India's own efforts.

Paddy fields in India show the extreme severity once attacked by these diseases or insect pests. It is obvious that these conditions will become a major obstacle to rice production in India which is aiming at expanded production by introducing new varieties in the future. Being aware of this fact, the Ministry of Food & Agriculture effected the pratrol survey in the four northern states in 1970 with a view to forecasting outbreak of rice diseases and insect pests. This measure was prompted by the damage to the crop done by the outbreak of Tungro in this region and aimed at establishing the methods of forecasting the recurrence of diseases and insect pests by gathering the necessary data for the year to come.

The plant disease and insect forecasting project, and the related research were inaugurated in Japan in 1941 when there was the outbreak of leafhoppers, and Japan has 30 years of experience in this field. Though the forecasting project is implemented under the administrative control of the plant protection authorities, technical phase of the project must be shared by the research organizations. Accordingly, the research field and administrative field have been acting in concert and "The General Plan of Plant Diseases and Insect Forecasting Project" has been completed by the Joint effort of the two sides. This plan is to be revised almost every five years to keep pace with the

advancement in study.

India is now experiencing the same situatiin by the outbreak of virus diseases caused by leafhoppers as that Japan experienced in 1941 by the outbreak of leafhoppers.

Therefore, the best result can be expected from the cooperation of Japan in the field of disease and insect forecasting and related research and study.

Details of the proposed joint research project are as follows.

Diseases and insect pests to be covered

Diseases and insect pests to be covered by the proposed research co-operation project will be limited to paddy borer, gall midge, green rice hopper, tungro and bacterial leaf blight. These are the major diseases and insect pests that cause damage to rice crop in India. The reason for limiting the number of diseases and insect pests for research cooperation is that intensive research may be carried out on these diseases and insect pests at first.

Research for the establishment of methods of forecasting outbreak of diseases and insect pests will be divided into applied research and fundamental research. In the field of applied research, survey of the ecology of outbreak on the farm where there is actual outbreak of diseases and insect pests will be the central objective. And any problem encountered in the course of applied research will be taken up for fundamental research. For the purpose of applied research, use of state-run agricultural experiment stations and agricultural extension centers is conceivable. For the field of fundamental research, Indian Agricultural Research Institute is considered most suitable.

On condition that the research cooperation project covers a period of five years, details of subjects for study in the project will be as follows.

Stem Borer

Year	Applied Research	Fundamental Research	Fundamental Research (Short-term plan)
1st year	Study of population dynamics during rice crop season (General)	Physiological study of hybernating generation (dry season)	Classification and distribution of stem borer
2nd year	" (study of migratory behaviors)	"	Biochemical study at the time of outbreak and hybernating generation
3rd year	" (Study of multiplication mechanism in paddy field)	" Study of physiology and ecology of population at the time of outbreak	" Study of population dynamics at the time of outbreak
4th year	" (Study of the timing of plant protection)	"	Study of the method of estimating population density
5th year	" (Establishment of methods of forecasting outbreak)	"	

Gall Midge

Year	Applied Research	Fundamental Research	Fundamental Research (Short-term plan)
1st year	Study of population dynamics during rice crop season and during hybernation	Study in relation to host-range and gall formation (General)	Classification and distribution of gall midge
2nd year	" (Study of host range)	" (Egg deposition and multiplication of lava)	
3rd year	" (Study of imigratory behavior)	" (Laval development and gall formation)	Physiology of gall formation (plant)
4th year	" (Study of mechanism of damage)	" ———	Genetics and physiology of resistance ———
5th year	" (Study of method of forecasting outbreak)	" (")	

Leaf Hopper - Tungro

Year	Applied Research	Fundamental Research	Fundamental Research (Short-term plan)
1st year	Study of outbreak and population dynamics of vector	Multiplication and distribution of virus in rice plant and vector	Classification and distribution of leaf hopper
2nd year	" (Study of source of vector)	" (Establishment of detection method)	Study of serological method
3rd year	" (Study of source of virus)	"	
4th year	" (")	"	Genetics and physiology of resistance
5th year	" (Establishment of method of forecasting outbreak)	"	

Bacterial Leaf Blight

Year	Applied Research	Fundamental Research	Fundamental Research (Short-term plan)
1st year	Study on the pattern of bacterial population during rice crop season (General)	Isolation of bacteria, pothogenicity of bacteria and sensitivity to bacteriophage (*Study of* bacteriological physiology)	*Identification of* bacterial strain Serological study
2nd year	" (*Study on the source of disease* outbreak)	" (")	
3rd year	" (")	" (")	
4th year	" (")	" (Distribution of bacterial strains)	
5th year	" (Establishment of methods of forecasting outbreak)	" (")	

The afore-mentioned research must be carried out in collaboration with the Indian researchers, and the findings must be incorporated in the technology of forecasting disease outbreak. In other words, the research cooperation project must be carried out on condition that while research is conducted in small divisions of applied and fundamental research, findings should be incorporated in the technique of forecasting outbreak of diseases and insect pests.

The forecast project in India will be planned in the unit of district in the future. As the administrative structure of district in India is fairly systematic, guidance will probably be provided by plant protection officers of the district or provincial government in the near future. In such a case, the findings which serve as the basis of technical advice by these field instructors will be provided under the proposed research cooperation project for the establishment of methods of forecasting outbreak of diseases and insect pests.

Though the applied research is closely related to the fundamental research, fundamental one should go deep into subject and aim high, and the results of research should be incorporated into the forecasting technique of the national level under the control of the ministry of Food & Agriculture. As these are many capable researchers in India and there also are some researchers of world-wide fame, the Japanese researchers must, in the course of their research work, consolidate the results of research and incorporate them, along with the results of applied research, into the forecasting technique in collaboration with their Indian counterparts. This point is characteristic of the proposed joint research project.

As the research for establishing methods of forecasting requires data gathering for a period of at least five years, the expected results may not be obtained within the very limited five year period. Even in the period of five years, however, progress of research aiming at the establishment of forecasting procedures will leave its own footwork in the research and administrative organizations in India. It will be advantageous to both Japan and India to transfer the results of research obtained during the project period, to the Indian institutes as soon as possible and direct the efforts of the Japanese researchers to the fundamental research as much as possible.

In actuality, there will be many cases in which the Japanese researchers will not be able to devote themselves only to a sophysticated study in specific field. It will be necessary to establish procedures by which experts in specific field may be called from Japan for assignment on short-term basis. Cooperation of experts on short-term assignment is particularly valuable in India. If this short-term system is incorporated into the project, researchers on long-term assignment will be able to engage in a wide rage of research work, and assign the research of specific subject to these short-term researchers. It makes the research cooperation more profound and significant.

For short-term research cooperation, the so-called exchange programme will also be practical, under which young and active researchers in India will be invited to Japan for study, and assigned to the research of specific subject upon return to India.

Various questions concerning plant diseases and insect pests which are the subject of the proposed research cooperation project have been discussed between the Japanese and Indian Government in the course of accomplishment over a nine year period from the day of the demonstration farm to the present agricultural extension center. As a result, it was generally recognized that plant protection involves many problems which can be solved only by strong measures initiated by the central government or state governments. The requirement for introducing forecasting technique to solve these problems has also been perceived in India. The proposed research cooperation project for the establishment of method of forecasting is to comply with the desire of the Indian Government. The Indian Government should give consideration to the possibility of requesting Japan's cooperation also in the field of plant physiology, genetics and agricultural meteorology, as necessary.

II. DISPATCH OF RUDIMENTARY SURVEY MISSION

It is decided that rudimentary survey mission will be dispatched to India for a period of one month from November 21, 1971.

1. Members of Survey Mission

Kotaro Nagai	Head of Mission	Head, Research Division, Tropical Agricultural Research Center, M.A.F.
Shunkichi Iwasa	Horticulturist	Director, Ibaragi Prefectural Horticultural Experiment Station
Hiroshi Fujii	Plant Pathologist	Chief, 1st Bacteriology Lab., National Institute of Agricultural Sciences
Socho Nasu	Entomologist	Chief, 4th Entomology Lab., National Institute of Agricultural Sciences
Yutaka Noshiro	Liaison	Agricultural Cooperation Dept., OTCA

2. Purpose of Survey

A. Disease and Insect Forecasting

(1) Preliminary negotiation with officials of the Indian Government for the project planning aimed at developing and establishing the method of forecasting outbreak of rice diseases and insect pests.

(2) Observation at Indian research institutes which will participate in the proposed joint research project, and consultations with Indian specialists in plant protection.

(3) Review of anticipated problems arising from the project planning and implementation of the project.

B. Horticulture

(a) Confirmation of India's request for Japan's cooperation in the field

of horticulture, background and details of the request.

(b) Field survey of proposed horticulture project area in Himachal Pradesh state, Uttar Pradesh state, Bihar state, and Mysore state, as required.

C. Preparation of a master plan of the joint research project on the basis of the outcome of negotiations with the Indian counterparts and the findings of survey.

3. Itinerary of Survey Mission

According to the primary schedule, Survey Mission left Japan on November 21, 1971. After arriving in India, the Mission paid a call to the Japanese Embassy, and discussed the schedule of the Mission with participation of Mr. Kosaka, Agricultural Attache of the Embassy. Then, the Mission prepared a schedule in consultation with the Ministry of Food & Agriculture, Government of India.

As a result, members of the Mission were divided into following 2 groups, working separately from each other during certain period.

Plant Protection Group:

Nagai, Fujii and Nasu, members of the Mission.

Horticulture Group:

Members Iwasa, Noshiro and Secretary Kosaka of the Japanese Embassy.

For this line-up, the Indian Government assigned Dr. T. P. Sriharan ((Entomologist, ICAR) to the plant Protection Group, and Dr. Daljit Singh (Horticultural Deputy Commissioner, IG) to the Horticulture Group.

The itinerary of the Survey Mission finalized in cosultation with Ministry of Food & Agriculture was as follows. Though the Plant Protection Group was able to carry out its assignment on schedule, the Horticulture Group had to suspend its activities after December 17 because of the Indo-Pakistan conflict.

Itinerary of the Japanese Delegation on

Horticulture and Plant Protection Groups

November

21	Arrive Delhi
22	Discussion with Embassy
23	Discussion with Ministry of Agriculture and finalisation of itinerary
24 & 25	Visit IARI-Division of Horticulture, Entomology and Plant Pathology

HORTICULTURE GROUP	PLANT PROTECTION GROUP
26 Dep. Delhi By Road Arr. Srinagar (Pauri Garhwal)	26 Dep. (650) Delhi IC401 Arr. (845) Calcutta Dep. (1230) Calcutta IC261 Arr. (1330) Bhubaneshwar Dep. (1500) Bhubaneshwar By Road Arr. (1630) Cuttack
27 to 29 HALT AT SRINAGAR (Visit Joshimath and Pauri Garhwal areas for seeing horticulture development and fruit research station, Chaubattia, Ranikhet)	27 to 28 HALT AT CUTTACK (Visit Central Rice Research Institute)
30 Dep. Srinagar By Road Arr. Delhi	29 Dep. (700) Cuttack By Road Arr. (900) Bhubaneshwar Dep. (1040) Bhubaneshwar IC262 Arr. (1200) Calcutta
December	30 Dep. (1045) Calcutta IC265 Arr. (1305) Madras Dep. (1915) Madras IC509 Arr. (2010) Bangalore
1 Dep. Delhi (720) IC403 Arr. Bangalore (1050)	December
2 HALT AT BANGALORE (Visit Indian Council of Agricultural Research's Institute of Horticulture Research, Hessarghatta, University of Agricultural Sciences, Bangalore, Lalbagh 4 Garden, Bangalore)	1 HALT AT BANGALORE (Visit University of Agricultural Sciences, Bangalore and Institute of Horticulture Research, Hessarghatta, and 4 Lalbagh Garden, Bangalore)

	HORTICULTURE GROUP			PLANT PROTECTION GROUP	
5	Dep. Bangalore (1550) Arr. Delhi (1920)	IC404	5	Dep. (1550) Bangalore Arr. (1645) Hyderabad	IC404
6	Dep. Delhi (605) Arr. Ranchi (1055)	IC411	6	HALT AT HYDERABAD (Visit Rice Project Co-ordinators Centre and Plant Protection	
	Dep. Ranchi	By Road	7	Institute)	
	Arr. Netarhat				
7	Dep. Netarhat	By Road			
	Arr. Ranchi (for night halt)		8	Dep. (1725) Hyderabad Arr. (1920) Delhi	IC404
8	Dep. Ranchi (740) Arr. Delhi (1230)	IC412	9	Preparation of Report, additional visits to Indian Agricultural Research Institute and discussion with the Indian Authorities	
* 9	Dep. Delhi (600) Arr. Ludhiana (1200)	Road			
	(Visit Horticulture Experiment Station of Punjab Agri. University, Ludiana)				
10	Dep. Ludhiana Arr. Chandigarh	Road			
11	Dep. Chandigarh Arr. Delhi	Road			
12	Preparation of Report and discussion with Indian Authorities				
16			16	Departure to Tokyo	
17	Departure to Tokyo		18	Arrive Tokyo	

* The trip was suppressed by order.

III. RESULTS OF SURVEY

1. Disease and Insect Forecasting Group

a. Proposal of a Joint Research Project at the Ministry of Food and Agriculture (November 23, 1971)

At the Ministry of Food & Agriculture Nagai, head of the Mission, formally made an offer for joint research cooperation to Dr. K. Prasad, Deputy Director, and officer in charge of the project at the Ministry of Food & Agriculture. He explained the outline of the proposed research cooperation project for the "Establishment of Methods of Forecasting Outbreak of Rice Diseases and Insect Pests" in line with the proposal made to Deputy Minister T. P. Singh who had previously made a visit to Japan.

It was apparent that there had been sufficient consultations on this proposal in advance between Secretary Kosaka of the Japanese Embassy and officials of the Indian Government, and the names of officials from the Ministry of Food & Agriculture and ICAR who would be assigned to the Plant Protection Group and Horticulture Group were immediately announced at this meeting.

Officials of the Ministry of Food & Agriculture including Dr. K. Prasad showed a great interest in the activities of the Horticulture Group, but the object of the Survey Mission that only a fact-finding Survey would be made in the field of horticulture during the current trip, which was notified to the Indian side in advance by Secretary Kosaka, was well understood by the Indian officials.

Finally, the question of concluding a bilateral agreement on Indo-Japanese agricultural research cooperation was brought up for discussion and the Indian side set forth its views on whether the agreement should take the form of a general agreement on agricultural research cooperation or the form of an agreement limited to the research cooperation for establishment of forecasting procedures. Although no conclusion was reached on this subject at the meeting, Dr. Prasad expressed the view that it would be more advantageous to India to conclude a general

agreement covering every kind of agricultural research cooperations, and specific problems should be resolved through exchange of letter in each case.

b. Discussions at the Indian Council of Agricultural Research (November 23, 1971)

Chief delegate Nagai paid a courtesy call on secretary General Dr. B. P. Pal and immediately began discussions in detail with Deputy Secretary General Dr. T. R. Mehta. Dr. Mehta had been in close contact with the Japanese Government ever since the establishment of "Model Farm" in India, and had been well informed of the intent of the Mission. He approved the proposed research cooperation project for the establishment of forecasting precedures if no objections were raised by the Indian research institutes concerned. At this meeting, a representation was made by the Indian side on the substance of the proposed research cooperation, and views were exchanged on the designation of diseases, insect pests and crops to be covered by the project, but the intent of the Mission was soon understood by the Indian counterparts.

c. Discussions at the Indian Agricultural Research Institute (IARI) (November 24, December 10 - 11, 1971)

Chief delegate Nagai called on Director Dr. M. S. Swaminathan at IARI on December 10 and explained the purpose of the Survey Mission. Previous to this visit, Nagai called on Dr. S. P. Raychaudhuri, Director of the Pathology Department, and Dr. Pradhan, Director of the Entomology Department at the same institute on November 24, and exchanged views on the proposed research cooperation for the establishment of methods of forecasting. A call was made again on these two officials after the completion of field tar for discussion in detail.

As a result, the following opinions were expressed by the two officials.

Insect control and related matters (By Dr. S. P. Pradhan).

"The overall concept of the research cooperation project is very good. I (Dr. Pradhan) have been exchanging views with the Japanese researchers

on the physiological study of stem borer and have exchanged a great deal of information in the past. "Rice revolution through crop protection" is my cherished view on the rice production in India." Dr. Pradhan is a senior director at IARI and is worldly known in the field of insect morphology. He has a wide knowledge on plant protection and has powerful influence with research institutes in India. Details of the proposed research cooperation project worked out by Dr. Pradhan and Dr. Phatia of the Entomology Department were as follows.

1) Insects to be covered:

Yellow stem borer

Gally fly

Jassids

Gunghy bug

It was agreed that the fundamental research on these insects would be carried out jointly by the Japanese and Indian researches at the Entomology Department, IARI. At present, no researcher at the Entomology Department are specializing the above-mentioned insects. When the proposed research cooperation project gets under way, assignment of junior entomologist to the research of specific insect will be practical.

2) Field experiment:

For field experiments, designation of the following sub-stations would be desirable.

Cuttack (Yellow stem borer)

Warangal (Gally fly)

Pusa (Bihar Province) (Gunghy bug)

Rahuri (Gally fly)

An entomologist and about two research assistants may be assigned to each of these sub-stations.

3) Exchange programme:

One Indian entomologist will be sent to Japan for training and one Japanese researcher will be received by IARI each year.

The above is an outline of discussions held at the Entomology Department, IARI. The Entomology Department has been conducting research on injurious insects generally encountered in agriculture but has no section that specializes in the research of rice insects. The Department is well arranged for the study of such fields as insect taxonomy, physiology and genetics, and is considered adequate for the proposed research work. However, due to the fact that the Indian's scheme of plant protection is a grand conception which covers the whole country, this scheme often conflicted with the concept of the proposed research cooperation project which places emphasis on the forecasting outbreak of diseases and insect pests. On this point, the difference in views between Dr. Pradhan and the Mission was not ironed out completely due to the limited time available during the current survey trip. There is a need to have further discussions to coordinate views with officials of the Entomology Department at the next session.

Plant Diseases and Related Matters (By Dr. S. P. Raychaudhuri)

Dr. Raychaudhuri, Director of the Pathology Department, is a specialist in plant virus and tissue culture. He also has been instrumental in the advancement of study of bacterial leaf blight and virus diseases by establishing a rice disease research laboratory in the Pathology Department. Accordingly, he expressed full approval of the proposed research coooperation project.

Plant diseases on which research is conducted currently at the Pathology Department include Tungro virus disease, its insect vector, and bacterial leaf blight.

Tungro virus disease and its insect vector N. virescens

It was made clear that a wide range of research cooperation would be possible such as isolation and purification of virus particles, identification of tungro by means of fluorescence anti-body technique, ecology of vector insects, epidemiology of tungro virus disease, establishment of forecasting procedures of disease outbreak, etc. Some of these researches are already in progress at the Pathology Department.

Research Staff

Research of tungro virus is being conducted by Mr. M. D. Mishra (Virus pathologist) and Dr. A. N. Basu (virus entomologist). When the proposed research cooperation project becomes a reality, these researchers will naturally participate in the project. Besides, participation of senior research assistants in the research group will also be possible.

It is hoped that virus entomologists and virologists be sent from Japan as visiting scientists. It is further requested that an entomologist, a virologist and an electron microscopist be sent from Japan and assigned to IARI to provide instructions for a period of 3 to 6 months, as part of the Exchange Programme. It is hoped that an exchange programme under which an Indian researcher may be sent to Japan for training for a period of one year or six months also be worked out. The existing laboratory, microscops and green house may be utilized for the proposed research cooperation project, but it is also necessary for Japan to provide some more research equipments.

The above is a summary of Dr. Raychaudhuri's opinion concerning the research on tungro and its vector insects. Members of the tungro research group were very friendly and kind toward the Survey Mission and it seemed that their research activities were steadily approaching substantiality.

Rice Bacterial Leaf Blight

Research on rice bacterial leaf blight at IARI began in 1963, and has obtained notable results under the ICAR Scheme in the past several years. At present, Dr. Y. P. Rao and Dr. S. K. Mohan are engaged in this research as bacteriologists. When the proposed research cooperation project is materialized, IARI intends to make a request to the Indian Government to assign two more bacteriologists for cooperation with the Japanese experts. It is requested that specialists on epidemiology and bacteriophage will be sent from Japan on short-term basis of 3 to 6 month period, in addition to a long-term specialist. A training programme is also worked out under which one Indian researcher may be sent to Japan for training

of one year or 6 months. The following definite research subjects were pointed out; (1) survival of pathogenic bacteria in seeds and weeds infected by leaf blight bacteria (2) study of kresek symptom (3) infection of rice seedling in nursery bed (4) dissemination of bacteria by insects (5) variation of bacteria in pathogenicity (6) assessment of crop damage caused by disease (7) bacterio-phage method and other advanced bacteriological technology.

Besides, they expressed their desire to equipt such facilities as growth chamber, vaccum freeze dryer, high speed centrifuge, etc.

d. Discussions at the Central Rice Research Institute (CRRI)
(December 27 and 28, 1971)

The Mission had an opportunity to meet with Dr. S. Y. Padmanabhan, Director of the Institute, while he was attending a meeting at Bhubaneshwar, and Chief delegate Nagai's explanation on the purpose of the mission was readily accepted by the Director. The Mission immediately headed for CRRI, and upon arrival, heard opinions of experts in the field of entomology and plant pathology concerning the proposed research cooperation.

In the field of entomology, opinions were given by Mr. J. P. Kulshrestha playing a leading role in the discussion. As a result, it became clear that the Institute has the following scheme.

1. Rice gall midge

The laboratory of the Institute has already bagun research on the forecasting procedures of outbreak of insects by studying the number of insects caught by light trap. Therefore, it is the desire of the Institute to make a further study on the mechanism of break-out of this insect by clarifying population dynamics in the field and its relationship to meteorological phenomena.

2. Rice leaf hoppers

An outbreak of these insects is frequent with high yield variety of rice causing a great deal of crop damage and they are also vectors of tungro virus.

It is the desire of the Institute to clarify the mechanism of

outbreak of these insects to establish methods of forecasting their outbreak.

3. Stem borers

Research is to be made to clarify variation in population of stem borers in the field by studying their population dynamics and its relationship to climatical factors, their ecology during the hybernation and their natural enemies.

4. Other injurious insects

Rice gundhi bug

Rice hispa

Rice leaf folder

CRRI is considered most suitable as the center of research on the above-mentioned insects and IARI is more suitable as the center of research on rice gundhi bug.

The following locations may be mentioned as suitable sites for research on population dynamics of insects.

Leaf hoppers - Arrah (Bihar)

Gundhy bug - Faizabad (U. P.)

Rice hispa - Mandya (Mysore)

Leaf folder - Adhuthurai (Tamilnadu)

As for research staff, two junior entomologists and two insect physiologists will be able to participate in the project. Besides, participation of some research assistants can also be expected.

It is requested that an insect ecologist, a specialist on leaf hoppers and an expert in insect forecasting with be sent to India from Japan on one or two year assignment. It is also requested that two Indian specialists be trained in Japan each year.

The above is a gist of views expressed by officials of CRRI concerned with entomology. Dr. Padmanabhan, Director of CRRI is a plant pathologist himself and seemed to have made careful study of the proposed research cooperation project.

Plant Pathology

The Plant Pathology group, headed by Dr. N. K. Chakrabarti and staffed by more than ten scientists including senior pathologists Drs. S. C. Mathur, S. Devdath, Messrs. J. V. Raghavan S. S. Jain, is actively engaged in the research work with a pride of being the research center on rice plants in India. Director of the Institute Dr. Padmanabhan is a well known pathologist on rice blast problem. He also has published the papers of his research on the prevention of rice bacterial leaf blight since this disease prevailed in India. At present, Dr. S. Devdath's working on bacterial leaf blight problem.

The following is the outline of discussions held with the above-mentioned staffs with the participation of Dr. Chakrabarti.

CRRI would approve and heartily welcome the proposed research cooperation project for the establishment of disease and insect pests forecasting procedures. Main research center of the projects should be located at CRRI. The reasons for this are: (1) CRRI is the center of the country as far as rice research is concerned; (2) All pathologists assigned here have been earnestly engaged in the research on rice diseases and many of them have 10 - 20 years experience in this field. All of them are willing to extend their cooperation to the proposed project; (3) The Institute is capable of sparing sufficient room for laboratory and accommodation for the Japanese specialists to be assigned to the project; (4) CRRI is equipped with its own medical, water and power facilities, and no inconvenience will be felt by the Japanese staffs.

As for subjects of research on bacterial leaf blight, they emphasized the importance of epidemiological study at habitually infected areas. The Institute is also ready to extend its full cooperation to bacteriological study in laboratory.

Although the proposed project takes up only bacterial leaf blight, the Institute has an accumulation of data on the forecasting of rice blast over long period of time. It is requested, therefore, that this subject will also be included in the project if possible, and a Japanese expert in blast problem will be sent to India on short-term basis.

e. Discussions at AICRIP (December 6 & 7, 1971)

Explanation was made on the purpose of the Mission by Nagai at a meeting with Dr. S. V. S. Shastry, Director of the Institute and Dr. W. H. Freeman at AICRIP, Hyderabad. Then, members of the Mission looked around the laboratory and experiment field.

The research on rice diseases and insects pests at AICRIP is centered on stem borers, rice gall midge, tungro, bacterial leaf blight and rice blast. Research in this institute is conducted with special emphasis on the development of new resistant varieties.

The staff members of the Institute also showed the interest in the proposed research cooperation project for the establishment of forecasting procedures, and expressed that they were ready to cooperate in the whole project. However, the Mission requested them to give their opinion on two subjects of the project, gall midge and tungro.

1) Gall midge

Subject for Study: Ecological study of population dynamics of gall fly particularly in relation to biotype, resistant varieties, climatical factors and natural enemy.

Opinions were given by the Indian researchers on the possible cooperation in the research of such interesting subjects as ecological study of population dynamics in the field, study of parasite in the field, study of biotype of gall midge and study of resistance mechanism in cooperation with the field of breeding. They also stated that there was need of researchers who would specialize the study of gall midge and that they had sufficient data and material for such a study.

As for the place of research cooperation, facilities of AICRIP are available as a matter of course. Besides, 10 experimental fields at same of the sub-stations in India may be selected for ecological study of population. As the outbreak of gall midge is closely related to climatical factors, a comprehensive study on this subject can be accomplished at AICRIP (Hyderabad).

In this connection, assignment of Japanese scientists, each of

the following, is desired.

1) Insect Population Ecologist
2) Agricultural Climatologist
3) Plant Physiologist

The plant physiologist mentioned above is required for study of host-parasite interaction.

Participation of several assistant researchers from AICRIP in the project is possible. Staffs of sub-stations will also be able to extend assistance to the research project.

2) Leafhopper-Tungro

Subject for study: Study on ecology of leafhoppers and jassids, and of rice virus diseases transmitted by these insects.

Leafhoppers and planthoppers

Study of life cycle of leafhoppers and planthoppers, their natural enemy and mechanism of host resistance including their geographical variability, relationship between population dynamics and climatical factors and migratory behaviour.

Tungro

Study of purification of virus, serology, host-range and symptomatology of virus disease, strains of virus and their interaction and pathogenic variability of the virus.

Relationship between virus and insects

There are the subjects, on which they were ready to extend their assistance to the proposed research cooperation project.

They expressed their desire for the assignment of Japanese researchers consisting of a population ecologist, a virologist (electron microscopy), an insect geneticist and a climatologist for this project including research cooperation on short-term basis. It was understood that the Indian side was ready to assign almost the same number of experts to the project.

Although there is considerable uncertainty as to the possibility

of continuing research aimed at developing methods of forecasting because of the fact that AICRIP gives top priority to developing resistant variety of rice, Dr. Shastry gave assurance on this point by saying half in joke that the proposed research could be accomplished with no difficulty unless it did stop the study on breeding at the institute. His remark evinced his strong desire for participation of an entomologist in breeding resistant variety of rice.

Advanced research at AICRIP under the direction of Director Dr. Shastry and Dr. Freeman, and abundant research materials available at the institute are worthy of attention.

In the field of pathology, AICRIP was staffed with leading foreign bacteriologists (Dr. Masao Goto from Japan, Dr. H. E. Kauffman and Dr. I. W. Buddenhagen from USA) who were assigned to the institute sometime from 1968 to 1971 under the USAID Programme.

To facilitate their research, such laboratory equipment as high-speed centrifuge, vacuum freeze dryer, spectro-photometer and incubator are provided, and maintained in good working condition. The institute has so far made a series of reports on the findings concerning disease ecology in field, assessment of crop damage, methods of inoculation for resistance tests, etc.

Dr. Buddenhagen who was currently on the assignment to the institute emphasized the importance of ecological study of bacterial leaf blight in the field in relation to disease forecast.

On the proposed joint research cooperation project, both Dr. Shastri and Dr. Freeman repeatedly emphasized the advantage of Hyderabad in respect of research and living condition, and expressed their approval of the project.

f. Observation Tour of the Central Plant Protection Training Institute (December 7, 1971)

Prior to the departure from Japan, the Survey Mission is informed about the application being submitted by the Central Plant Protection Training Institute to the United Nations for grants to expand its facilities.

As the actual state of this institute had not been made clear to the Japanese scientists so far, the Mission made a visit to the institute located at Hyderabad.

Established in 1966, the institute is engaged in such activities as sponsoring educational, and academic meetings, research and experiment in plant protection. The training course is divided into the long-range and short-term course. Lectures are given on the subject of plant disease and insect control, and weed control. Research and experiment are conducted in parallel to seminars and academic activities. Research work is divided into the field of applied entomology, plant pathology, agricultural chemistry and agricultural implements and one to five researchers are assigned to each field. The institute has total members 25 personnels.

The main function of the institutes seems to be the education of trainees and for this reason, the institute seems to lack sufficient laboratory facilities. Members of the Mission looked around the library and farm equipment room lead by Mr. B. K. Varma (entomologist) and Mr. T. B. Lal (Plant pathologist), and the laboratory of Mr. V. Lakshmimarayana (Agricultural chemistry).

IV. SUMMARY OF FINDINGS AND JOINT MEETING AT MINISTRY OF FOOD AND AGRICULTURE

1. Summarization of Findings (December 9 & 10, 1971)

Upon return to New Delhi, the Survey Mission reviewed, at the Japanese Embassy, the results of discussions held at each of the institutes visited by the Mission, and summarized the findings as follows.

Summary of the observation tour of Japanese mission
on joint research project

Members of Mission expressed their deep appreciation to the authorities concerned of the Government of India for kindly making every necessary arrangement for the observation trip. The Japanese mission was divided into two groups and made observation on each specific field of research. They also expressed their thanks to Dr. T. P. Sriharan, Entomologist, ICAR and Dr. Daljit Singh, Hortioultural deputy commissioner, Ministry of Agriculture, who accompanied plant protection and horticultural-group respectively. This is a summary of the preliminary report. The final and authentic one will be submitted at a later stage.

I. Plant protection (forecasting) group:

Members of plant protection group visited several agricultural institutions including IARI (Delhi), CRRI (Cuttack) and AICRIP (Hyderabad) and had fruitful discussion with many scientists there.

All plant protection scientists agreed that the control of diseases and insect pests has become one of the most important factors for "Green revolution in rice", and welcomed the Japanese proposal to establish effective method of disease and insect forecasting through Indo-Japanese joint research project.

A detailed operation plan of the project should be discussed and drawn up later in mutual consulation between authorities concerned of the two Governments.

A tentative programme suggested by this group on research centres for respective subjects is as follows:

	IARI	CRRI	AICRIP
Stem borer	⊠	→ O	
Gall midge		O ←	⊠
Leaf hopper, Tungro complex	⊠	→	O
Bacterial leaf blight	⊠	→ O	

⊠ : Center
O : Seasonal Sub-center

II. Horticultural Group:

Observations were made in hilly areas in U. P. and Bagalore and Coorg in Mysore. It was their impression that horticulture in Mysore including institutes of the Central and State Governments is in a fairly advanced stage, whereas in hilly areas in U. P. there is much to be done. During their observation tour, Indian officials and scientists concerned suggested some proposals to be taken up as Indo-Japanese joint projects, for example, area development project in hilly areas in U. P., joint research projects in hilly areas and Mysore.

A final report in detail will be prepared in Japan and sent to the authorities concerned of the Government of India in due cource of time.

III. Proposal:

To develop the cooperation in the field of agricultural research, it was desired to have a general agreement between two Governments under which the individual schemes of cooperation could be taken up.

However, this mission exchanged with the Indian side only the summary record of discussion on its forecasting project.

An agreement will be concluded by a next survey mission which is expected to visit India in March or so of 1972.

The central point in the issue was which institute should be selected for locating the centers when the proposed joint research project become a reality. After a series of discussions, an agreement was finally reached to locate the center for stemborer, leafhopper-tungro complex and bacterial leaf blight at IARI, and the center for gall midge at AICRIP. These centers will play the central role in the research activities under the proposed joint research project.

Besides, one location was added to each center as seasonal sub-center where researchers may stay temporarily to conduct their research work as required.

The main reason for not locating a center at CRRI which has a historic background was that consideration was given to the convenience in the living of Japanese researchers and their families.

Selection of AICRIP for locating the gall midge center was that the Mission attached importance to the close relationship of gall midge control to the breeding of resistant variety of rice. Although the research on bacterial leaf blight, and leafhopper-tungro complex at IARI is expected to make progress without any major problems, the study on stem borer was not sufficient due to the limited survey period as previously mentioned. It is hoped that the next survey mission will give due consideration to this point.

2. Negotiations at the Ministry of Food and Agriculture

(December 11, 12 and 16, 1971)

After summarizing the findings, members of the Mission, together with Secretary Kosaka of the Japanese Embassy, paid a visit to the Ministry of Food and Agriculture to make a comprehensive review of the findings. In parallel to the report on the survey, the Mission entered into a preliminary negotiation in preparation for the formal meeting in the room of Deputy Secretary Dr. Prasad. Dr. Mehta, Deputy Director General of ICAR also attended this meeting.

At this first meeting of preliminary negotiations, Dr. Prasad stated in a sharp tone to the effect, "We do not need research cooperation for research's sake. What we need is the research cooperation aimed at practical application in the field".

Against this, officials concerned of ICAR and members of the Mission refuted by saying to the effect, "In order to carry out plant disease and insect control efficiently and economically, it is essential to establish technique of forecasting and controlling the outbreak at early stage. The proposed research cooperation project is aimed at formulating a basis for the establishment of technique and is not intended for research's sake. It is also possible to start overall plant protection measures on trial by applying the technique of forecasting established on the results of the proposed research cooperation to actual use at the agricultural extension centers and to transfer problems fed back from such an experiment to the state-run forecasting project now under way".

With the explanation by the members of the Mission that the proposed joint research is not intending for the research's sake, and instead, its intetion is to establish a forecasting technique and is in comformity with the desire of the Indian Government. Dr. Prasad looked still dissatisfied but gave his approval reluctantly and changed the subject to horticulture.

The fact that such remarks as mentioned above were made by an influential official of the Central Government at the outset of the preliminary negotiations following the survey trip held in an atmosphere slightly different from that prior to the survey trip is considered to have stemmed from the insufficient explanation made by the Mission to convince officials concerned of the Ministry of Food and Agriculture. In particular, this Survey Mission, the primary purpose of which was to consult with the Indian side on "Research Cooperation", made contact only with ICAR and its subordinate research institutes and had no dialogue with officials concerned with plant protection of the Ministry of Food and Agriculture. The officer in charge of plant protection is Dr. S. N. Banerjee who has overall control over the forecasting project now under progress in five northern states of India. Dr. Banerjiee is said to have an intention of gradually expanding this forecasting project to all states of India. He made a trip to Japan in 1971 to observe the progress of the forecasting project and toured related research facilities in Japan. As a result, he understands the need of the proposed research cooperation and apparently had an intention of extending his cooperation to the

project.

It is natural for Dr. Banerjee who is in charge of the forecasting project which is already in progress, to have some doubts about the proposed research cooperation project. Because it had been heavily inclined to the research institutes, and the Mission spend considerable time on the contact of the research institutes.

Upon explanation on the purpose of the proposed joint research project, Dr. Banerjee approved the intent of the Mission and promised to provide enormous data and materials in his possession when the project become a reality. He further informed the Mission that CHINSURA was the most suitable site for research on stem borer.

In the course of these negotiations, Dr. Prasad deepened his understanding of the proposed joint research project. When the Mission presented to him a chart illustrating relationship between the proposed joint research project and the forecasting project now under way, he seemed to understand the position and significance of the proposed joint research project from the administrative point of view.

From this point the preliminary negotiation made smooth progress and a draft of summary record of discussion was almost completed by the tremendous efforts of Mr. Kosaka of the Japanese Embassy.

The question on the draft agreement on agricultural research cooperation which had been talked about prior to the departure for survey trip was not brought up for discussion in the course of the negotiation.

Negotiations at ICAR (December 15, 1971)

The negotiations which were originally scheduled to be held prior to the joint meeting at the Ministry of Food and Agriculture were held after the joint meeting, owing to unavailability of time.

At the meeting held in the room of Dr. Mehta, Deputy Secretary General of ICAR, and attended by Dr. M. D. N. Srivastara, officer in charge of plant disease and insect control, Dr. S. P. Raychaudhuri, Director of the Plant Pathology Department, IARI and Dr. S. N. Banerjee, officer in charge of plant protection at the Ministry of Food and Agriculture plus members of the Mission

and Mr. Kosaka of the Japanese Embassy, specialty subjects were discussed.

Discussions here centered on the substance of research to be out under the proposed project and Indian officials who had once been researchers themselves talked about their long-cherished vision which might stem from the proposed joint research project.

When the attendants of the meeting were asked for their opinions on the selection of site for locating research centers under the proposed joint research project, which was the biggest question confronting the Mission, there was no objection to the selection by the Mission. Only Dr. Banerjee again recommended CHINSURA (West Bengal) as an additional site for research on stem borer, to which the Indian showed their agreement.

Joint Meeting at the Ministry of Food & Agriculture (December 13, 1971)

A joint meeting on the proposed joint research project was held in the conference room of the Ministry under the chairmanship of Deputy Minister Mr. T. P. Singh.

Attendants of the meeting were Dr. K. Prasad, Deputy Secretary, Mr. R. N. Gupta, officer in charge of Dr. S. N. Banerjeer, officer in charge of plant protection, Dr. Daljit Singh, officer in charge of horticulture and Mr. A. J. S. Sody, Director of the Agricultural Extension Department, from the Ministry of Food and Agriculture, Dr. T. R. Mehta, Deputy Secretary General and Dr. D. N. Srivastava, officerin charge of plant disease and insect control, from ICAR, members of the Japanese survey Mission and Mr. Fujimoto, Counselor, and Mr. Kosaka, Secretary, from the Japanese Embassy in New Delhi.

Chief delegate Nagai presented to the meeting a summary of findings and a drat "Summary Record of Discussion" compiled at the preliminary negotiations.

At the outset of the meeting, Mr. Singh stated:

"Is India so behind in the field of rice disease and insect forecasting as to depend on foreign countries in respect of technology, researchers and facilities? I still cannot understand this point". To this question, mainly the Indian officials including Dr. Banerjee, Dr. Srivastava and Dr. Mehta made the following remarks.

Dr. Banerjee stated that as India has an accumulation of research data on stem borer gathered in some past 20 years, these data would be readily available to the researches when the proposed joint research project became a reality. Dr. Banerjee, officer in charge of plant protection at the Ministry of Food and Agriculture, is an entomologist himself having engaged in the research on stem borer for a long time at the agricultural research institute in West Bengal.

Dr. Srivastava stated that India has relatively little experience in the research on gall midge, leafhopper-tungro and bacterial leaf blight and in particular, the research on Tungro, which is a virus disease discovered in India only several years previously, has made little progress so far and that it would be advantageous to India if research cooperation was extended from Japan where advanced research is being conducted on all rice diseases an insect pests.

Summarizing these views, Mr. Singh concluded by saying, "The proposed joint research project is necessary for India to make up the backwardness in the research in the relatively new field and to narrow a gap between the study and technology in the advanced field", and instructed the Indian officials to work out a detailed plan with a view of implementing the project.

Later. Dr. Prasad proposed to add more items to the list of subjects for study. With the addition of itemized subjects proposed by Dr. Prasad, a "Summary Record of Discussion" was completed again on December 14 to narrow down the difference in views.

At the last half of the session Mr. Singh changed the subject to the field of horticulture and requested Japan's cooperation by saying, "As I am much interested in the cooperation from Japan in the field of horticulture, I am looking for cooperation from Japan in some form or other though it does not have to be in a concrete form at this stage". To this, the Mission pledged to convey the request to the proper channel of the Japanese Government after returning to Japan. Councilor Fujimoto of the Japanese Embassy stated to the effect that the Japanese Government is determined to proceed with the proposed joint research project according to the established policy even though the situation of India is not necessarily stabilized in the make of the India-Pakistan conflict. To this, Mr. Singh expressed his appreciation on behalf of the Indian Government.

Summary Record of Discussions between the Japanese Survey Mission and the Authorities concerned of the Government of India concerning the Indo-Japanese Joint Research Project for establishment of the methods of forecasting outbreak of rice diseases and insect pests held at the Ministry of Agriculture, the Government of India in New Delhi on December 13, 1971.

The Japanese Survey Mission headed by Dr. K. Nagai visited India from November 21 to December 17, 1971 for the purpose of finding the possibility of having the Joint Research Project for establishment of the methods of forecasting outbreak of rice diseases and insect pests and for an exploratory survey and discussions regarding the possibility of collaboration in horticulture. The Mission visited CRRI in Cuttack, the University of Agricultural Sciences in Bangalore, AICRIP in Hyderabad, IARI in New Delhi for field observations and discussions with their scientists on the proposed Project. They found that there was much to be done in the control of diseases and insect pests at this stage when rice production in India had entered the threshold of breakthough. In this connection, the Mission mentioned that high yielding varieties required liberal application of fertilizers for a full manifestation of their yield potential and, as a result of high level of fertilization, induced more diseases and insect pests. Therefore, it was essential to adopt the control measures against the diseases and insect pests in order to stabilize increase rice production. The Authorities concerned of the Government of India were of the same opinion on this point.

In view of the fact that any countermeasures for pests could prove effcient and economical only when the outbreak of the diseases and insect pests - when, where and to what extent they will occur - is well forecast, the said Project was recognized to serve as a basis for the disease and insect pest control, and it was agreed that an Agreement concerning the said Project would be concluded in March or so of 1972 as outlined below.

1. OBJECTIVE:

The objective of the Joint Research Project is to establish the methods of forecasting the outbreak of major rice diseases and insect pests in India.

2. DESCRIPTION OF THE PROJECT:

To implement the said Project, both sides will carry out the programmes

outlined in the Annexure.

3. OPERATIONAL WORK PLAN:

An operational work plan will be drawn up annually between the Japanese Researchers and the Indian Counterpart Researchers indicating the requirements of experts, staff, supplies and services, equipment and items of work, etc.

4. COOPERATION TO BE EXTENDED BY THE GOVERNMENT OF JAPAN AND THE GOVERNMENT OF INDIA:

(1) The Government of Japan, in accordance with laws and regulations in force in Japan, will take necessary measures to provide at its own expenses the services of Japanese Researchers required on both long-term and short-term assignment and also provide necessary equipment, machinery, tools, spare parts and other materials which will be utilized exclusively for the implementation of the Project.

(2) The Japanese Researchers mentioned above will be granted privileges, exemptions and benefits as admissible to experts assigned to India under the Colombo Plan Technical Cooperation Scheme.

(3) Customs duties and any other charges, if any, as may be imposed in India in respect of the articles mentioned above in (1), which will become the property of the Government of India upon being delivered c.i.f. at the port of disembarkation to the Indian authorities concerned, will be met by the Government of India.

5. INDIAN COUNTERPART RESEARCHERS:

The Government of India will take necessary measures to provide at its own expenses necessary Indian Counterpart Researchers who are to be engaged as well as requisite land and buildings for implementing the Project. The Government of India will also provide the office facilities for the Japanese Researchers including Indian staff required for the administration and maintenance of the above office.

6. SCOPE OF RESPONSIBILITY OF JAPANESE RESEARCHERS AND THE GOVERNMENT OF INDIA:

The Japanese Researchers will give technical advice and guidance to

the Indian Researchers and other technical personnel. The Indian authorities concerned will be responsible for the administration, operation and implementation of the Project.

7. RESPONSIBILITIES OF THE GOVERNMENT OF INDIA:

(1) According to the necessity for implementation of the Project, the Government of India will provide at its own expenses equipment, machinery, vehicles, tools, spare parts and other materials as well as their replacements available in India and other than those provided by the Government of Japan.

(2) The Government of India will bear the running expenses necessary for the implementation of the Project.

8. JOINT PROJECT COMMITTEE:

(1) There will be close cooperation between the Japanese Researchers and Indian Authorities concerned for the successful implementation of the Project.

(2) For this purpose, a Committee between the Japanese team and the Indian Authorities concerned will be set up.

9. THE TERM OF COOPERATION:

The proposed term of cooperation will be 5 years.

10. HORTICULTURE:

The Mission also looked into possibilities of collaboration in the field of horticulture. The Japanese experts were yet to formulate details of such cooperation. This will be possible after the report of their operation is available. The Indian side emphasized the need for such cooperation in the vast temperature zones. They also agreed that work on citrus was very important and cooperation would be welcome.

11. The present summary Record of Discussions, in part or in whole, is not binding either on the Government of Japan or on the Government of India. However, this may serve as the basis for finalising an Agreement for the implementation of the Project.

ANNEXURE

Operational Programme

(Research Subject)	Applied Research	Fundamental Research
(I)	Stem borer	
	1. Study population dynamics during rice crop season, relating to climatic factors such as rainfall, temperature and humidity to population change.	1. Physiological study of hibernating generation.
(II)	Rice gall midge	
	1. Study population dynamics during rice crop season, relating to climatic factors such as rainfall, temperature and humidity to population change.	1. Study biotypes and their genetic differences intensively in one location under controlled growth chamber condition.
	2. Study off-season biology to determine mode and locations of survival and role of alternative hosts.	2. Study mechanisms of host resistance with emphasis on plant and insect physiology interaction.
(III)	Leafhopper-Tungro	
	1. Study migratory behaviour of insect, life cycles and factors governing their population dynamics ecotypes, biotypes and mode of hibernation.	1. Detection and characterization of virus (purification, serology and electron microscopy).
		2. Host-range and symptomatology of virus disease.
		3. Strains of virus and their interaction.
(IV)	Bacterial Leaf blight	
	1. Role of infected seeds and weed hosts to disease outbreak.	1. Bacteriophage technique as a tool for detecting bacterial population.
	2. Factors influencing blight and wilt phase of the disease.	2. Pathogenic variability in pathogenic bacteria.
	3. Multiplication of bacteria in rhizosphere of other crops.	3. Bacterial physiology, serology and morphology in relation to physiological specialization of bacteria.
	4. Loss in grain yield of rice caused by disease.	

Establishment of forecasting procedure by the combination of Applied and Fundamental Research

(Staff)

	India	Japan
Senior Scientist	4	7
Junior Scientist	12	-
Visiting Scientist	-	11

(Exchange Programme)

4-5 personnels annually from India.

(Laboratory facilities to be required)

Electronmicroscope, Lyophylizer, Insectron, Phytotron, Ultracentrifuge, Ultramicrotome, Inoculation Chamber, Fluorescence Microscope, etc.

V. CONCLUSION

The matter of primary concern for the Rudimentary Survey Mission was whether the detailed plan of the joint research project for the establishment of the methods of forecasting outbreak of plant diseases and insect pests will be readily accepted by the Indian Government. Fortunately, the plan was welcomed by ICAR and other research institutes and was approved by the administrative authorities after detailed explanation on several problematic points. There was much progress on the part of the Indian Government that the Ministry of Food and Agriculture immediately began preparation of documents necessary for negotiations with the Finance Ministry for appropriation of budget.

The intention of the Indian Government was to implement the project by concluding an agreement as soon as possible. The reasons for the approval of the proposed joint research project by the administrative authorities of the Ministry of Food and Agriculture, after a few days' negotiations were;

1. The administrative authorities took prompt actions under the direction of Mr. Singh and that the proposed joint research project did not conflict greatly with the intent of Dr. Prasad outlined in his report on foreign aid (1970).

2. Sufficient and detailed pre-arrangements had been made through the effort of Secretary Kosaka of the Japanese Embassy in New Delhi.

3. The relationship between the proposed joint research project and the forecast project under progress in India was clarified and that the position of the proposed project in India was made clear to the Indian administration through a series of negotiations.

4. The Indian Government expects future cooperation from Japan in the field of horticulture following the proposed joint research project.

As the reaction of the Indian Government to the proposed project is at a high pace as mentioned above, the questions that will confront the next survey mission are expected to include the following.

1. Finalization of Record of Discussion and Handling of Questions Concerning the Scope of Agreement

As the substance of Record of Discussion has been discussed in detail between Dr. Prasad of the Ministry of Food and Agriculture and Mr. Kosaka of the Japanese Embassy, no major changes in the principal points are expected. However, there will be some substantial debates by both sides on the scope of an agreement which will be concluded subsequently.

2. Japan's Own Five Year Joint Research Programme

The Indian Government is expected to request the Japanese Government to present Japan's own plan for each year in planning a project. In such a case, there is no need for detailed programmes in the specific field of plant disease and insect pest.

3. Rollback of Request for Establishment of Additional Research Centers

As the nature of the proposed research center becomes clear, it is expected that other research institutes will request the establishment of additional centers.

4. Limitation of Scope of the Proposed Joint Research Project for the Establishment of Forecasting Procedures

The goal of the project must be set forth clearly (with due consideration to the relations with the agricultural extension center).

5. Handling of Problems Associated with the Establishment of Research Centers

Handling of problems mainly associated with the implementation of the project such as receiving of equipment and materials, their maintenance and storage, housings for Japanese experts and their families. Joint surveys by OTCA officials and experts on plant diseases and insect pests including a detailed survey for engineering of research centers necessary for the implementation of the project.

Although the Summary Record of Discussion exchanged between the Rudimentary Survey Mission and the Indian authorities lists the Tropical Agricultural Research Center and the Nat. Institute for Agricultural Sciences as the cooperation agency in Japan. It is meant that the implementation of the joint

research project is the responsibility of OTCA, and these institutes will extend cooperation in the field of research. Listing of these institutes was requested by the Indian authorities and the inclusion was approved by the Mission on the judgement that it would not be a major obstacle to the research in Japan.

As for the relationship between the proposed joint research project and the Japan-India Agricultural Extension Center, almost definite conclusions had been drawn for "Separation from each other" at the joint ministorial meeting held prior to the departure of the Mission. However, it was felt upon completion of the survey that there should be further study on the new phase of the relationship between the two for the following reasons.

1. The forecast project in India is being carried out on the national level (Long-term forecast) and on the state and district level (Short-term forecast) and the two are inseparable.

2. The technical guidance on plant protection at the Extension Center requires technology of plant protection aimed for states and districts.

The purpose of the proposed joint research project is to develop techniques to forecast abnormal breakout of diseases and insect pests several months in advance by linking the findings of research to the national forecasting project, whereas the forecasting technique provided by the state or district level is centered on the short-term forecasting method.

Taking a typhoon for example by way of comparison, the technique of forecasting the generation and course of typhoon is the long-term forecasting, and the technique of forecasting the consequence of the arrival of typhoon to work out detailed countermeasures is the short-term forecasting. There are considerable differences between the two from a theoretical point of view. Now, this short-term forecasting method will be applied to practical use as a technique in states and districts.

The Cooperation in developing such a technique will also be part of the responsibility of the proposed joint research project. If the proposed joint research project is to be separated completely from the Extension Center according to the existing policy which has almost been finalized, the following questions may be pointed out as a new development.

1. Whether or not the existance of research centers will be an obstacle to the guidance on plant protection provided on the state and district level.

2. If the cooperation for the proposed joint research project cannot be expected from the Extension Centers, there is a possibility that the necessary survey and research on disease and insect forecasting for states and districts will not be practical.

During the preliminary negotiations held at the Ministry of Food and Agriculture upon completion of the survey trip, the following was given as one of the reasons for the proposed joint research project not being "The research for research's sake".

"Under the proposed joint research project technical guidance on the plant protection in states or districts will be provided in an efficient and economical manner, and the participation of the Indo-Japanese agricultural extension centers in the demonstration will also be possible." This statement was made on the judgement that it was advisable for the proposed joint research project and the Extension Centers to develop such relationship in the future.

If the proposed joint research project is to be limited to the development of techniques for the national forecasting project (Long-term forecasting), a clear-cut explanation should be made to the Indian authorities to that effect.