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A REPORT OF THE JAPANESE AGRICULTURAL TECHNICAL ADVISORY TEAM FOR THE AGRICULTURAL DEMONSTRATION FARMS IN INDIA

DEC. 1966

Overseas Technical Cooperation Agency
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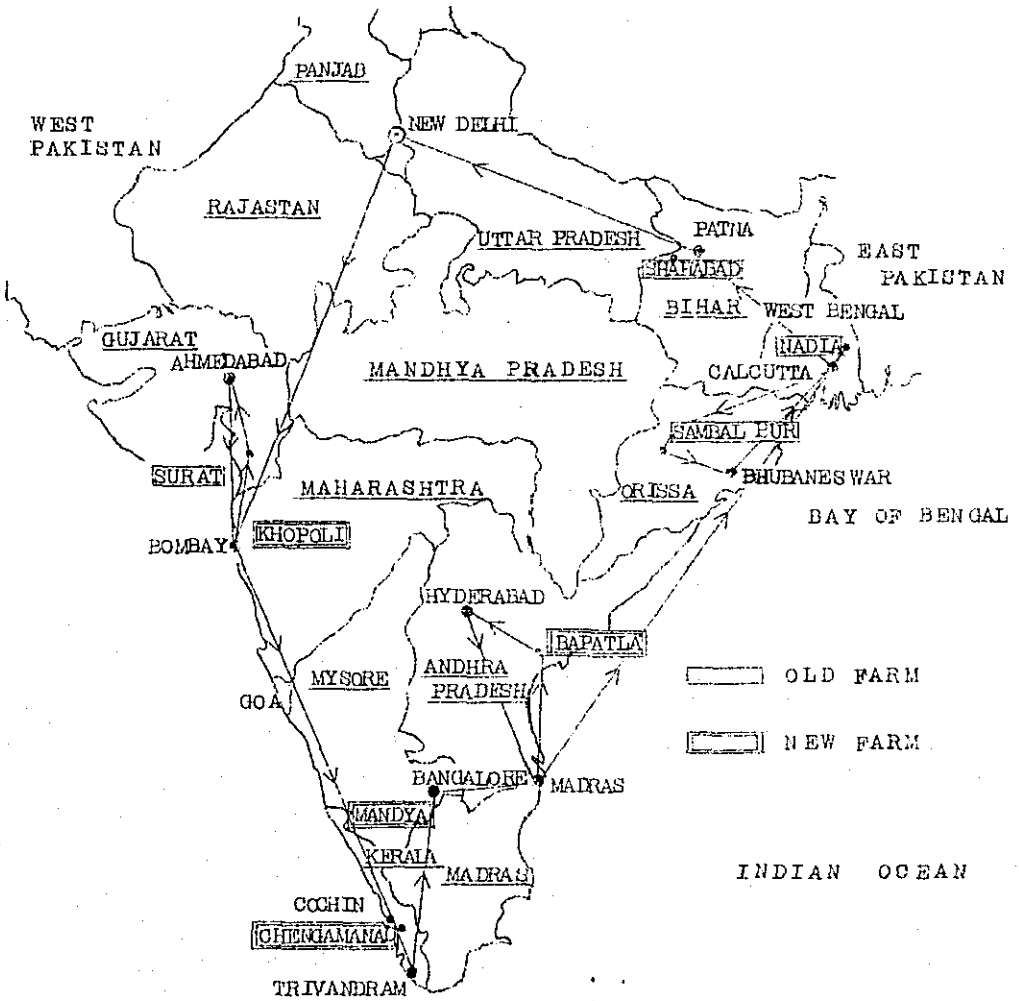

1. List of Members of the Japanese Agricultural Technical Advisory Team and Others concerned

	Name	Post	Period of Engagement
Team Leader	Dr. S. SUZUKI	Expert on Soil & Fertilizer. Chief, Dept. of Agronomy, Shikoku Agricultural Experiment Station, Zentsuji, Ministry of Agriculture & Forestry.	Jan.11 - Mar.9
Member	Dr. T. MIZUKAMI	Expert on Plant Pathology. Chief, Division of Plant Pathology, Dept. of Plant Pathology and Entomology, National Institute of Agricultural Sciences., Tokyo, Ministry of Agriculture & Forestry.	"
"	Mr. K. NAGAI	Expert on Rice Breeding, Chief of the 6th Laboratory, Division of genetics., Dept. of Physiology and Genetics, National Institute of Agricultural Sciences, Hiratsuka, Ministry of Agriculture & Forestory.	"
"	Mr. T. SUGIYAMA	Expert on General Administration, Acting Chief, Overseas Center's Section, External Operation Division, Overseas Technical Cooperation Agency.	"

	Name	Post	Period of Engagement
Member	Mr. T. MATSUSHIMA	Expert on Agricultural Management, Technical Official, International Cooperation Section, Agricultural Economic Bureau, Ministry of Agriculture & Forestory.	Jan.11 - Mar.9
Japanese Participants from India.	Mr. Y. MIKI	First Secretary, Embassy of Japan	Feb.19 - Feb.25
"	Mr. T. NAGATA	Consul, Consulate General of Japan, Bombay	Jan.16 - Jan.23
"	Mr. M SANO	Vice Consul, Consulate General of Japan, Bombay	Jan.28 - Feb.1
"	Mr. S. HIRAKAWA	Vice Consul, Consulate General of Japan, Calcutta	Feb.19 - Feb.25
"	Mr. K. KURYU	Vice Consul, Consulate General of Japan, Calcutta	Feb.5 - Feb.16 Feb.27 - Mar.4
Indian Participants	Dr. T. R. MEHTA	Director, Farm Advisory Unit, Directorate of Extension, Ministry of Food & Agriculture.	Jan.18 - Jan.23
"	Shri S. I. H. NAQVI	Deputy Director Coordination Directorate of Extension, Ministry of Food & Agriculture.	Jan.14 - Jan.20

	Name	Post	Period of Engagement
Indian Participants	Shri C. P. SASTRY	Crop Production Specialist, Directorate of Extension, Ministry of Food & Agriculture.	Jan.23 - Feb.5
"	Dr. AMBIKA SINGH	- Do -	Feb.6 - Feb.19
"	Shri J. N. HOTA	- Do -	Feb.19 - Mar.4

2. The Outline of Itinerary of the Japanese Agricultural Technical Advisory Team

Jan. 11 Tue	Left Japan and Arrived in New Delhi at night.
12 Wed 13 Thu	Made a formal call on the Embassy of Japan and the Government of India and counsulted with the officials concerned about the schedule of the Team.
14 Fri	Left New Dehli for Bombay
15 Sat 16 Sun 17 Mon	Made visits to the Khopoli Agricultural Demonstration Farm and State Agricultural Research Station at Karjat and discussed various technical problems with both Japanese and Indian Technical staffs and gave technical advices on the operation of the Farm. Made a consultation with the Consulate General of Japan in Bombay.
18 Tue	Made a formal visit to the State Government of Maharashtra and consultation and request on the technical matters in the operation of the Farm. Left Bombay for Surat by train.
19 Wed 20 Thu 21 Fri	Made visits to the Vyara Agricultural Demonstration Farm, Gantori Ashram and Agricultural Cooperative Society and discussed various technical problems with both Japanese and Indian technical staffs and gave technical advices on the operation of the Farm. Left Surat for Ahmedabad by train.
22 Sat	Made a formal visit to the State Government of Gujarat and consultation and requests on the technical matters in the operation of the Farm.
23 Sun	Left Ahmedabad for Cochin via Bombay.
24 Mon 25 Tue	Made visits to the Chengamanad Agricultural Demonstration Farm,discussed various technical problems with both Japanese and Indian technical staffs and gave technical advices on the operation of the Farm.
26 Wed 27 Thu 28 Fri	Made study trip to plantation farms on the hilly areas and rice growing areas in the back-water tract.

Jan.	29 Sat	Made a formal visit to the State Government of Kerala and consultation and requests on the technical matters in the operation of the Farm.
	30 Sun	Made visits to the Central Tubar Crops Research Institute in Trivandrum, and Agricultural College at Vellayani.
	31 Mon	Left Trivandrum for Bangalore via Cochin
Feb.	1 Tue 2 Wed 3 Thu 4 Fri	Made visits to the Mandya Agricultural Demonstration Farm, discussed various technical problems with both Japanese and Indian technical-staffs and gave technical advices on the operation of the Farm. Made observation tours of K.R.S. Dam, State Agricultural Research Station at Nagenahali, Food Technology Research Institute, Gram Sevaks Training Center, District Agricultural Office and Cooperative in Mandya.
	5 Sat	Made a formal visit to the State Government of Mysore and consultation and requests on the technical matters in the operation of the Farm. Left Bangalore for Madras.
	6 Sun	Rest in Madras.
	7 Mon	Left Madras for Bapatla by train.
	8 Tue 9 Wed 10 Thu 11 Fri	Made visits to the Bapatla Agricultural Demonstration Farm, discussed various technical problems with both Japanese and Indian technical staffs and gave technical advices on the operation of the Farm. Made a visit to the Bapatha Agricultural College, State Cashew Nut Res. Sta, and Krishuna Dam. Left Vijayawada for Hyderabad by train.
	12 Sat	Made a formal visit to the State Government of A.P. and consultation and requests on the technical matters in the operation of the Farm. Made a visit to the State Agricultural Research Station at Rageendranagar.
	13 Sun	Left Hyderabad for Calcutta

Feb. 14 Mon, 15 Tue, 16 Wed — Made visits to the Ranaghat Agricultural Demonstration Farm, discussed various technical problems with both Japanese and Indian technical staffs and gave technical advices on the operation of the Farm.
Made a visit to the Harringhata Livestock Center.

17 Thu — Made observation tours of the Seed Multipication Farm at Nakashipara, State Horticultural Research Station at Krishnagar and Fuliya Extension Training Center.

18 Fri — Made a consultation with Japanese technical staffs and Consulate General of Japan in Calcutta.

19 Sat — Made a formal visit to the State Government of West Bengal and consultation and requests on the technical matters in the operation of the Farm.
Made a visit to the Botanical Garden.

Left Calcutta for Jharsuguda by train.

20 Sun, 21 Mon, 22 Tue — Made visits to the Chakuli Agricultural Demonstration Farm, discussed various technical problems with both Japanese and Indian technical staffs and gave technical advices on the operation of the Farm.
Made observation tours of a agricultural extension office and extension activities at Attabira, and Bargarh blocks and State Horticultural Experiment Farm at Gambharipalli.

23 Wed — Left Sambalpur for Bhubaneswar by Car.

24 Thu — Made a visit to the Central Rice Research Institute at Cuttack.

25 Fri — Made a visit to the State Agricultural Technology College and a formal visit to the State Government of Orissa and consultation and requests on the technical matters in the operation of the Farm.

Left Bhubaneswar for Calcutta.

26 Sat — Made study trip to the State Agricultural Research Station at Chinsurah and Naricha Village.

27 Sun — Left Calcutta for Patna

Feb. 28 Mon Mar. 1 Tue 2 Wed		Made visits to the Arrah Agricultural Demonstration Farm and discussed various technical problems with both Japanese and Indian technical staff and gave technical advices on the operation of the Farm. Made observation tours of the facilities of agricultural machinery and implements work shop and soil survey laboratory run by the Package Program, and also the activities of agricultural extension works in the rural areas.
3	Thu	Made a formal visit to the State Government of Bihar and consultation on the technical matters in the operation of the Farm. Made a visit to the State Agricultural Research Station in Patna.
4	Fri	Left Patna for New Dehli Made a visit to the Headquarter of Package Program.
5	Sat	Made preparations for the meetings.
6	Sun	Rest
7	Mon	Made an oral report to the Embassy of Japan and attended a meeting of the project leaders of the Agricultural Demonstration Farms at Embassy of Japan.
8	Tue	Attended a joint meeting of Japanese Agricultural Technical Advisory Team and officers of the Central & State Department of Agriculture to discuss and review the progress of the Agricultural Demonstration Farms.
9	Wed	Left New Dehli early in the morning for Tokyo.

3. General Remarks

The Indo-Japanese Farm (hereinafter called the Farms) which started with the purpose of demonstrating fertilised intensive rice culture for high yield as well as of practical training on the related cultivation techniques, have made so far remarkable achievements and at the same time have shown various problems while settling in the localities in the course of four years' operation. And it has also become clear that the nature of works of the Farms is not so simple as supposed initially. Here we would like to point out the major problems concerned in order to contribute to the development of four newly established Farms and to the future activities of the other four formerly established ones.

1. Demonstration of high yield intensive rice culture

While improving the basic conditions, such as rearrangement of the canals for irrigation and drainage, layout of the field and leveling of field surface which are essential to the intensive rice culture, the efforts have been made continuously in the four formerly established Farms with the aim of realizing a high yield by the application of Japanese cultivation techniques with the unfamiliar local varieties under the unaccustomed climatic conditions. The process of the works are thought to have three steps.

A : Even depending on the local varieties and common cropping seasons, the potential productivities of varieties or of lands are to be fully developed with minimizing the depreciation elements for the yield by an intensive management and care-taking.

B : Some parts of the indigenous practice are to be improved positively to realize more increase of the yield. It is, for example, to change the transplanting and the heading date or to raise the fertilizer response by introducing the more adaptable varieties from other states or countries.

C : The annual total production is to be raised up and stabilized by establishing the reasonable cropping scheme with green manure.

Different characteristics are found in all the Farms, when their works for the past four years are checked up, but they are thought in general to have almost finished the step "A" and started to proceed into step "B" and "C" more or less. In "A", 50 md/ac is

regarded as a yield limit for Kharif cropping. But it is needless to say that there is still possibility of yield increase, as further improvement is expected in the rationalization of fertilization as well as in the measures for disease and pest control at every Farm.

The step "B" will be detailed in the next chapter (4-1-3) but, however intensive and careful the rice cultivation is, it may often prove fruitless, if it lacks the suitable varieties, because the cultivation method and the variety make the two wheels of a cart for realization of yield increase. This aims at positive increase of yield, utilizing more fertilizer than in the step "A", as the means of tentative techniques, before the completion of breeding of the special varieties for intensive culture.

Unlike in case of rice competition, in which only one cropping determines all, consideration should be paid to the annual total production in the Farms.

In the steps "B" and "C", Nadia Farm is most enthusiastic but Shahabad an Surat Farm have some restrictions to proceed into these steps due to their climatic conditions or the shortage of water supply.

2. Trials for standardizing the demonstrative high yield

In order to make the demonstration successful, it is quite necessary to have some trials in a part of the Farms for varietal selection or the rationalization of fertilizing date and dosage etc, especially in the steps "B" and "C". This kind of trial was already recognized by the Indian authority and in progress in most of the Farms. In addition, some plots of various cropping systems practiced in the step "C" may be called either demonstration or trial, but more efforts should be made for these trials in each Farm, because any advancement would not be expected without adequate trials. Irrespective of whether in demonstration or in trial plots, inquiry on the reason of either success or failure is indispensable for further progress.

Thus such kind of works as survey or measurements taken at suitable growth stages or the analysis on yield components should be considered as a part of the trials. It is desired to recognize that the process to the yield increase is much more important than the mere figures of the yield record themselves.

The Advisory Team was very glad to see local research officers or specialits were so generous and cooperative to the works in the Farms. Since most of Japanese staffs are not qualified to have academic research works, whenever important or fundamental problems were found in the Farms, it is desirable that the State research stations pick them up as their projects.

3. Establishment of the systematic techniques for extension and training of farmers.

The method of a high yield cultivation will not contribute to the promotion of production without being extended out of the Farms. But the techniques in the demonstration plots cannot be direct models for the general growers. The demonstration plots are characterized to put priority in getting a high acre yield, even neglecting the economical balance. Its purpose would be fulfilled in taking out the potential productivities of the land or of the varieties to the maximum so as to awaken and stimulate the willingness of farmers for increased production. It is the demonstration plot that makes a role of "show window" of the intensive methods.

For extension service, it should be left to the decision of the local agricultural officers, what is appropriate to the general farmers, or to what extent it should be adjusted for application, because the selection of techniques for extension should follow the policy of the State Governments and the social, economical and intellectural level of the farmers, and it is not easy for every Japanese staff to understand fully these local situations.

About the cropping scheme, it should be notified first of all that the Farms are mainly engaged in rice culture. Practical cropping scheme should be more multifarious according to localities, than the kind of system shown in the Farms. Apart from this matter, the biggest difference between the Farms and growers' farms is pointed out at present in the lack of machineries and of chemicals on part of the latter. Some States recognize well the above points, for example, in W. Bengal State, the seed farms are being utilized in establishing modified intensive methods applicable practically in farmers' fields. It seems, however, that the confusion of both kinds of techniques for demonstration and extension causes a sort of misunderstanding to a considerably large extent.

The technical training of farmers has started formally in the 4th year, except in a few Farms where it started previously by the local requests. As subjects of training at the initial stage, there were theoretical explanation on rice culture for better understanding and individual techniques such as line planting or weeding, as well as operation of machines or implements. But after starting of the formal training, comprehensive technic on farm management throughout a year became necessary for the general growers who want to practice it in their fields.

In this connection, it is worth mentioning the heavy job of Indian farm managers. They are expected originally to absorb and master intensive field techniques, as the future successors, and are holding financial responsibilities. Apart from these essential works, they are bearing miscellaneous jobs such as guiding of visitors and helping of Japanese staffs in language, so on. After the formal training is started, they must play a main role in practicals and in looking after the trainees. Thus it is too much to expect from one man. They will be exhaused, unless having able assistants.

The Farms, Shahabad and Sambalpur, which are located in the Package Program Districts have an inclination to accept the request for practical techniques for extension. Such a realistic request to the Farms proves that their techniques have been rooted deeply in the localities and perhaps beyond presumption at the time of the signing of the Agreement. However there seems to be anxiety that the Farms are too heavily burdoned with both works, when the feasible techniques for local farmers are requested in addition to the demonstration works for the maximum yield in each locality. Because it is difficult for the Farms to concentrate on raising up acre yield when importance is put on the techniques for extension which cause the yield increase to be limited to some extents and make the so-called "show window" not appealing. Here is emerged a dilemma. Which is considered to be more important, extension or demonstration? It should be examined thoroughly taking into consideration the policy of the State Governments and the wishes of Indian and Japanese staffs. This decision will be an important point to direct the future of the formally established Farms.

In addition, sufficient consideration should be paid to select out the fields or farmers for the first extension activity. As the Japanese intensive method should be applied only at the places provided with the facilities such as irrigation and drainage, it must be borne in mind that the coverage of application of this method is

not always same as that of the Package Program that includes the whole area of the District. As an example, the paddy variety, "Taichung Native 1" recommended by this Program was said to have suffered to a large extent due to its premature heading. As its reason, it is presumed that the duration of nursery became too long by the delay of transplanting owing to the lack of water. The Japanese method can not be introduced without danger where the supply of irrigation water is instable.

4. Estimation of the Farms, especially of their economical aspects.

Estimation of each Farm is used to be measured by the figures on acre-yield, which came from the division of total paddy production by total cropping acreage, as arranged in the Table 1. However it should not be overlooked that these figures do include some of croppings, outside of true demonstration plot. According to the above mentioned, the Farms can be divided into 3 plots, for demonstration, trial and extension. But there is one more on which the classification is to be made.

In some newly established Farms, there are partially incompleted plots for the intensive cultivation. Khopoli Farm was in process of digging drains or of clearing rocks and stones mixed in top soil; Mandya or Bapatla had some plots insufficiently leveled, and even in Sambalpur Farm, formerly established one, 2 plots were still being leveled in Feb. 1966. All of these parts, together with some plots where are ill-drained or obviously inferior in fertility should not be included into ture demonstration plots, even if they have cropping, so as to avoid the misunderstanding of visitors.

In addition to them, the cultivation for seed purpose for the next cropping or the sample cultivation of fine grain varieties which are requested to grow locally but ill fitted for high yield demonstration, is to be similarly treated. These must be put in the additional plot (4th plot) together, and to be registered separately in the records. The plots of No. 1 to 3 which are different from the 4th, have some inseparabilities but if possible the definite separation not only in head but also in the actual field plots is desirable, It is because at least two phases (demonstration and extension) are desired to be properly estimated in their respective different roles. Hence, when the records in figures are required, only the results coming from the 1st demonstration plot should be used since the original objective

of the Farms is nothing but the display of high acre yield.

It is said that the products are purchased by the Government as seeds in most of the Farms, but it is regrettable to hear some criticisms on the economical balance of the Farms, with use of a simple rate which is obtained by dividing the amount of total production by the total invested expenditure, like in the case of seed farms of State Governments. It is very understandable for the Advisory Team that the expenditure for the Farms with merely 10 acres seems specially enormous, because the ordinal running expenses for field management is guested to be quite limited, not only for the seed farms, but also even for the State Research Stations. However some amounts of investments in the Farms are effective for a long term, such as soil improvement which is essential preparation for the intensive culture.

For example, it is heard that the Surat Farm was criticized when they invested a big amount of bulky organic matters transported from Bomnay for soil improvement, but it has definitly contributed to the present high yield. Similarly some critical opinions were heard against recommendation of soil amelioration by top dressing of river deposits into the demonstration plots in Chengamanad Farm, where soil fertility is extremely inferior for demonstrative purpose.

The major criticism saying the Japanese method costs much more, seems to be based on the superficial comparison or misunderstanding that identifies the maximum yield techniques for demonstration with the practical techniques for extension. For the latter, the deeper examination is required concerning the economical balance between the aimed acre-yield and the necessary materials and expenses, and the estimation or decision, to what extents it should be, is in charge of the Indian specialists concerned.

In the previous year, the comparison between the mechanical and cattle plowing was put on question, as the latter is generally adopted by the farmers. As the result of trials, the latter was proved to be economically inferior to the former, so that it has been decided to take off cattle plowing from the works of the Farms. However the general farmers are actually depending on the cattle for plowing and they do not mind much about the time efficiency. The item to study for extension should be to find the difference between the cattle and mechanical plowing in the plowed depth and in the soil inversion and to decide the fertilizer dosage suitable for each method. Their different economical

Table 1. Annual Yield in 8 Farms

Season & Year		Cropped Area AC	Yield Kg/AC	Cropped Area AC	Yield Kg/AC	Cropped Area AC	Yield Kg/AC	Cropped Area AC	Yield Kg/AC
		Nadia		Sambalpur		Shahabad		Surat	
I. Kharif									
First (Aus)	1 (62)	-	-						
	2 (63)	8.99	1233						
	3 (64)	10.10	1462			0.95	1302		
	4 (65)	5.81	1363			0.50	1138		
Second (Aman)	1	17.94	815	7.76	1022	9.50	1369	10.50	1408
	2	10.73	1104	9.51	1617	9.55	995	10.37	1671
	3	9.11	1532	9.70	1636	9.74	1347	11.85	1067
	4	11.07	1468	9.57	1783	9.58	1588	11.67	1758
II. Rabi									
Third (Boro)	1	3.00	1002	4.21	1331			0.72	2099
	2	2.84	1095	7.38	784			1.86	2066
	3	2.82	1785	4.79	1351			2.06	2133
	4	2.77							
Wheat	1	1.25	431	1.24	473	5.10	299	3.07	374
	2	6.94	555			8.60	613	6.20	565
	3	4.30	778			9.00	705	9.87	526
	4	2.44				9.60			
		Bapatla		Mandya		Chengamanad		Khopoli	
Kharif First	1 (65)					12.85	609		
						(6.85	788)		
Second	1 (65)	10.10	1564	9.87	1838	12.80	900	9.50	
		(9.01	1629)	(9.72	1851)	Total of 2 croppings		(8.83	876)
						12.85	1505		

Note: 1. Figures in this table are collected from reports in Japanese, so some parts are different from the table prepared by Mr. Naqvi, which were distributed for the joint meeting in New Delhi on 8th March 1966.

2. Figures in ( ) in newly established farms are made by excluding direct sowing or preparative plots.

3. Year in rabi cropping represents the year of seeding.

balances are not important for extension at present. At any rate it seems too early to discuss the economical balance of the Farms as a whole.

Every Farm has its own characteristics based on the environmental conditions or on the project leader's idea. Shahabad Farm whose cropping scheme is almost limited to rice and wheat, seems to remain in the step "A" with a preference of practical techniques. Surat Farm has recognized, from its start, the pioneering role of rice culture, devoting its considerable portions of the works to the trials. Nadia Farm is positively in the steps "B" and "C", but cautious to the trials. Sambalpur Farm began to wish to get in the steps "B" and "C" after its 4th year. However, generally speaking, the formerly established 4 Farms seem to be rather passive in the elevation of acre-yield, having been inclined more or less toward the feasible technique.

Inclination into extension seemed to be caused partly by the approach of the termination of the Agreement term, but partly by frequent comments on the economy of farm management. Though it is very reasonable to say that positive increase in fertilizer application is necessary to get high yield, actual fertilizer dosage was rather restrained in every Farm in general.

In Nadia Farm, the improvement of green manure cropping made possible to reduce the amount of chemical fertilizers. This measure was taken to control diseases as well as to meet criticism on farm economy. If the Farms are too much concerned with the economical balance of earnings and expenses, the anticipated results of original aims would be disturbed to be realized, and thus making all the investment uneconomical. The estimation of the Farms should be based on their utility for the promotion of local rice production.

Proper and just appreciation of the works of the Farms is desired for the deepening of mutual understanding.

5. On what concerns the future of the formerly established Farms

Though it is very difficult to make a time schedule in the agriculture, it can be said that the five years are insufficient to complete the step "C" only making scarcely possible to examine the steps "A" and "B", even as far as the high yield domonstration is concerned. In the condition of using the new variety, the IRRI says that it is possible to produce 8 ton/ha of paddy in the low latitude regions, while here is harvested 50 md/ac that is not

more than 4.6 ton/ha. Among the Farms, some exceeds 10 ton/ha like Surat Farm, but this figure is the conversion from small plots. It will need considerable efforts to stabilize the production of every Farm on the level of 8 ton/ha. And if these efforts are coupled with the compositional work of practical techniques for extension, the achievements will be slow down.

The extension of the intensive cultivation as precise as possible has been intended for the general farmers upon the results obtained so long, as the Farms were forcasted to terminate in the five years. The extension rather than the elevation of the in-Farm yield seems to be more realistic and supported by the State Governments. So, it is presumed that the Farms seem inclined in going on rather as extension center than as experimental one in the future.

In connection with future of the formaly established farms, the Advisory Team reported to the Authority concerned the actual states of the farms and also desires and requests of the State Governments such as further 5 years extension of Nadia Farm. The Team is glad to see that an understanding is more deepend for further cooperation in this agriculture field. Generally speaking, the Team feels that the period of five years seem incomplete for agricultural projects.

If the further cooperation is continued, with regard to the Japanese staffs of the Farms, it is desirable that those who stayed at the Farm for the period of more than five years will be replaced by new staffs.

In this year, ten Indian staffs of the Farms have been sent to Japan for advanced technical training. Till now, the training of the Indian successors of the Farms has not been sufficient. It is hoped that those Indian counterparts will take over the management of farming from Japanese staff on their return and make best use of the knowledge and techniques acquired in Japan for the further progress of the Farms. It is also to be desired that they will not transferred soon after their returns.

Finally, The Advisory Team hopes that when the policies of each States are decided with regard to the Farms, further cooperation and necessary helps will be given to the Farms by the both Governments of Japan and India.

4. Rice Variety and Cultural Practice

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1. Kharif cropping

    1) On the vegetative-lag phase of winter rice
    2) Yield constitution elements - especially ear number
    3) Selection of the variety and the growth period

2. Rabi cropping

3. Multi cropping

The item was discussed about each Farm individually in Japanese edition. In this report, however, this will be described according to the cultural seasons, as most of important problems are common to each Farm and the space is limited.

1. Kharif cropping

1) On the vegetative-lag phase of winter rice

In the fact that the most varieties of Aman type, main Indica rice, have about 170 days of duration (seed to seed) in average, and that some of them have more than 200 days of it, the necessity is felt keenly to shorten this duration within 150 days, in order to gain positively the increased yield by use of the fertilized intensive cultivation.

As the inter-node elongation begins generally not waiting for the young panicle formation, when the day number for growth is multiplied under the high temperature, the rice plants incur lodging, elevating the center of gravity of plants, which makes the cardinal cause that prevents the fertilizer effects. Dr. A. Tanaka who had already paid attention to this fact during his stay at Cuttack in 1956-7, divided the so-called vegetative growth period into two phases, namely, active vegetative phase (transplanting to maximum tiller number stage) and the vegetative-lag phase (maximum tiller number stage to ear initiation stage)

In Japan, it has been the key point for the rice growing by late varieties in the Western region, how to keep the rice plants in an appropriate nutritive condition during this vegetative-lag phase. After the maximum tiller number stage, rice leaves become yellowish to some extents, so this phase was noticed by our farmers as one of "three yellow phases" in life cycle. But the devices of mid-season drainage followed by top dressing at ear initiation stage, have been recommended both to control unnecessary growth and to encourage reproduction activity. This kinds of countermeasure may be possible when this phase can be shortened into about 10 days as in Japan.

In the case of winter rice, the vegetative lag phase covers 30 to 40 days and in some cases, longer than the active vegetative phase, thus it makes difficult to find proper counter-measures. But the vegetative-lag phase can be shortened by means of late planting concerning the Aman type which has high photosensitivity. Here is the Table 2 that should be referred. In this Table, made of a voluntary extraction from the experimental data of Dr. Tanaka et al. The growth processes of the three varieties, different in photosensitivity are traced in the divided four cropping seasons. The IRRI is located at Los Banas,28 meters above sea level, 14°10' of N Lat. with the annual day length range of 11 - 13 hours, having the same rainy season as India.

The test varieties are shown as follows:

Variety	Type	Photosensitivity
Tainan 3	Japonica (Formosa) (Ponlai Rice)	Low
Peta	Tjereh (Indonesia)	Medium
BP1-76	" (Philippines)	High

The Tjereh type is quite similar to Aman type.

This experiment was executed on the fixed and common conditions as follows:

30cm x 30cm of spacing; N-40, P-17, K-33 kg/ha of fertilization. The details are found in IRRI's Technical Bulletin, No.3, Oct. 1964.

Table 2 shows clearly that the day number for each growth phase is almost uniform throughout variety and cropping season, except in the vegetative-lag phase and the duration of life cycle depends upon the length of V-lag phase. The day number in the Table which shows minus, implies that the formation of young panicle has started before the maximum tillering stage. It is supposed that the growth was a little abnormal about the plots of Tainan 3 seeded in July and October.

The period B, which is approximately 50 days, is due to the soil fertility of Los Bañas and to the rather sparse density of planting in this experiment. This period may be a little shorter in Indo-Japanese Farms. The generally high figures in yield might be obtained by the conversion from small plots and by means that four hills were tied together to keep the plant standing, whenever there was danger of lodging. The plants of Peta seeded in October shorten the vegetative-lag phase to 10 days, having similar growth type to Ponlai rice and exceed in yield. And those seeded in July is unexpectedly inferior in yield, which is supposed owing to some experimental errors.

BPI-76 which holds a so high photosensitivity as to provoke the ear initiation before a sufficient growth of plant in case of October seeding, brings the decrease of yield. Such type of varieties are not actually sown in March, dry season. In this case the vegetative-lag phase of BPI-76 attains as long as 84 days. This process of gorwth is supposed about the varieties of 200 days even grown in rainy season.

Though the number of elongated inter-nodes in the vegetative-lag phase seems characterised by the varietal difference, it is supposed about Aman type varieties that 4 to 5 inter-nodes elongate after about 20 days and that the total length of the elongated inter-nodes becomes 30 to 50 cm already in the ear initiation stage. As they lengthen themselves by double or triple at the heading date, any means should be taken to oppress it, because the lodging nearly before or just after the heading stage brings the fatal decrease of yield.

In the Farms, there are two Aman type varieties well estimated, namely T-141 and Latisail whose growth process in Sambalpur or Shahabad shows that 100 is the day number from their transplanting (about July 20th) to their heading date (October 28th). Supposing that 45 days are needed for active vegetative phase (up to the maximum tillering stage), and 23 days after the ear initiation stage (up to heading), the vegetative-lag phase will be 32 days long.

Table 2. Growth pattern and some observations of 3 varieties in 4 seasons (IRRI 1962-3)

Variety	Date sown	Number of days for each growth phase						Grain yield ton/ha	Culm length cm	Number and total length of elongated internodes			
		A	B	C	D	E	Sum			At earinitiation No.	cm	At flowering No.	cm
Tainan 3	3.15	25	42	0	22	34	123	4.89	133	2	8	5	89
	5.3	25	42	0	23	33	123	4.30	145	2	8	5	92
	7.16	25	60	-14	20	34	125	5.10	135	2	7	5	90
	10.26	25	70	-19	22	39	137	5.69	126	2	7	5	87
Peta	3.15	25	42	28	25	30	150	3.80	190	5	52	8	159
	5.3	25	42	27	22	30	146	4.32	198	5	53	8	163
	7.16	25	50	10	22	28	135	3.21	192	4	25	7	145
	10.26	25	50	10	22	30	137	6.04	134	3	7	6	111
BPI-76	3.15	25	50	84	25	27	212	4.80	174	6	45	9	140
	5.3	25	50	50	26	27	178	5.63	178	6	57	9	145
	7.16	25	56	-3	24	28	136	4.29	154	3	9	6	105
	10.26	25	56	-21	24	40	122	2.88	114	0	0	4	72

Note: Growth Phase

A: Sowing to transplanting (Nursery phase)
B: Transplanting to maximum tiller number stage (Active-vegetative phase)
C: Maximum tiller number stage to ear-initiation (Vegetative-lag phase)
D: Ear-initiation to flowering (Reproductive phase)
E: Flowering to harvest (Ripening phase)

Similarly Latisail in Nadia Farm holds almost 30 days of this phase. The average yield is equal to 1804 kg/ac in Sambalpur and 1740 kg/ac in Shahabad, but in the best plot, they exceed 50 Md. (1865 kg/ac). It is inferior to those in Nadia with the average of 1583 kg/ac (1538 kg/ac for T-141), as the Farm has suffered from the damage by bacterial leaf blight. It is supposed to be a result of apprehensions for lodging not only for disease that the dosage of nitrogenous fertilizer is limited in 15-20 kg/ac of component in Nadia Farm.

The immediate removal of the vegetative lag phase, covering about a month, will be difficult but it is realizable to reduce it to the half by application of late planting method. In Surat where the transplanting has not started until August in this year by the lack of irrigation water, T-141 found in the varietal trial has 83 days of growth to heading date in paddy field, which makes suppose that the vegetative-lag phase in 15 days long. The yield counted from small plots is 3035 kg/ac, with application of 24.5 kg/ac of N component. This fact is very suggestive. Under the present practice, the increase of fertilization amount conceals danger and then the yield can difficultly surpass 50 md/ac largely. On the other hand, it was said that the late planting in rainy season would incur the yield decrease, by virtue of an insufficient sun shine hours. But not only because the weight increase of dry matter is weakened and pauses in the V-lag phase but also because the absorption of either nitrogen or phosphorous acid is stopped, it will do no matter, unless very late planting is executed which will make the V-lag phase minus, and abridge substantially the active vegetation phase, resulting in the shortage of the ear number. As caution, some difficulties are foreseen on the care-taking of nursery bed under heavy rain and prudence is needed in the region where out-break of gall flies are seen annually.

2) Yield constitution elements - especially ear number

Concerning the Indica rice, one of principal causes limiting the yield is thought that the general Indica varieties have less number of ears per hill and that it is difficult to maintain high average ear number per square meter. This is because the leaf blade is broad, easily to bend and because the photosynthate is difficultly deposited but easily consumed to increase the dry matter, which incur in any way over-exuberance, preventing the sun light reaching the hill foots. These might be characteristics necessary to compete with weeds, but is not perferable

for the intensive cultivation. The lowered light transmission ratio accelerates the blighting up (or senescence) of the lower leaves, which kills young tillers and betrays the expectation of ear number increase. The less number of ears is considered not only owing to a low tillering ability but to an increase of ineffective tillering caused by the shading due to over-exuberance. It has been observed in the Farms that it is necessary to secure the effective tillers as early as possible even when the winter rice of long growth period is concerned. But this purpose causes the trouble, when the excessive amount of the first top dressing provokes the more over-exuberance. As indigenous method in Konkan region, about ten plants are put at a hill, which must be also for the aim to secure the ear number. Increase of planting density or of plant number per hill is limited in the intensive cultivation by the nature of the measures taken against lodging, disease and insect pests. And the final need is to get an appropriate variety. T-141 and Latisail which have comparatively high tillering capacity and stiff straws are now mainly cultivated in the Farms. And the instruction of each Farm to raise healthy seedlings and to practice carefully the works of seedling gathering and transplanting, has its aim to utilize the tillerings from the lower nodes as much as possible. In the local habitude, the farmer transplant seedlings by pushing on the foot of them with the thumb, which makes the seedlings broken, not activating the important tiller buds at lower nodes.

It may need more labourers than usual, but when only the economical balance of the work is remarked, that kind of important points will be not notified.

Then, 50 md/ac is equal to 461 g/m^2 in rice grain, for which the matching number of ear shall be presumed when spacing is 22.2 $hill/m^2$ (30cm x 15cm) and weight of 1000 paddy grains is 26 gr., the ear number required for a hill is 9.98 ($222/m^2$) with 80 ripe grains per ear and 8.87 ($197/m^2$), with 90. This level may seem not difficult to realize but the limitation of present varieties looks like within 220 ears per m^2. As the fertilization effects result mainly in the ear number increase, it should be attempted to level up the ear number to 250-300/m^2, by means of the selection of suitable varieties and of the transition of cropping season (shortening of the vegetative-lag phase).

Even in the case of bold grains, Indica rice has a low weight of 1000 grains, which is due to the short ripening stage by the climatic influences and because the photosynthate is prevented to flow into the spikelet by a rapid blighting up of the leaves. It can be expected that the varieties of middle grain, like Latisail,

have about 26 gr. of 1000 grains in the case of good maturation, but it is desired to know that those of fine grain which can not have even 20 gr. are never suitable for demonstration of high yield.

The above presumption that the matured grain number per ear is 80 - 90 may be considered as an excessively low estimation. But this number is the average of the total panicles in a hill, and excludes the diminution such as grain shattering in the course of harvesting works. No remarkable matter has been observed about the sterile grains in most of the Farms, though it is generally said that Indica rice holds markedly many infertile grains in an ear, when the fertilizer dosage is increased.

Surat Farm has the records on the investigation of sterility percentage of different varieties and many ones do not attain even 10% such as Ponlai rice etc. which belong to the early variety. This does not matter at all. T-141 attains 11.6%. Concerning the extremely fine grain varieties, Zinya-31 is 27.1%, Kolamba 42 is 24.5%, which is to be notified. CR 1004 extremely late variety, exceeds 30%, by the influence of water deficiency after heading. However, a strict comparison is not possible on these figures, because fertilizer doses are unequal between varieties in this case. Further survey should be made on the sterility percent in each Farm.

Ponlai rice such as Taichung 65 is superior to Indica one, so far as panicle number is concerned, because it can cover the disadvantage of small panicles by the number of panicles per hill. The example is shown as follows, extracted from the result of manurial trial on Taichung 65 in Mandya Farm;

Plot	Number of hills	Number of panicles		Number of ripe grain per panicle	1000 grain weight (grs)	Yield of paddy grains	
		per hill	per m^2			g/m^2	kg/ac
1.	22.4	8.5	190	57.4	26.3	287	1,163
2.	22.4	11.2	251	74.8	25.6	480	1,942
3.	22.4	14.2	318	87.0	26.8	742	3,002

Dosage of nitrogenous fertilizer (component) 1...30, 2...39, 3...45 kg/ac
Spacing ; 33cm x 13.5cm (22.4 hill/m^2)
Transplanting date : June 20, 1965

In the Table, the ripe grain number per panicle is calculated from two other elements. The actual measurement of the panicle on longest culm is given as 78.1, 96.3 and 144.6 respectively. About Ponlai rice, the ripe grain number per panicle in the average of all the panicle of a hill can be expected to be about 70. Taichung Native 1, Indica, has high tillering capacity, but grain number per panicle is usually less than that. This is an example of "panicle-number type", rerely found among Ponlai varieties, though many Japanese varieties belong to this type.

It is very natural that the yield constitution elements fluctuate mutually relating each other, but the most important matter is the securing of ear numbers for the purpose of high yield; 250 panicles per m^2 promises about 2 ton/ac and 300 would realize an attractively high yield. (In the rice competition in Japan it attains 450 to 500 per m^2)

It is desirable that the analytical examination would be repeated on each element detached of yield component, in order to select the productive varieties and to find best spacing or fertilization.

3) Selection of the variety and the growth period
(Corresponding with I-B of the General Remark)

The first problems at the selection of suitable variety is on what day the heading date is scheduled. Here this stage of Aman rice has been ordinarily in the late October in relation with the end of rainy season, which follows just the indigenous and semi-natural cultivation method that depends on the rain fall. As the stagnation of rain water in a long duration must not exist in the Farms and that the blighting up of lower leaves or the lodging of plants can be prevented by the shortening of vegetative-lag phase, the late October should not seem always suitable as the heading date. Even if extraordinarily drought was prevailed in 1955, further studies are required,on this matter as the rainfall in October is not so heavy to apprehend generally in three formerly established Farms and the new Mandya Farm as well as in Khopoli.

In any place, 140 - 150 days of growth period that implies 80 to 90 days from transplanting to heading,must be maximum for a

positive high yield cultivation. The problem is concerned when the growth period (total duration) should be fixed during kharif season.

(1) If the late October can not be changed for the heading stage, there is no means except delaying the sowing and transplanting dates. In some plots of Nadia Farm, Latisail had been planted on August 12th, which brought a poor result of 1419 kg/ac in average. But this result was owing to the overflowing water caused by the heavy rain just after the transplanting and suffering from the late occurrence of bacterial leaf blight. Further trials are required on this late method. As the lodging can be prevented, it is meaningless unless execute with a positive increase of fertilizer amount. In this connection any example in which the late planting was obliged to do, by lack of the irrigation water at the scheduled date, does not make any suggestion because the quality of the seedlings was degraded by ageing in the case. It is preferable to study on the high yield, based on the proper design, concentrating in the security of ear number in execution of much fertilized cultivation by sound seedlings. The advantage of this is found in the availability of the rice varieties now valuably in use.

(2) Suitable new varieties could be sought more broadly, where there is no objection on the heading stage during the early or middle October. On this case, there are also two methods that the transplanting date is put in the mid-July as usual or it is a little delayed. As a typical example, Shahabad Farm has BR-34 partially, since T-141 can be harvested too late to admit the sowing of wheat in November. In this case, the transplanting date of BR-34 is delayed somewhat to 24th or 27th of July, and the heading date comes around October 16th, thus the vegetative-lag phase is presumed to be about two weeks long. This is a recommended variety of Bihar State, but as its cultivation is always threatened by lodging in a fertilized condition because of its weak culm, it is prevented to adopt wholly in spite of its suitable heading date. Otherwise in Mandya, the example of SR-26-B which is planted on July 10th to 13th, heading on the 15th of October, brings comparatively high yield of 1909 kg/ac, but it is still less than that of S-1092 etc. As these varieties are photosensitive, how shall it be to delay by 10 days more about the sowing and transplanting date?

In conclusion, the appropriate early varietis of Aman group will come to be selected out, but even if so is it, some delay of planting will be necessary.

(3) Ponlai rice getting in heading stage in September

When the vegetative-lag phase is completely eliminated, which is to make concur the maximum tillering stage and the young panicle formation stage, the day number in paddy field becomes to be about 70 up to the heading, so, if the transplanting date is on July 20th, the heading stage comes on September 28th. This is why in the IRRI, 115 to 130 days are aimed as the growth duration of high yield varieties in researches, which is based on the studies of the formerly mentioned Dr. Tanaka. But any varieties which make their heading in the middle or late September, may not be applied in many places, even if no lodging happens, because of the difficulties in ripening or of the inconveniences in harvesting and storing operation during rainy days.

This is why the late planting is still desired. In the Kharif season of 1965, every Farm has not yet grown a new variety or hybrid strain bred in IRRI. The following data is regarding Ponlai rice which is thought to have similar basic characteristics.

Variety	Location	Transplanting Date (1)	Heading Date (2)	Day number from (1) to (2)
Formosa	Surat	Aug. 8	Sept. 26	49 days
	Nadia	Aug. 3	Sept. 18	46
	Sambalpur	Jul. 12	Sept. 4	54
	Shahabad	Jul. 11	Sept. 13	64
Taichung 65	Sambalpur	Jul. 12	Sept. 9	59
	Mandya	Jul. 17	Sept. 14	59

In spite of the late planting in the early August at Nadia and Surat, the heading happens in the middle to late September. It happens earlier on the planting in mid-July. The day number in paddy field up to heading which takes around 60, is indicated here to be shortend by 5 - 10 days owing to the late planting. Some shortening seems inevitable in the case influenced by the late planting, because Ponlai rice is low in photosensitivity but not completely nil. When the day number until the heading stage becomes excusively few, it is unable to bring the tillering ability of the variety into full play, as its result, the securing of ear number becomes difficult, moreover the uniformity of heading within

a hill is disturbed. Ideally, it is desired the variety being about for 70 days in paddy field until the heading and not being shortened even planted lately, that is to say, the variety of duration-fix type.

Surat has less rainfall in October, which makes it possible that the heading is satisfactory in the late September. Here is yielded 2436 kg/ac of Formosa in ordinary plot , and so high as 4128 kg/ac in the trial plot. It is marvellous, judging from 50 day's variety in paddy field up to the heading, even though due to the high fertility of the soil.

The variety, Formosa was regarded as the selection from the natural cross within Japaonica group after they had been introduced in Surat. Among the initial selection of No. 1 to No. 7, strains, No.3 was considered as most promizing, whose feature was reddish apiculus at the heading stage (No. 2 has not this color). As it is different from the original variety in Taiwan, it is better to nominate it afresh, when grown out of the Farm. The fixation of No. 3 strain is supposed to be satisfactory(still under the inspection of the reporter, but it needs one year more).

Among Ponlai rice varieties there are found those which has longer growth period than Taichung 65 or Tainan 3, recommended in the Package Programme. And among these which were cultivated for a trial at Hiratsuka, Japan, 1966, Chianan 14 has the longest growth period, being followed by Chianvng Yu 280, Taitung 25 and Taichung 184. The productivity of these varieties seems to be worth of test in the Farms. The new variety bred in the IRRI would be prefered on its cooking quality than to Ponlai rice, but further study will be required on its superiority concerning the relation between cropping season and active vegetative phase or the productivity.

(4) Role of Autumn rice (Aus)

The Autumn rice which exists as duration fix type is so weak of straw and so low in the fertilizer responsiveness that the high yield is not expected to this rice. This is, however, adapted either in the case that it is cultivated as one of twice croppings in rainy season like in Nadia or that, the early harvest is needed as a part of the cropping cycle with green manure crop.

Even in those cases, it may be true that the selected early varieties belonging to Ponlai rice would be better yielder, but

the problems remain in the sprouting on panicle, as their ripening happens midst of the rainy season. Regarding this matter, Dular and Charnock of Aus seem to keep seed dormancy, to some extents. It is said too that Aus results in less sterile grains than Aman even when it is rainy during flowering. If so, this feature should be utilized for the further varietal improvement.

2. Rabi cropping

If the water supply can be ensured, for instance, by means of the construction of new reservoirs, the Rabi cropping makes easily effective the intensive cultivation method in the sunny weather and with less damage caused by the disease and pests or the lodging. As the heading stage is not so defined as in the rainy season, the advantage of Rabi cropping is brought from the wide range of suitable varieties and the positive application of fertilizer owing to the excluding of vegetative-lag phase, almost fully.

It is inevitable, however that this cropping decreases yield in some case, suffering the concentrative attacks of sparrows or rats, in the environment of few cropping or that it makes the disadvantage that the harvesting works are destinated in the scorching heat.

Some more days will be necessary for growing seedling in cold season, which will make determine the day number of growth is 135-140 days. The sowing and transplanting stage are rather questionable to fix appropriately. Except in Shahabad where the rice culture is impossible in winter, the other three Farms adopt different methods each other, of which the most characteristic one is found in Nadia where has Rabi cropping of Latisail, Aman rice.

For this cropping, sowing on November 1st and planting on December 15th are made to be standard, which can not be changed much. This is because the vegetative growth should be finished for the formation of young panicle in the late March when the day length become similar as about October 5th, normal panicle initiation stage of this variety. If the transplanting is earlier too much, the young panicle will be differenciated early enough to be injured by the coldness. If it is later too much, the heading should be awaited until October.

As the minimum temperature becomes below 10°C during the late December and through January, the careful attention should be paid about the water management at the nursery and the early

stage of paddy field, so as to prevent the dropping of soil and water temperature. Such kind of inconvenient works for making use of highly photosensitive variety are due to the lacking of high yielder among Boro and Aus groups.

Indica and Ponlai rice are so sensitive to the low temperature that the raising of seedlings is not easy. Sowing date is delayed in Sambalpur and Surat much further than in Nadia. In Sambalpur, Aus had been sown in the late November and planted in the early January and that which would be harvested in 1966, was delayed by one month more, that is to say, it was planted in the early February. In Surat, it is sown in the late January and planted on March 9th, which delays the heading stage from the late April to the early May. The result seems satisfactory, as the yield of Formosa, though calculated from the small plot, exceeds 2500 kg/ac but, in general, it should be notified that the excess delaying makes shorten the active vegetative phase, namely the growth rapidity, which is measured by the number of days required for the exsertion of each leaf, is accelerated by the steep rise of temperature from the begining of March, as the results, total ear number becomes insufficient.

Though it is standard to sow on January 15th and plant on February 20th at Chiayi in Taiwan just under the tropic of Cancer, it is more appropriate that earlier date is better for Ponlai rice in India. This corresponds specially to the newly established Farms located on the lower latitude. When the period of tillering is too much shortend there, the number of ears will be lacked and the ear itself will become poor. However the varieties of shorter duration may be prefered sometimes even sacrificing the yield more or less, as the irrigation water is precious in the dry season, so rice is competitive with the other crops or with cropping acreage in the case of extension purposes.

Indo-Japonica hybrid strains from the IRRI should be examined first in the Rabi cropping. Taichung Native 1 which is susceptive to bacterial leaf blight, is considered not to do matter in Rabi cropping. As the dryness comes to its extremity after March, the cultivation of green manure crops for seed purpose was executed in Surat Farm around rice fields, which made a remarkable effect for the prevention of dry wind. In the paddy fields of Iraq, it is said the wind break belt of date palm is indispensable. The rice varieties of Iraq and Egypt was thought to have some value for a trial so that some amounts of seed samples were distributed to the newly established Farms.

3. Multi cropping

The triple cropping is tried partially in Nadia and Sambalpur (in 1966) while the triple cropping of rice and wheat combined is practiced as example in Shahabad and Surat. The yield was not over 4390 kg/ac (117.7 md/ac) in Nadia because of a poor cropping of Aman rice but, as expectation, 130 to 140 md/ac is not impossible through a year. The records of Surat tells twice cropping of rice produced 3750 kg/ac and the wheat, 533 kg/ac. 1700 kg/ac of Kharif rice, reduction by half, due to the severe out-break of army worms is regrettable. Here is a lowly producing land of wheat naturally, but the Farm seemed to mark the originality for Rabi culture (planted on March 15th and harvested on May 24th) in the field after the harvesting of wheat. In Shahabad, the rice culture consists of planting on April 25th and of harvesting on July 5th, spreading over the dry and rainy seasons.

Such a triple cropping reduces the soil fertility and makes difficult the disease and pest control, so that it is not considered as desirable for the extension. The important work should aim to complete the double cropping of rice by improving the green manure cropping, to transfer it into the cultivation system like in Nadia, which results in cutting down the chemical fertilizers.

5. Soil and Manuring

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4. Improvement of the fertilizer application techniques
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1. Characteristics of the soil at each Farm

The result of the investigation of the soil profile and the result of physical and chemical analysis of the soils (by Shikoku Agricultural Experiment Station) are shown in the Table 3 and 4, concerning 8 Farms.

Each Farm of Surat, Bapatla and Khopoli which belongs to black soil is extremely high in C.E.C. and rich in Ca. and Mg. containing much clay. The Farms belonging to yellowish red - red soil are these of Sambalpur and Mandya, these of Nadia, Shahabad and Chengamanad belong to alluvial soil.

The soil characteristics are mentioned hereunder about each Farm.

1) Nadia Farm: which belongs to alluvial soil and light clay of the Hooghly River with the trace of amelioration of soil fertility by heavy dressing of compost and contains secondarily much of either humus and total nitrogen to Surat Farm among the eight Farms. But in comparison with Japanese paddy field soil, Nadia Farm is less than one third of it in Humus and T.N. contents, being higher in C.E.C., richar in Ca. and Mg. and a little poorer in K and P.

2) Sambalpur Farm: which is extremely poor in all kinds of compositions, so-called degraded soil and it belongs to yellowish red soil and to sandy clay loam. The ground water surface is so high as situated only at 30 cm deepth, because of the elevation of the ground water due to the completion of the huge Hirakud Dam near by the Farm.

C.E.C. of the soil being only 3.8 me/100g, the soil reaction is acid and the rice plants show Mg. deficiency.

3) Shahabad Farm: which belongs to the alluvium of the midstream of the Ganges River, and to light clay rich in silt and clay. The soil is extremely poor in humus and nitrogen content is average of that in India, while is one fifth of that in Japan. The soil have also plenty Ca. and Mg. a little high C.E.C., much K and little P, so is somewhat alkaline in the soil reaction. Though the paddy field soil is rich in Mg. the up-land crop near to it shows Mg. deficiency.

4) Surat Farm: The soil of this Farm is deep black one, so-called black cotton soil derived from basalt. It is very compac too solid to be broken like stone, muddy when it absorbs water and

Table 3. Physical Properties of Paddy Soil of Indo-Japanese Agricultural Demonstration Farms

Farm	Soil type	Layer	Depth	Color	Structure	Rusty Mottle Concretion	Hardness	Plasticity	Stickness	Mechanical analysis				
										Coarse sand	Fine sand	Silt	Clay	Texture
			cm							%	%	%	%	
Nadia	Alluvial soil (The River Hooghly)	I	0-16	10YR5/3	Prismatic	No	Hard	Medium	Medium	1.4	32.9	32.8	32.9	Lic
		II	16-58	10YR5/4	No	Mn concretion	Medium	Medium	Medium	0.2	15.7	43.1	41.0	Lic
		III	58-	10YR5/4	No	No	Soft	Weak	Weak	0.8	67.7	19.1	12.4	SL
Sambalpur	Red and Yellow Soil	I	0-18	7.5YR5/6	No	No	Hard	Weak	Weak	48.2	28.3	13.7	9.8	SL
		II	18-38	7.5YR5/6	No	Fe mottle	Medium	Not so weak	Not so weak	38.7	25.4	18.4	17.5	SCL
		III	38-	5YR5/8	No	Mn concretion	Medium	Medium	Medium	-	-	-	-	-
Shahabad	Alluvial Soil (The River Ganges)	I	0-20	10YR5/6	Prismatic	No	Hard	Not so strong	Not so strong	3.4	30.4	30.8	35.4	Lic
		II	20-37	10YR5/4	No	Mn concretion	Hard	Strong	Strong	3.4	28.0	32.2	36.4	Lic
		III	37-	10YR5/4	No	Mn concretion	Not so hard	Strong	Strong	3.5	24.7	32.1	39.7	Lic
Surat	Deep black soil	I	0-20	2.5Y3/2	Prismatic	No	Very hard	Very strong	Very strong	4.8	25.7	19.6	49.9	HC
		II	20-	2.5Y4/4	Prismatic	No	Very hard	Very strong	Very strong	2.8	25.6	18.3	53.3	HC
Bapatla	Medium black soil	I	0-16	10YR3/2	Blocky	No	Soft	Very strong	Strong	14.8	7.0	12.2	66.0	HC
		II	16-	10YR3/3	Blocky	No	Soft	Strong	Strong	13.2	6.5	13.1	67.2	HC
Mandya	Red Soil	I	0-15	10YR5/3	Prismatic	No	Very hard	Medium	Medium	35.4	35.9	10.7	18.0	SCL
		II	15-28	10YR5/2	No	No	Not so hard	Medium	Medium	23.7	42.6	8.9	24.8	SCL
		III	28-	2.5Y4/2	Blocky	No	Soft	Very strong	Very strong	-	-	-	-	-
Chengamanad	Alluvial soil (The River Periyar)	I	0-17	2.5Y7/2	No	No	Hard	Very weak	Very weak	53.3	26.6	9.8	10.3	SL
		II	17-36	2.5Y6/2	Prismatic	Fe mottle	Hard	Weak	Weak	31.9	17.3	12.2	38.6	Lic
		III	36-85	2.5Y6/2	Prismatic	Mn concretion	Not so hard	Medium	Medium					
Khopoli	Medium black soil	I	0-17	10Y2/3	Blocky	No	Very hard	Not so strong	Strong	-	-	-	-	-
		II	17-29	10YR4/3	No	No	Not so hard	Weak	Weak	-	-	-	-	-
		III	29-85	10YR6/3	No	No	Not so hard	Weak	Weak	-	-	-	-	-

Table 4. Chemical Properties of Paddy Soil of Indo-Japanese Agricultural Demonstration Farms

Farm	Layer	PH H_2O 1:1.25	PH KCL 1:1.25	Org.C %	T-N %	C/N	CEC Me/100g	Exchangeable Me/100g Ca	Mg	K	Na	N/5 HCL Sol P_2O_5 Mg/100g	K_2O	Conductivity mv/cm 29°C	Water Soluble Me/100g Ca	Mg	K	Na	Moisture %
Nadia	I	6.9	5.8	0.545	0.073	7.5	20.3	16.25	4.25	0.37	0.59	25.4	24.7	0.102	0.32	0.15	0.02	0.08	4.0
	II	6.6	5.3	0.395	0.050	7.9	23.4	20.64	4.89	0.21	0.40	28.2	23.5	0.079	0.21	0.17	0.01	0.08	5.0
	III	8.0	6.8	0.138	0.024	5.8	-	29.89	2.42	0.34	0.61	59.8	15.7	0.196	0.74	0.15	0.03	0.07	2.2
Sambalpur	I	5.3	4.5	0.316	0.028	11.3	3.8	2.16	0.34	0.18	0.41	3.5	13.3	0.018	0.06	0.05	0.03	0.09	0.8
	II	6.4	5.7	0.218	0.027	8.1	4.5	3.06	0.82	0.09	0.38	1.5	12.6	0.051	0.11	0.09	0.02	0.07	0.8
	III	6.6	5.8	0.158	0.024	6.6	7.1	3.94	1.73	0.22	0.46	2.2	17.5	0.056	0.16	0.05	0.02	0.06	1.9
Shahabad	I	7.7	6.7	0.264	0.044	6.0	17.6	14.14	3.90	0.71	0.71	7.5	33.7	0.135	0.26	0.20	0.03	0.19	4.1
	II	7.6	6.5	0.207	0.035	5.9	18.2	14.03	3.50	0.74	0.56	7.2	33.1	0.125	0.24	0.15	0.06	0.19	4.7
	III	7.1	6.0	0.184	0.035	5.3	18.1	12.82	4.27	0.64	0.65	5.7	29.5	0.102	0.20	0.13	0.06	0.19	4.3
Surat	I	6.6	5.7	1.126	0.098	11.5	49.9	29.58	18.00	0.86	0.72	37.2	25.3	0.18	0.36	0.27	0.02	0.16	8.7
	II	7.3	6.3	0.647	0.044	14.7	50.0	32.03	15.99	0.46	0.75	16.5	18.1	0.12	0.29	0.20	0.02	0.13	9.2
Bapatla	I	7.9	6.8	0.531	0.047	11.3	46.0	27.78	15.89	2.94	6.68	14.7	89.1	1.20	0.54	0.38	0.04	4.57	10.3
	II	8.0	6.8	0.469	0.035	13.4	47.7	29.89	16.72	3.03	5.23	11.8	85.5	0.86	0.35	0.21	0.04	4.40	10.6
Mandya	I	9.0	7.3	0.468	0.044	10.6	13.5	10.96	2.42	0.65	2.75	11.5	21.7	0.53	0.60*	0.54*	0.22*	2.79*	2.6
	II	9.4	7.7	0.244	0.023	10.6	16.9	9.17	1.94	0.40	5.82	8.5	22.3	0.74	1.81*	1.85*	1.03*	7.40*	3.5
	III	9.4	7.5	0.232	0.018	12.9	27.1	17.51	5.55	0.29	12.14	11.2	21.1	0.65	1.13*	1.02*	0.62*	5.60*	6.3
Chengamanad	I	4.9	4.1	0.484	0.054	9.0	3.29	1.01	0.16	0.17	0.47	4.5	7.2	0.03	tr	tr	0.01	0.06	0.8
	II	5.0	4.0	0.318	0.048	6.6	7.85	1.69	0.66	0.21	0.39	2.3	6.0	0.02	0	0	0.01	0.06	2.6
	III	5.0	4.0	0.211	0.034	6.2	9.48	2.05	1.05	0.19	0.50	2.2	7.8	0.02	0	0	0.01	0.06	3.1
Ehopoli	I	7.1	6.0	0.522	0.039	13.4	35.0	17.41	14.76	0.35	0.54	38.6	11.4	0.17	0.34	0.33	0.01	0.13	5.4
	II	7.3	6.2	0.196	0.018	10.9	54.1	26.75	24.56	0.23	0.63	56.2	16.3	0.26	0.45	0.47	0.01	0.17	8.0

Remarks: *Centrifugal treatment were imperfect.

possesses very bad physical properties due to heavy clay soil. But concerning its chemical properties, this soil is superior to those of the other seven Farms; rich in humus and nitrogen (a half of the Japanese soil), highest in C.E.C. with 50 me/100g and higher than the Japanese soil in the other compositions. The application of much quantity of refuse of sugar cane for the purpose of the amelioration of the physical properties is thought to have increased content of humus and nitrogen in the soil not less than to have improved its physical properties.

5) Bapatla Farm: This Farm environment belongs to coastal alluvial soil though in the largest part of the Farm it belongs to medium black soil. It has almost average content of humus and nitrogen as the Indian paddy field soils, with very high value of C.E.C. because of its heavy clay, like that of Surat Farm. The soil reaction is alkaline, rich in Ca. Mg. and P and a little short in K. About the soil conductivity, this Farm is ranked at the top of the eight, showing the value of 1.2 milli mhos/cm, which is not yet enough to be called saline soil. Soda content is very high showing 6.68 me/100g as exchangeable Na and 4.57 me/100g as water soluble Na. However, this value does not allow to include in the category of alkali soil, as far as according to the classification by Richard (1954) (that gives the name of alkali soil only to the soil whose Na saturation degree is not less than 15% on the exchangeable base) In the field, the rice plants show in some parts a poor growth due to the salt injury, therefore the proper measures should be executed in accordance with the amelioration method of saline soil or of alkali soil.

6) Mandya Farm: This Farm belongs to red soil and can be apparently included in the category of alkali soil so far as the content of exchangeable Na and ph value are concerned.

The soil texture is sandy clay loam, developing the prismatic structure. The content of humus and nitrogen and C.E.C. value are almost samely as the average of paddy field of India, holding a little mere Ca. and Mg., rich K and poor P.

As the alkaline injury is observed in a part of the Farm, the countermeasure for the alkali soil is required.

7) Chengamanad Farm: This farm is the alluvial soil derived from the granite which has been conveyed on the laterite by the Perliyar River, and is heavy degraded paddy soil mostly consisting of sand. It has nearly the average content of humus

and nitrogen as the Indian paddy field, but holds simply 3.29 me/100g of C.E.C., which means the minimum among the eight Farms. Its soil is acidic with ph 5, lacking extremely in either Ca, Mg, K and P. In the environment, the up-land crops show very evidently the Mg deficiency. In the paddy field, "Akiochi" literally a autumn depression and "Aogare" literally "blue green withering" are found with the failure of rice plants.

8) Khopoli Farm: This farm belongs to medium black soil, and colluvial soil derived from basalt. At the spot of the survey, no gravel is found out, but much gravel are observed widely where the lay out by use of bulldozer is insufficient and the basal rock is sometimes exposed too.

Its top soil is black and compact, becoming so hard when dried up, as well as so muddy when moistened. As the third layer is sandy clay loam, the drainage is comparatively favoured. The chemical properties are similar to the ordinal black soil, i.e. the soil holds high C.E.C., rich Ca. and Mg.,ordinary K, a little rich P and neutral soil reaction.

2. Amelioration of bad soils

1) Method of black soil amelioration

The Farms of Surat, Bapatla and Khopoli belong to this soil which is rich in every component and superior to the other soil in its chemical properties. But its defect exists in the inferiority of its physical properties. The application of plenty bulky organic manures is effective to the amelioration of it.

The Surat Farm has made a sucess by application of sugar cane refuse. The other rice straw, compost and green manures are effective. About green manures, the lignified mature dhaincha and the other are better than the young in their amelioration effect of physical properties.

2) Method of saline soil and alkali soil amelioration

According to the result of the analysis, there is no soil that can be called saline soil. But the Bapatla Farm has very a similar soil, as it has much of water soluble Na and 1.2 milli mhos/cm of conductivity. In fact, the salt injury causes the insufficient growth of rice plants after transplanting in some places. The Mandya Farm is clearly included in the category of alkali soil.

The methods of amelioration for these soils are as follows:

(1) The resistance of rice plants against the salt injury is most weak when the transplanting injury is overlapped by the salt injury: even 0.1% of NaCl injures the plant but after recover the growth with the animation, 0.1% of it and about 10 days before the heading, 0.5 of it have no injury. Therefore, the first thing to do for the paddy field possibly thought to be injured by salt, is to leach out it thoroughly by water before the transplanting.

(2) As methods of salt removal, there are two: the method of leaching out the salt to underground and that of washing out with irrigation water the salt accumulated on the soil surface.

In the case that the drainage system is well equipped and the groundwater depth is lowered more than 50 cm, the leaching out method is applicable.

If not so (like in the Bapatla Farm), the washing out method is better. First before the transplanting the paddy field is plowed well enough to form big clods, which are dried, depositting the salts on its surface, then the irrigation water should be flowed several times to wash the salts away into the salt removal ditch. When the amount of irrigation water is insufficient, it is more effective to lesson the water amount of one time poured and to increase the times of it.

(3) Both soils are very compact and its clay are changed into Na or Mg-clay being inferior in their physical properties, so that the salt removal with use of irrigation water can not be sufficiently realized. It is needed in this case to transform them into coagulative Ca-clay. As the caustic or slaked lime are inable to do it in alkali soil, it is preferable to use the gypsum, each time 200 kg/acre of gypsum is applied through several times. Or, it is good to apply year after year the super phosphate as the gypsum is in difficulty of obtaining.

(4) The application of rice straw, the cultivation of green manure crops and its application are also highly effective.

3) Method of amelioration of degraded paddy soil

Chengamanad Farm soil belongs to the heavy degraded soil and it has little of caly and much of sand, holding extremely

low C.E.C. On the the whole, the nutrient elements in the soil are less. Futhermore, the degraded soil is so poor in iron content especially free ferric oxide that free hydrogen sulphide (H_2S) is generated in the existence of sulphate or sulphur in such a reduced condition as the flooded paddy field, followed by the break-out of the root rot of rice plants. On the other hand the degraded soil is weak to hold the nutrient elements often resulting in the lack of the nutrition. Furthermore, K, Mg, Mn and Si are so deficient that the rice plants become unable to grow normally, fallen into autumn depression.

As the amelioration measures of degraded soils, there are several methods: Application of reddish clay soil containing much clay, addition of materials containing iron, dressing of calcium silicate (basic slag) digging up and mixing of sub soil and application of Mg and Mn.

3. Application methods and amounts of fertilizer at each farms

The outline is shown in Table 5 about the application methods and amount of fertilizer at the Farms.

At Nadia Farm, the three principal fertilizer elements applied are the least amount among the 8 Farms, and they are also under those of the recommendation of India. At the other Farm, all three elements are remarkably over those of the recommedation of India and one half at least and equal at most to those of the Japanese. Though in the recommendation of India many places are designated not to need the application of potassium, the application practice of every farms is very much. But the application of potassium is rather suitable to the Farms, because the soil of India is not always rich in potassium, according the result of the soil analysis, except Bapatla Farm where it is clearly abundant.

It is said in Nadia Farm that the yield is not only kept so highly but also increase year by year, in spite of application of a small amount comparatively of the three principal elements. This fact many be because of the increase of the soil fertility due to a plenty application of compost (which is presumed from the increase of the nitrogen content of the soil), the continuous application of abundant green manures and the advancement of all of the rice culture techniques in the Farm.

It is suitable to Sampalpur Farm that it applies a good deal of phosphours and potassium, as it lacks extremely these elements just as shown in the soil analysis result. Bapatla Farm of which the potassium content is specially at a high level needs exemptedly the application of potassium so little as mentioned in the recommendation of India.

4. Improvement of the fertilizer application techniques

1) Application method of the thre principal fertilizer elements.

Nitrogen is preferable to be applied by a way of three times split dressings: basal dressing and two times top dressing (at tillering stage and at ear formation stage) successively with the ratio 4:3:3. It is better to make the second top dressing in 23 or 25 days before heading.

Phosphours should be applied totally as the basal dressing, and potassium is divided equally into two split dressing : basal dressing and a top dressing in about 40 days before the heading. The top dressing of potassium could be applied too at the same time with that of nitrogen at the ear formation stage. This method saves the labour of the dressing.

As the basal dressing of nitrogen, it is to apply the method of a deep placement that the fertilizers is applied before plowing to the soil and plowed under to place deep. But as a notice. don't leave it without irrigation for more than three days in this case, if not so, great deal of nitrogen will be lost due to the nitrification followed by the denitrification. So, in such a case the following method is prefered. The plowing is carried out preliminary and nitrogenous fertilizer is applied on the plowed soil surface just before the irrigation, then the gradual irrigation and the leveling makes the fertilizer mix in all soil layers. The ratio of nitrification is indicated as follows about sulfate of anmonium and urea.

Table 5. Fertilizers Applied for Rice Cropping at Indo-Japanese Agricultural Demonstration Farms

Kg/acre

Farm	Cropping	Bulky Organic Manures added	Fertilizer			Paddy yield		Remarks
			N	P_2O_5	K_2O			
Nadia	1st cropping	*Dhaincha* 4.5 t	6.3	18.0	13.5	1.442	N.K_2O:	Two times split dressing
	2nd "	Compost 4.5 t, Dhaincha 4.5 t	4.7	14.4	15.0	1.028-1.662	N.P_2O_5.K_2O:	All as basal dressing
	3rd "	Kalai 3.8 t, compost 9.8 t	11.4	14.4	13.5	1.784	N:	Two times split dressing
Sambalpur	1st Cropping		21.1	38.5	38.7	1.300-1.670		
	2nd "		15.4	38.2	36.4			
Shahabad		Night soil 3-4t	13.0-19.0	16.0-20.0	24.0-28.0	1.238-1.740	N.K_2O:	Two times split dressing
Surat			19.0	8.4	18.9	3.000-4.000	N:	Three times split dressing
Bapatla	1st cropping	Compost 6 t	15.0-20.0	15.0	10.0	1.500	N:	Three times split dressing
	2nd "	Rice straw 0.5 t *or* Compost 1.8 t + Dhaincha 0.8-1.8 t	25.0-30.0	20.0	20.0			"
Mandya		Compost 4.8 t Sugar cane mud 1.0 t	34.0-39.0	24.0-36.0	22.0-25.0	2.000	N: K_2O:	Four times split dressing *Two times split dressing*
Chengamanad	1st cropping	Rice straw	15.0	25.0	20.0		N:	*Three times split dressing*
	2nd "							
	Indica		15.0	20.0	20.0			"
	Japonica		40.0	20.0	30.0			"
Khopoli		Dhaincha 0.3 t	21.0-26.0	20.0	15.0	1.043	N:	Three times split dressing

(B. Saito)

Time	Sulfate of Ammonium			Urea		
Hrs.	NH3-N %	NO3-N %	Sum %	NH3-N %	NO3-N %	Sum %
24	88.7	3.0	91.7	46.2	5.2	51.5
48	80.6	10.3	90.9	74.2	14.4	88.6
72	73.0	18.3	91.3	61.3	27.1	88.4
96	53.6	34.6	87.2	40.9	46.3	87.2

Remarks : N added : 10 mg/100g dry soil (paddy field)
Incubation temperature : 30°C
Soil moisture : Upland field condition

Urea has greater nitrification rate, and in 4 days, 46.3% of urea, almost the half, is changed into nitrate. (34.6% in case of sulfate ammonium). Nitrate is missed away in one or two days after the irrigation preceding transplanting.

2) Application method of rice straw and green manures

Rice straw is permitted to be applied as it is not as the compost. Its proper amount to apply is up to that of which is produced in the same field. But its application just before the transplanting would cause the root rot, accelerating the reduction on some soils. So, an abundance of rice straw should be, in this case plowed under in the field in a month before the transplanting. In addition, it is more desirable to add it some nitrogen source, as which any of calcium cyanamide, urea and ammonium sulfate is applicable. The suitable amount of nitrogen to add is 0.32 - 0.4 kg to 100 kg of rice straw. In the case that the green manure crops are cultivated before rice culture, if the rice straw is applied as the mulch for these crops, it serves a double purpose;

The mulching effect and the effect to avoid the injurious effects caused by the decomposition products of fresh straw.

Concerning the application method of green manure, as it makes injurious effect caused by the decomposition products of fresh plant material, the paddy field applied. The green manure should be made to rest in a upland field condition without irrigation for several days. Thus under the exidized condition, the injurous matter is not formed. But even in this case, the green manure must not be left for more than one week, as the longer term leaving quickens its decomposition to development of the nitrification.

The process of the decomposition of the green manure is shown, as an example, in the following table (S. Osugi)

Ratio of the decomposition into NH3 and NO3 of total nitrogen in Saatwicken

Unit : %

Soil condition	N form	Days					
		7	14	21	28	35	42
Field condition	NH3-N	17.0	7.0	2.0	1.4	1.4	1.4
	NO3-N	0	13.2	30.4	46.0	51.2	54.8
Flooding condition	NH3-N	12.3	17.9	26.6	29.2	26.4	15.2

3) "Akiochi" lit. Autumn depression of rice plant

"Akiochi" is apt to happen in the degraded paddy soil, simply to say, that indicates the phenomenon that a rank vegetative growth is accompanied by low grain yield. As the cause of this, the followings are thought to be important:

1. Low soil fertility, 2. Damage of roots by formation of injurious matters, especially of H_2S. 3. Poverty of such elements as Si, Ca, Mg and Mn which are the other than the three principal fertilizer elements.

Therefore the improvement of the soil itself is required first of all. As it is described above, here is mainly pre-

sented the measures of fertilizer application.

(1) Application of non sulfate fertilizer

It is prefered not to apply sulfate fertilizers which originate to evolve hydrogen sulfide but to do urea, calcium cyanamide, ammonium chloride, fused phosphate and muriate of potash.

(2) Reasonable application of nitrogenous fertilizers

It is an important cause for "Akiochi" that the nitrogen supply has ended in the later stage of the growth. To avoid this, not only the improvement of soil fertility is necessary but also both practice of the deep placement of the basal dressing and the top dressing at the ear formation stage are very important.

(3) Split and heavy dressing of potassic fertilizers

The lack of potassium can accelerate too "Akiochi" and sometimes becomes the main cause for "Akiochi". So it is necessary to apply sufficiently potassic fertilizers and to dress in the split dressing that the amount of potassic fertilizers is divided equally into two parts which are used as the basal dressing and as the top dressing about 40 days before the heading. The details of this method will be described in the item of "Aogare".

(4) Application of Si, Mg, Mn, etc.

As SiO_2, calcium silicate (Basic slag) is applied at 800 kg/acre, as Mg, dolomite or fused phosphate is applied, and as Mn, the fertilizers containing manganese sulfate are applied.

(5) Application of bulky organic manures like compost

The aims of these application are improvement of the soil fertility and the physical properties of soil.

(6) Control of irrigation and drainage

When hydrogen sulfide (H_2S) happens to generate, the field is to be drained to oxidize at all times and its drainage is to be continued for 40 to 25 days before the heading too, then the soil may be solidified and oxidized. The drainage before the harvest time is to be executed on and after 30 days after the heading, refrainning early drainage than this time.

4) "Aogare" lit. Blue-green Withering of Rice Plant

(1) "Aogare" (Lit. blue-green withering) of rice plant occurred extensively in the South-western part of Japan in 1955, and attracted general attention as a curious disease of rice plant. The disease, however, had occurred sporadically for former decades.

The authers experiments showed that the disease was not an infectious malady but a physiological disorder.

In the field, the disorder "Aogare" is noticed by the appearance with a peculiar symptom, sudden withering, about 20 days or more after heading. The disorder is accelerated by some environmental conditions, mostly by drainge after heading. Typhoon, dry wind, cool air temperature etc. also accelerate its occurrence.

The process of the symptom is as follow: Rice plant wither, starting from upper leaves and within one or two days, plant look as if pulled out and left drying in the sun. After five or seven days, they are discolored to grayish brown. At this stage, the plant show no distinction from injuries caused by rice borers, rice leaf-hoppers, or rice small sclerotium.

Stems usually are bent at about 20 cm above the ground, or the lodge. The basal part of stems is thin, the stem wall becomes soft and thin with dull yellow color of wax or amber. Nodes mostly turn brown. Healthy roots are few in number, thus the plants can be pulled out without difficulty.

This withering is quite different from the one caused by a mere drought. Though it is true that the disease often occurs, when the irrigation is temporarily suspended, drainage is not the original cause. Healthy plants do not suffer from any water shortage under such conditions. On the other hand "Aogare" may break out even when the water is fully kept in the paddy field. In the case of wilting caused by drought, plants will recover if the water supply is restored. But the wilting caused by "Aogare" is irreversible.

(2) The contents of carbohydrate and starch in the basal part of the stem of the disordered plant were less than those of the healthy one at any growth stage due to abnormal carbohydrate metabolism.

"Aogare" rice plant contained more nitrogen and less potassium than ordinary one. Accordingly K_2O/N ratio of the disordered plant was lower than that of the healthy one. The nitrogen metabolism was also disturbed, and the content of non-protein nitrogen was higher in the disordered plant than in the healthy one.

(3) "Aogare" rice plant with brown spots on leaves as a symptom of potassium deficiency contained putrescine and arginine. However, the disordered plant without spot contained no putrescine but only arginine. Accordingly, putrescine itself might not be the direct cause of "Aogare". Such an abnormal physiological condition in which nitrogen metabolism was disturbed and much arginine etc. were formed, might induce "Aogare".

The ability of root development of the disordered plant was also weaker than that of the healthy one.

(4) According to the solution culture experiments, continuous supply of potassium until the heading stage was necessary for the prevention of "Aogare". Especially, supply of potassium at the growth stage, around 40 days before heading was most effective for its prevention.

As to the relation between K_2O/N ratio in the culture solution "Aogare" was not induced in the solution with K_2O/N ratio of more than 1.0, but was induced in the solution with K_2O/N ratio of less than 0.5.

(5) The pot experiments with the soil in which "Aogare" occurred at previous season showed that the nutritional condition in no K_2O, especially no K_2O and much N induced "Aogare".

The shading at the ripening stage promoted "Aogare" occurrence. However, the treatment before heading had no effect.

As to the drainage, the treatment after heading accelerated the disorder occurrence. "Aogare" was also induced by the treatment at the early stage of plant growth, but was prevented, to some extent, by the treatment at the middle growth stage (so-called "Nakaboshi").

(6) In the field tests, less application of nitrogen, split application of potassium or sufficient application of compost prevented the occurrence of "Aogare". On the contrary, much application of nitrogen caused a severe occurrence of the disorder. The effect of deep tillage and of magnesium-calcium-silicate application could not

be clarified in the present tests.

There was no difference in the contents of total organic acid, butylic, acetic and formic acid between "Aogare" and healthy soils. This suggested that the acid had no contact relation with "Aogare".

(7) Addition of various acids, aldehydes, aceton and butyl and other alcohols in the culture solution induced nothing more than temporary withering which was quite different from "Aogare", but inhibited water and nutrient absorption (especially potassium absorption) of rice plant. It showed that the substances used in the solution culture experiment could not be the principal cause of "Aogare", but might become an indirect predisposing factor. Mercaptan treatment which is liable to make rice plant sterile also did not induce "Aogare" but made the plant rather resistant to withering.

Either addition of hydrogen-sulphide in the culture solution or mechanical cutting-off of roots also did not induce "Aogare", even though both treatments decreased the yield.

(8) In short, the principal cause of "Aogare" is a physiological disturbance due to excess nitrogen and deficiency potassium in the plant body especially at the growth stage around 40 days before heading which are derived from the unfavorable soil condition and unbalanced application of nitrogenous and potash fertilizers.

(9) One of the "Aogare" preventive measures, which though a passive one, is practically being employed already, is to postpone the drainage until at least 30 days after heading. After this period, starch begins to accumulate at the basal part of stems again, and the drainage will no more cause "Aogare" disease.

As a positive and radical measure, it is recommended to avoid additional nitrogen dressing about 35 to 40 days before heading and to supply potash liberally, half and half as basal dressing and as top dressing in this period. The last top dressing of nitrogen should be given after the early stage of panicle formation. The resistance deffers also widely by varieties.

Generally, the varieties of that type which forms many effective tillers are vulnerable to "Aogare", and especially "Kinmaze", "Shin Kinmaze", "Koganenishiki" and "Senbonasahi" are very liable to "Aogare" disease.

6. Diseases and Insect Pests

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1. Diseases

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2. Insect Pests

    1) Yellow rice borer

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In the further step of the measures to the increase of rice production in India, the diseases and insect pests will cause inevitably troubles, as they are the important factors that prevent the increase of rice yield. This report covers, however, only the diseases and the insect pests now in question, mentioning their features and the counter-measures against them.

1. Diseases

1) Blast

The pathogen of rice blast in Pyricularia oryzae, which causes the most important disease of rice plants. In such a condition that the temperature permits the rice culture through the year, this disease happens at mercy of the moisture; rarely in the dry season and considerably in the rainy season.

Control measures

It is most important in principle to utilize the varietal resistances for the disease control. But the chemical control is required at present, because the varieties excellent both in yield and in quality are not neither always or anywhere possible to be cultivated.

Chemical control

a) Disinfection of seeds

Rice seeds are steeped for 3 to 6 hours in a 1/1000 organic mercury solution (containing 0.0015 to 0.002% of mercury).

b) Spraying of chemicals

It is effective too for the control of seedling blast and leaf blast to spray the chemicals on recognition of the disease outbreak. Even if no remarkable sympton is found in the nursery, the preventive spraying of chemicals is always desirable at the stage of nursery, as it can oppress the outbreak of this disease in the real paddy field.

Fungicides and their applications

Fungicide	Concentration	Amount of dose (per 10a) Nursery bed	Paddy field
Blasticidin S			
Emulsion	4% 1/2000-3000	7 - 8 L	100 - 150 L
Wettable powder	4% 1/2000-3000	7 - 8 L	100 - 150 L
Powder	0.4%	0.3 kg	3 - 4 kg
Blastin			
Wettable powder	50% 1/1000	7 - 8 L	100 - 150 L
Powder	4%	0.3 kg	3 - 4 kg
Kitazin			
Emulsion	48% 1/800 - 1000	7 - 8 L	100 - 150 L
Powder	1.5%	0.3 kg	3 - 4 kg
Kasumin			
Emulsion	2% 1/1000	7 - 8 L	100 - 150 L
Wettable powder	2% 1/1000	7 - 8 L	100 - 150 L
Powder	0.2%	0.3 kg	3 - 4 kg

According to the cases of the occurrences, the spraying of chemicals should be more repeated, for example, at appearance of many acute disease spots in color of grey-blue. Especially to say, concerning the varieties which get in the stage of heading during the monsoon, the spraying of chemicals at the stage of pre-emergence can not satisfy well the control of the ear blast, so that the second spraying is demanded at the stage of all plant in ear.

2) Helminthosporium leaf spot

The pathogen of this disease is Cochliobolus miyabeanus. This disease that happens more frequently than rice blast in the paddy fields of general Indian farms, is considered very seriously with holding the local name of brown spot or seedling blight. In Japan, this is not an object of fungicide application in general, even bringing damages to the paddy field of "Akiochi".

As mentioned in the Chapter on soil and fertilizer, most of paddy fields in India are similar to that of "Akiochi". Therefore, it seems very natural that this disease breaks out in these fields.

Control measures

The infection sources consist principally of injured straw and paddy like in case of blast. Generally to say, this disease occurs seriously and injures severely, particularly when the plants are suffering from malnutrition. It says that the countermeasures against this disease is basically same as against the paddy field of "Akiochi". It is mainly to improve the field with application of additional soil, siliciferous or ferreous materials and organic matters, in accordance with the reasonable fertilization process.

In addition, in such places as model farms and as governmental ones, where the rice culture is practiced using comparatively a plenty fertilizer, and that, if the soil conditions are not favorable there, "ear blight disease" that panicle branch and glume are injured, will become possibly to make a problem. Though the chemical control against this disease is necessary, the highly effective chemicals have not been developed yet. By now, it is effective to spray a 1/250 Triazine water solution at the stage of whole heading and on the 10th day from this stage.

3) Stem rot

This is a calling name of the disease caused by the pathogen of Leptosphaeria salvinil and of Helminthosporium signoidium. The disease breaks out about at the stage of tillering and makes worse rapidly after heading in general. Especially, it occurs seriously at the fallen rice plants, prevalently bearing a great damage in the bad soil condition where potash fertilizer is lacked in fertilization practices.

Control measures

The main infection source is sclerotium which remains in the infected stubble of the last crop. As the resistance of rice plant to this disease is lowered down in the latter half period of the growth, samely as in the case of helminthosporium leaf spot, the timely application of organic fertilizer or potash fertilizer is to be required to support this resistance.

4) Sheath blight

Though it is generally believed that the pathogen of this disease is Pellicularia sasakii, its damage scale in the rice culture of India has not been well recognized till now, and also even its pathogen itself becomes questionable. But the attention should be paid to the fact that the occurrence of this disease increases, giving a great damage from the stage of pre-emergence to that of heading, in case that the rice culture is practiced with much fertilization in the period of monsoon of high temperature and of high moisture.

Control measures

The serious occurrence of this disease is observed in the paddy field where nitrogen is applied in an unbalance or in an excess. So, the rationalization of fertilization method is extremely important for the control of this disease. As chemicals, polymeric-methylditho cyanatoarsine is an effective component. The chemicals are to be sprayed to the sheaths of rice plant leaves from the middle stage of pre-emergence to its last stage. For the area of 10a, 3 to 4 kg of dust or 100 L of a 1/2500 emulsion (0.004%) is to be sprayed.

5) Bacterial leaf blight

Bacterial leaf blight of rice, caused by Xauthomonas oryzae was known as a port-typhoon disease in Japan. This disease is increasing in recent times, especially the occurrence of the disease is reported from various countries of Southeastern Asia. Severe damage done by it is recognized at monsoon season.

(1) Epidemiology of bacterial leaf blight of rice

(A) Primary infection sources

There are two forms in the leaf blight organism, in connection with its overwintering: one is dry-form and the other is

growing-form. The organisms in dry-form are those found on or in the infected rice plant, forming a solid mass. Under dry condition, they persist for a long period, in a dormant state. Thus, the bacteria in the rice straw or in grain, can survive till the following rice cultivation, if the straw or grains are kept dry in the barn or piled up outdoors under shelter from rain. But if the straws are scattered on or ploughed into paddy field and become wet, the bacterial in the straws will be destoryed within a few months.

Abundant bacterial have been detected in the tissues of glume, but not from the endosperm of the seed in Japan. Whereas it was reported in China and India that the pathogen was found occasionally also within the endosperm.

The bacteria in growing-form can survive in the rhizomes and root system of Leersia oryzoides, a perennial marsh grass, and in the root as well as underground part of stubbles of rice, which remained alive in the paddy field.

(B) Primary infection

Pathogen from the infection sources is disseminated to seedbeds by irrigation water and may cause infection of rice seedling under favourable conditions.

It is usually very difficult to find out the infected seedlings with naked eyes in nursery bed. If a lot of seedlings contaminated with the pathogen are transplanted into the paddy field, it is not uncommon for severe outbreak of leaf blight to occur. Table 6 shows the result of an experiment in connection with this problem. In this test, inoculation was made in the middle of June, and symptoms appeared at the end of June on some seedlings in the plots inoculated by immersion. Apparently healthy seedlings were transplanted to the paddy. Bacterial population was assayed by use of phage. It will be seen from the table that number of bacteria on seedlings remarkably influence the disease intensity in the paddy fields after transplanting, and heavy infestation of the seedling may cause epidemic in the paddy field.

Table 6. Relation between bacterial population in seedling and disease occurrence in the field

(Tagami et al. 1961)

Method of inoculation	No. of bact. cell in the inoculum per ml	Bacterial population per seedling Jul.5	Bacterial population per leaf Aug. 7	Diseased leaves per 100 plants Aug. 28	Intensity of disease of flag & 2nd leaves Oct. 20
Spray	70	0	24	10	12.7
	700	0	17600	253	41.7
Immersion	70	82500	38600	222	43.0
	70000	1190000	149000	802	85.4
	700000	2330000	158000	968	87.0
Non-inoculation	-	-	32	4	13.2

Date of inoculation June 18th

" transplanting July 9-11

(C) Major environmental factors including rice varieties in disease development

Of the various environments, most closely relating factors to a epidemic of leaf blight are the climatic conditions and cultural practices. In the former, the flooding by heavy rain incites severe infection of rice plants in nursery or in paddy field in early season. Flooding plays some important roles not only in transmitting pathogen but in inciting the symptom appearance.

In regard to the cultural practices, the mode of nursery, water irrigation, application of fertilizer and rice varieties, are all closely related to the disease development. The mode of nursery is directly related to the primary infection. It has been known by experience that the seedlings raised in non-irrigated or semi-irrigated nursery bring about less disease occurrence in the paddy field, than those grown in deeply irrigated nursery bed. As to irrigation water, the disease is usually severer in the field which is irrigated through whole rice growing season. But, draining and drying for a long period at water requiring stage of rice such as heading time, will enhance disease development. As for fertilizer application, much influence upon the disease development is exerted by nitrogen, which makes rice plant susceptible. Fig. 1 shows an example of tests for effect of fertilizers. The disease was severer in high nitrogen applied plot than that of low nitrogen. It is generally accepted that the more the nitrogen is applied, the severer the disease is to occur.

Relating to the rice varieties, they have been regarded as a principal factor in the epidemic. Distinct difference in susceptibility has been recognized among rice varieties.

Fig. 2 shows a comparison of bacterial population in the inoculated leaves of resistant and susceptible varieties. Multiplication of the pathogen after entry, is closely related to the degree of susceptibility of rice variety. In the susceptible variety, the pathogen could proceed to logarithmic phase after 1-2 days of lag phase and then increased rapidly to the order of 10^5 per leaf. Simultaneously the symptom appeared. In the resistant variety, the growth of the pathogen was similar to that in susceptible variety till the initial stage of logarithmic phase. However, it was soon followed by stationary phase, failing to attain enough number of bacterial cells for revealing symptom. The varietal difference in resistance was also recognized in the multiplication of the pathogen on the surface of rice roots. Fig. 3 shows the varietal difference in number of bacteria multiplied on their root surface. In the case of susceptible varieties, millions of bacterial cells per ml. were found after 10 days incubation, but only hundreds of thousand in moderately resistant or resistant varieties.

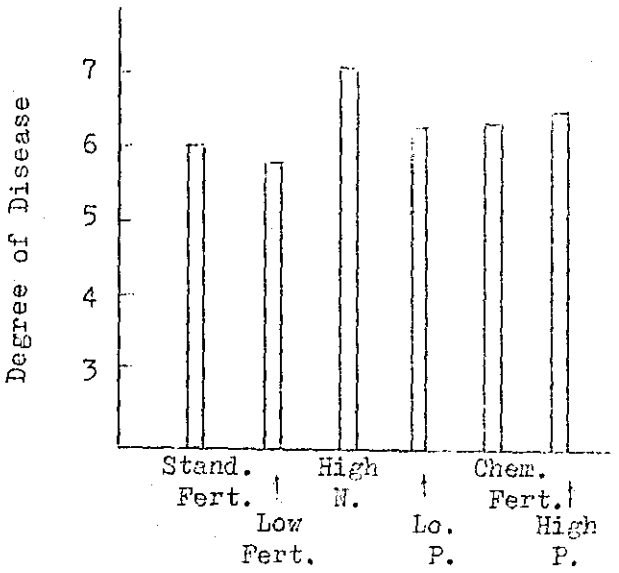

Fig. 1 Effect of fertilizer in disease development (Kondo et al. 1953)

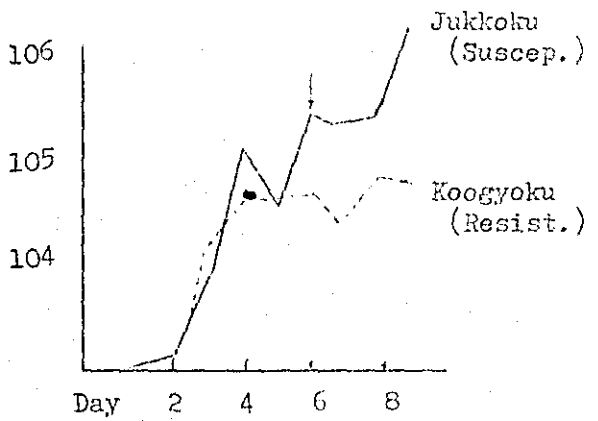

Fig. 2. Comparison of population of the pathogen in the leaves of susceptible and resistant varieties. (Tagami et al. 1961)

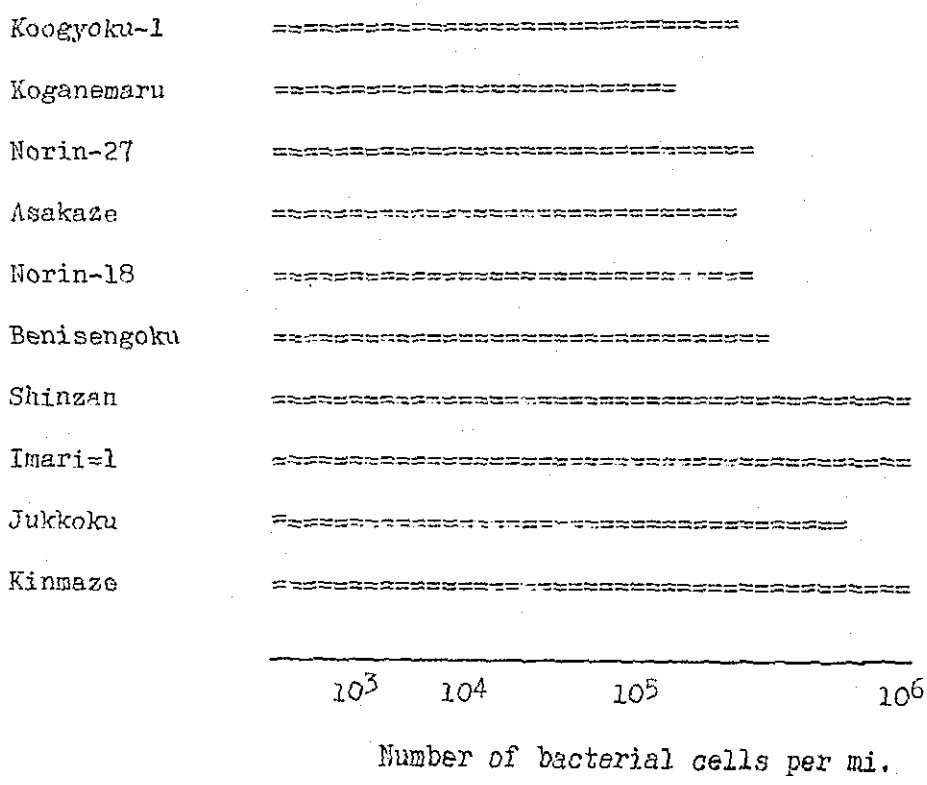

Fig. 3 Varietal difference in bacterial multiplication of the roots surface

(D) Behavior of the pathogen in rice plant

Although most of the pathogens arrived at the surface of rice leaves by means of wind dissemination or contact with diseased ones are usually killed in a short period in natural dried condition but they can survive for a longer period in rainy weather. These pathogens attached on above-ground part of rice, can enter the rice plant through wound or waterpores of hydathodes distributed along the edge of leaf blade. The pathogen disseminated by irrigation water behaves peculiarly in infection of rice plant. The bacteria suspended in the water will swarm to rice roots which emerged from the soil into irrigation water, and multiplies at the circumference of the root. This is probably induced by the bacterial reaction to sugar, amino-acide and oxygen secreted from

rice plant roots into water. Table 7 shows the amino-acids secreted by the root. These amino-acid and sugars are important as bacterial attractants and may be useful as bacterial nutirents. The pathogen multiplied around the roots of rice can enter the stem base through wounds due to root development.

The pathogen, invaded in the tissue via routes above stated, multiplies rapidly after 1-2 days of lag phase utilizing the nutirents secreted from infected tissue. Multiplied pathogens are partly excreted outside the host tissue and disseminated, but most of them invade the vascular bundles. Thus, the pathogen may infect the whole plant systemically through vascular system if the environmental conditions are suitable for disease development. Systemically infected rice, called as "Zurikomi", was rarely found in northern Japan, but not yet in the southern districts. On the other hand, it was reported that "Kresek" and pale yellow disease in Indonesia and Philippines, were the symptoms of rice caused by systemic infection with bacterial leaf blight pathogen. The rare appearance of systemic symptoms of rice in Japan may depend on the differences in rice varieties and also in virulence of the pathogen.

Table 7. Amino-acids secreted by the roots of rice plant (Wakimoto 1957)

	RF value in 1st dimension	RF value in 2nd dimension	Amount	Substance
a	0.64	0.38	+	Alanine
b	0.66	0.27	+	Glutamine
c	0.46	0.24	+	Glycine (Asparagine)
d	0.46	0.30	+	Threonine
e	0.38	0.30	++	Serine
f	0.37	0.35	+	Glutamic acid
g	0.11	0.34	+	?
h	0.10	0.28	+	?

(2) Control of the disease and forcasting by use of bacteriophages

(A) Control

Now a days, we have some comparatively effective agricultural chemicals against bacterial leaf blight disease. But application of these chemicals to habitually infected field at the time of appearance of the disease, has usually given poor control so far. This failure might be ascribed to delayed application. For success in control of the disease, the chemicals as the table 8, should be applied at the times mentioned below. The definite application time would be decided under the forecasting of the disease by use of bacteriophage.

Tentative plan for the control of bacterial leaf blight disease of rice

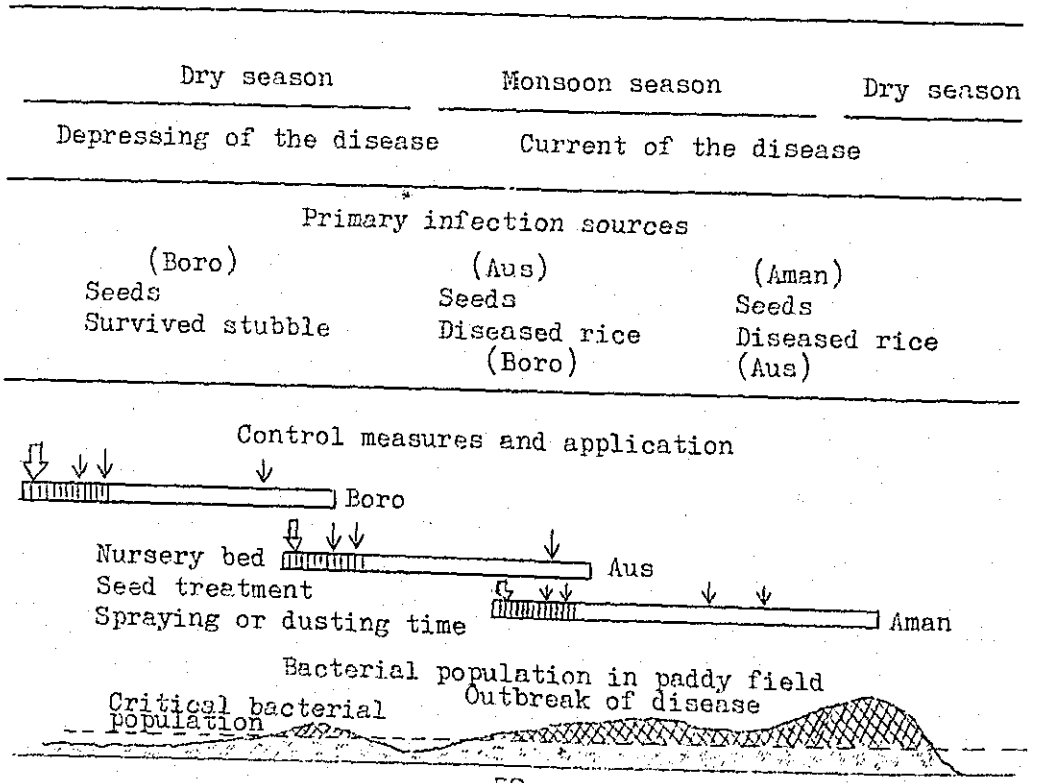

Table 8. Directons for Agricultural Chemicals

Kind of Chemicals, Concentration	Amount of Dose	
	Nursery per 10 m	Paddy per 100 m
Sankel Wettable Powder, 1/500	7-8 l	150 l
Cellugion " " "	"	"
Phenazin " " "	"	"
Shirahagen " " 1/1000	"	"

(B) Use of bacteriophage for forecasting

It was found by Tagami in 1959 that the bacteriophages in paddy field water increased in advance of disease occurrence, and they were always discovered earlier than the pathogen in irrigation water.

The irrigation water collected at several points of irrigation canals or in paddy field, 1-2 ml. of the water is taken and mixed with 2 ml. of X. oryzae suspension in test tube. About 5 ml. of melting potato-semi-synthetic medium (adjusted at about 50°C) is added to the mixture and poured into a Petri dish. Plauques may be counted after 15 hrs. at 25°C. Thus, the number of phage per 1 ml. of irrigation water can be obtained.

a) Forecasting performed in nursery and early paddy field stage

Generally, number of the phages detected are less than 30 per ml. of irrigation water at nursery stage. But when the phage population exceeded 100 per ml., seedling infection is just under proceeding. If far more number of phages are detected at late nursery stage, severe disease outbreak in early tillering stage of paddy field would be forecasted. Usually, the number of phages are very few in paddy field immediately after trans-

planting. However, if more than 2000 phages per ml. were detected, the earliest diseased rice must be exist in such paddy field. As for the population of phage in irrigation canals at transplanting time, the earliest disease appearance of Leersia oryzoides will be found when about 50 phages were detected in 1 ml. of the water. Furthermore, it is supposed that the first disease outbreak will be observed at 10-14 days after when more than 100 phages per ml. were detected.

b) Forecasting performed in later paddy field stage

When abundant phages (1000-2000 per ml.) were detected frequently at many plots in wider area, it is considered that many secondary infection sources (primary diseased rice plants) were already settled and high possibility of the disease occurrence may be forecasted.

In middle tillering stage, if the phage population in paddy field water were less than 50, more than 100 and more than 1000 per ml., forecasting disease occurrence to be considered as slight, moderate and severe respectively.

If the phage population in irrigation canal water were more than 100 per ml., the earliest disease outbreak will be found in this area. And the disease would be prevailing at more than 1000 per ml.

In maximum tillering stage, if the phage population in paddy field water was less than 100, more than 500 and more than 5000 per ml., disease occurrence would be slight, moderate and severe respectively. If the populationg of the phage in samples of water collected from many plots of irrigation canals, were over 1000 per ml. at every time, the disease occurrence is under proceeding widely in this area. Furthermore, the severe occurrence of the disease will be made more certain if such additional factors are taken into consideration, as widely cultivated susceptible varieties, heavy rain fall and typhoon in this area.

2. Insect Pests

Actually, the insect damage in the rice culture of India is very considerable and there are not few kinds of harmful insects. For example, it is said that there exist about a dozen of kinds including yellow rice borer, as what belongs to stem borer species.

1) Yellow rice borer

It is stem borer that gives to the Indian rice culture the biggest damage of which the main part is due to this insect, yellow rice borer (Tryporyza incertulas). The rise and fall of this insect pest is always closely related to the rice culture which is practiced in the large extent from the tropical zone in the South to the sub-tropical one in the North, in accordance with the characteristics that this insect does not eat to injure any other plants but the rice plants. Its first development happens in the rice culture of dry season, the second, in Aus and Aman cultures from the end of this season to the middle of the rainy season, the third, Aman culture after the above mentioned one. These three supposed development terms, which are completely different from those in the temperate zone which involve only the insect adults based on generation, cover always all the generations: adult, egg, larva, pupa.

Control measures

The aspect of the development of this insect is here entirely different from that in Japan, so that the Japanese method of its control shall encounter difficulties. As an example, the seedlings are daily injured thoroughly by eating of the larva, oviposited and hatched from late December in the nursery bed for the dry season rice culture which starts in mid-December, in the area of Bapatla of A.P. where it is observed the heavy development of yellow stem borer. And that, there are found in the paddy field the stubble eliminatings caused by the successive damage after the transplanting. In order to control these damages happening in the beginning stage of the rice culture, such chemicals are to be applied as have a successive residual action and as have a strong insecticide effect covering the eggs and the larvae soon after their hatching. And these chemicals must be applied many times in any way for this disease frequently happening district, so as to get a safficient control effect. Then it is difficult to establish an economically effective control method without thinking over the measures against the development sources of this insect pest.

The damage due to this insect is easily supposed to increase more and more, if the increase of production is planned in future by means of much fertilization rice culture or of multicropping cultivation. For the establishment of the countermeasure against this supposed damage, it is to grasp the real phase of the development of yellow stem borer in the district,

and to find the effective control time to cut away the influence of the dry season culture on the rainy season one by the thorough control of the former, because the chemical control is difficult about the damage of the latter as main crop. And as the kinds of chemicals applicable, what has the residual effect is preferable such as NaC-BHC granules. But as it is thought to be effective for preventing the eating of hatched larvae, the method of the application of this chemical needs to be more examined, in order to get enough the effect, according to the above mentioned disease frequently happening condition. It is to be notified that some of Indica varieties are injured by BHC chemical. For raising the effect of granule chemical application, it is necessary to keep the surface water in the paddy field for a difinite interval. But in the period of monsoon when the water is increased, this effect is supposed to fall, so that a suitable studies should be done on the instability of the chemical effects. The desirable chemical is defined to be what aims to kill the larva eating in for the purpose of an effective control using the chemicals. For examples, the followings are applicable:

Insecticides and their applications

Insecticide	Concentration	Amount of dose	
		Nursery bed (per 1 a)	Paddy field (per 10 a)
Parathion			
Emulsion	0.03 %	7 - 8 L	100 - 150 L
Powder	1.5	0.3 kg	3 - 4 kg
EPN			
Emulsion	0.07	7 - 8 L	100 - 150 L
Powder	1.5	0.3 kg	3 - 4 kg
DEP (Dipterex)			
Emulsion	0.07	7 - 8 L	100 - 150 L
Powder	4.2	0.3 kg	3 - 4 kg
MPP (Lebaycid)			
Emulsion	0.07	7 - 8 L	100 - 150 L
Powder	3.0	0.3 kg	3 - 4 kg
MEP (Sumithion)			
Emulsion	0.07	7 - 8 L	100 - 150 L
Powder	3.0	0.3 kg	3 - 4 kg

In the rainy season that the powder chemicals are made to lose their effects by the rain fall, the emulsion should be applied in the intervals of fine weather.

2) Gall Fly

Gall fly (Pachydiplosis oryzae), widely distributed in the zone of rice culture in the South-East Asia, causes damages. It is supposed that its larva repeats 6 - 8 generations in a year. In India, its damages are very heavy in the rainy season rice culture. The adult oviposits, flying to the young rice plants transplanted in the paddy field and the eggs are hatched in several hours to eat in the rice plants. The larva having eaten in, has continued to injure the plant by eating and reached the central part of the plants, so new leaf stops its growth and then withers to die in white.

The term that the rice plants in the monsoon period have the damage, depends a little on the different districts: initially from early and middle August and ultimately in late August in Orissa State but so in early and middle July in Kerala State.

Control measures

For the control of this insect pests, Parathion emulsion (0.04%, 100L per 10a) or Endrin emulsion (0.02%, 100L per 10a) is to be sprayed 4 times and each 10 days, starting from when the damage is found out. But as the process of the development of this insect is not limited to be same in each year, the appropriate time to control must be chosen to avoid the damage. That is more proved, therefore, when the cultivation method of rice plants is designed at the same time, taking in it the right way of avoiding the damage. This is to say that the setting and transplanting time of the rice plants in question are to be fixed as their maximum tillering stage has come to end at the ultimate development period of gall fly. It is because this device m makes that plants avoid the damage, as the hatched larva eats difficultly in the solidified stem of them which has finished their tillering to be matured, in case of which a little lag of a suitable control time does not matter. Of course, in any way, the complete control measures should be taken by using of the spraying the chemicals as first and by using of the other control methods at the suitable time, with the confirmation on

the development starting time by the forecasting the development process with aid of light trap, so as to control the damage of this insect pests effectively.

In addition, the new control method of this pest that was tested in Tailand makes effective results. It is to apply on the water surface the granule insecticide continuously effective. As a sufficient effect can not be expected to the spraying of the other insecticides where this pest happens in a long period. Actually it is BHC granule or Digistone granule to be applied in tw weeks after the transplanting with an amount of 3 - 4 kg per 100m^2 and secondly to be repeated in 2 weeks later on. Taking this method to apply twice the granule chemicals, it would enable to protect the rice plants almost completely from this damage by the insect of gall fly.

7. Minutes of the Joint Meeting of the Japanese Agricultural Technical Advisory Team and the Central & State Departments of Agriculture

(Reprinted from the circulation prepared by Mr. Naqvi, with slight adjustment)

A Joint Meeting of the Japanese Technical Advisory Team, project Leaders, State Reprentatives and the Officers of the Department of Agriculture was held at 10.30 a.m. on 8th March, 1966 in Committee Room No.1. The progress of the Demonstration Farms since their inception was reviewed. Shri J.C. Mathur, Joint Secretary was in Chair.

The Chairman, at the outset, thanked the Government of Japan for sending a Technical Advisory Team consisting of prominent Scientists and Administrators to India to study the functioning of the 8 Demonstration Farms set-up in collaboration with the Government of Japan. He also thanked the members of the Team for the keen interest with which they had studied each of the famrs by undertaking a strenuous tour lasting for about 8 weeks. He emphasised the importance of the visit of the team in the context of the present food situation in India. The experience of Japan and the adoption of their technology in India would go a long way in solving the food problem of this country. He then requested the members of the team to relate their experience and to indicate the measure which should be adopted by the Central and State Governments for improving the efficiency of the existing farms. This experience would be of considerable value in the adoption of Japanese technology on a larger scale in the country.

The Leader of the Japanese Team, Dr. Suzuki, thanked the Government of India and the State Governments for providing all facilities to the members of the team on their tour. He indicated that the results of the study made by the team would be submitted to the Government of Japan in the form of a report which would be sent to the Government of India also. The broad views of the team on some of the important aspects indicated by the leader are however as under:-

ITEMS 1 & 2 Review of the progress of old and new Indo-Japanese Demonstration Farms.

1) SOILS:- Dr. Suzuki gave a general outline of the soil conditions in the new and the old farms. It was observed that the soils of the new farms were not as good as those of the older farms - Changamanad solis were degraded; Mandya soils were alkaline; Baptala soils were saline and Khopoli soils had too many rocks in the top soil. For improving the soil at these Farms the following measures were recommended:

(1) Khopoli Farm: Addition of soil in the fields to maintain a uniform soil depth. Green manure crops may be grown and incorporated to improved physical condition of the soil.

(2) Changamand Farm: Application of clay soil @ about 40 tonnes per acre: basic slag and fertilizers.

(3) Bapatala Farm: To remove salinity the soil should be washed with water at least 2-3 times. To improve soil condition paddy straw, compost, green manure or other organic refuse should be applied.

(4) Mandya Farm: To remove the alkalinity, gypsum and superphosphate may be applied.

2) Fertilizers: Regarding the recommendation to use calcium cynamide along with paddy straw application, it was agreed that urea or ammonium sulphate can be used in the place of calcium cynamide, which is not available in the country.

The Magnesium deficiency in Sambalpur was considered and it was agreed to take remedial measures in consultation with the State Soil Chemist. Preparation of the soils - like removing the rocks at Khopoli was generally agreed upon.

Regarding the recommendation for carting of clay to Chengamanad Farm it was agreed that this might not be feasible in practice but that the same objective of soil inprovement should be achieved by the addition of bulky organic manures.

From the notes circulated for the meeting, it was noted that in the case of Ranaghat (West Bengal) higher yields were obtained each year even when the fertilizers doses were progressively decreased. While accepting that this might be due to higher efficiency in the use of fertilizers, it was felt that the mere study of the statements might be misleading. The team was requested to study this data and give a detailed note along with suggestion for further improvement of yield.

* Brief note attached at the end of this chapter.

3) Plant Protection: Bacterial leaf blight and blast (neck infection) were considered to be the major diseases noted by the team. It was agreed that the recommendations made by the team (in their note) would be tried during the ensuing season. The manufacture of the special pesticides in India was considered desirable and the team was requested to give a note on the manufacture aspect of the problem. Mr. Yoshida of the O.T.C.A. also agreed to examine the possibility of providing plant protection material for the demonstration farms under the aid programme. The Government of India will communicate the requirements of the State Governments in this regard to the Japanese Embassy.

4) Varieties and General Problems: The old farms, except Surat, have already selected major varieties for demonstration, from local varieties, and similar selection was under-way in the new farms. However, selection of more suitable varieties was considered to be the key problem in view of the general opinion that varieties currently under cultivation on the farms, such as T-141 or Latisail, had reached almost maximum limit of their yield. For getting higher yields it will be necessary to try and introduce other varieties. It was suggested that the co-ordinated trials in India which were in progress would be helpful in fixing suitable varieties for the demonstration farms.

It was mentioned that at the last Joint Meeting of the officers concerned with the Japanese Demonstration Farms held in April, 1964, it was agreed that trials of new varieties would be taken at these farms. It was emphasized that this should be done on a small area only and should not be included in calculating the economics of cultivation on the farm. It was also agreed that seed material of the new varieties might be obtained from Cuttack and distributed to all the farms.

The suggestion to divide each of the farms into blocks was agreed. The first of the blocks should be used as a "show window", to provide evidence of how far paddy yields can be raised, although the cost may be high, the second may serve for the establishment of feasible and recommended methods for extension. The third may be used for trials, and the fourth consists of plots still under leveling or re-arrangement, together with ill-fitted plots included in the Farm area.
(Detailed description on this matter is given in the General Remarks.)

ITEM 3: Demonstration and training programme of farmers and extension workers.

As decided at the last Joint Meeting held in April, 1964 the demonstration and training programme has been taken up at the old farms. During 1964-65 the Japanese techniques were demonstrated to 165 farmers and training was imparted to 53 extension workers and 90 farmers at the Arrah Farm.

At the Ranaghat Farm the construction of a training center has been completed. Training of pump drivers, mechanics etc. in the use of power tillers and threshers was taken up during 1964-65. The Training Programme of the V.L.Ws. in paddy cultivation will however, be started from April, '66. It was pointed out that long term training i.e, a full season's training might also be taken up for the farmers' sons as it would not be possible for the practicing farmers to leave their farms for long durations. Arrangements have been made for training of 50 young farmers at a time. No arrangements have so far been made for the training of farmers.

At the Vyara Farm a hostel has already been constructed and training is being imparted to Agriculture Extension Officers and the officers concerned with seed multiplication farms in rice growing areas. It was also proposed to select farmers from different blocks for training. It was indicated that the training of farmers would be arranged 4 or 5 times during the season for 2/3 days in order to cover the important operations. Fifteen trainees can be taken at a time.

At the Chakuli Farm training programme has been taken up from last year and 200 farmers have been trained.

At the new farms facilities are being developed to start the training programme in the subsequent years. At the Khopoli Farm the construction of a hostel is under consideration. At the Chengamanad Farm training would be taken up from 3rd year onwards. The Bapatla centre also has not yet reached the stage when training work can be taken up. This can be done only after the package of practices suited to the agro-climatic conditions has been finalised. However, the training in machinery has been taken up from the current year (1965-66)

The leader of the Japanese Team was of the view that at the new farms training in use of machines could be taken up straight away. Other aspects of training can be taken up as and when the farm in question has developed its performance significantly. However, the Mandya Farm appeared to be ready for the training programme even in the second year.

ITEM 4: Administrative problem relating to management of the farms.

1) Payment of travelling allowance etc. to the Japanese Technicians. Under the terms of the Colombo Plan Agreement the Japanese Technicians, working at the Demonstration Farms, while on tour, will be treated as grade (I) Officers of the Government of India. The detailed rules in this regard have already been communicated to the State Governments. The State Government Officers were requested to intimate the details of the rules etc. to the disbursing officer of the Japanese Demonstration Farms.

2) Import of spare parts for personal use of Japanese Technicians free of duty. The proposal has been taken up with the Department of Economic Affairs and their decision in the matter will be communicated to all concerned at an early date.

3) On account of inadequate medical facilities available in areas where the Japanese Demonstration Farms are located, it was suggested that the Japanese Technicians might be allowed to obtain medical advice and treatment from private practitioners and the charges thereof may be reimbursed by the State Government. It was pointed out that according to rules the Japanese Technicians were eligible for medical facilities on the same basis as admissible to grade (I) Officers of the Government of India stationed at the place of the headquarters of the expert. Such medical facilities would be available only through the Medical Officers under employment of Government or any Government recognized hospital. The representative of the Japanese Embassy requested that in view of the inadequate medical facilities at a number of farms the matter might be taken up with the Director General of Health Services.

4) The Japanese Technical Advisory Team during their visit to various Japanese Demonstration Farms also discussed some administrative problems and made a number of suggestions. There were subsequently discussed at the State Head-quarters with the concerned officers. In most cases the State Governments had agreed to provide the necessary facilities including appointment of additional staff.

At the Mandya Farm the team had suggested the appointment of 3 permanent Mazdoors, one Maistry, one watchman and one peon. The State Government were reluctant to appoint permanent staff

for the farm. Since the farms would continue as demonstration centres even after the departure of the Japanese Technicians, it was decided to request the State Government to reconsider their view and appoint permanent staff at the Farm

It was also pointed out that at the Ranaghat Farm Indian labourers run the Japanese Machinery. But in view of the fact that they were paid very low wages at the normal rates the turn-over was heavy. It was suggested that the State Government might consider paying higher wages for the technical work in order to reduce the turnover of the staff.

Regarding the installation of a telephone at the Chakuli Farm for the Japanese Project Leader it was informed that the Minister for Agriculture Orissa, had himself written to the P & T Department, but this could not be set up due to the declaration of emergency, the representative from the Orissa Government assured that this matter would again be taken immediately with the P & T Department.

ITEM 5: Setting up of parallel demonstration farms

The representatives from the West Bengal, Bihar and Maharashtra expressed the keenness of their respective State Governments to set up of parallel demonstration farms to cover the broad agro-climatic regions in their States. It was informed that the Government of West Bengal proposed to start ten parallel demonstration farms in the intensive rice districts with the ultimate aim of having one such farm in each district of West Bengal. At these farms agricultural practices being followed at the Ranaghat Farm will be adopted with necessary modifications suiting to that region. Similarly, the Government of Maharashtra proposed to set-up two sub-centres of the Japanese Farm at Khopoli, one in the district of Chanda or Bhandara and the other at Ratnagiri. The Government of Bihar wanted to establish two farms, one in Saharsa and the other in Purnea in the Kosi development area on the same model as Arrah. In this connection it was suggested that though each of the new farms to be started in the various States would have to be run with Indian technicians, but it might be necessary to have some higher level Japanese Advisers to assist the State Governments to guide the operation of these parallel farms.

Mr. Miki from Japanese Embassy pointed out that the question of setting up parallel demonstration farms was closely linked-up with the training of Indian counterparts in paddy cultivation in Japan and the future of these farms after the Japanese Technicians go back. The existing technicians, with their executive responsibility for the functioning of the farms will find it difficult

to guide and advise the additional farms if they are given this added responsibility. Keeping this in view it was generally agreed that these farms may be run under the guidance of higher level Japanese Advisers to be made available at the State headquarters on the pattern suggested by the West Bengal Government.

On an enquiry whether the Japanese Government would be able to provide such higher level advisers to all the interested State Governments, Mr. Yoshida of the Overseas Technical Cooperation Agency, Japan, mentioned that he would recommend this proposal to his organization. He, also, pointed out that it might be difficult to obtain suitable experts in sufficient numbers and that only one or two technicians may be made available to the interested State Governments. The experts might be provided to only one or two States in the first year and to other States in subsequent years. It was agreed that priority might be given to those State who had already sent their proposals to the Government of India. It was also agreed that a formal request might be made by the Government of India in connection with the requests of the State Government.

Regarding the number of Parallel Demonstration Farms to set up in each State, Mr. Nagai suggested that on account of limitation of mobility and management it would be desirable that the Japanese Advisers were not made responsible to look after too many farms.

ITEM 6: Study of economics of mechanised cultivation and bullock cultivation

At the previous Joint Meeting of the Officers held on 24th April, 1964 at New Delhi, it was agreed that bullock cultivation would also to be tried on at least 1 acre at each of the Demonstration Farms. It was indicated that this experiment had been carried out only on the Ranaghat Farm where the bullock driven implements were used on one field to compare the performance of the same with that of the power driven implements. The crop was autumn paddy and the variety was Charnak. All other treatments were the same. The results indicated that the yield obtained from bullock cultivation was 1279 kgs. per acre against 1362 kgs. per acre obtained through mechanised cultivation. Further the per acre expenditure was higher (Rs.372/-) in the case of bullock cultivation as compared to Rs.301/-per acre for mechanised cultivation.

The experiment was not tried further as the mechanised cultivation was considered decisively superior. It was, therefore, agreed that no further trials were necessary with bullock cultivation.

ITEM 7: Production of films on Japanese Methods of Paddy Cultivation

It was informed that the West Bengal Government had already produced a coloured film on Japanese Method of paddy cultivation. The other State Governments also showed interest in the production of similar films. The general view was that the coloured films would be more effective and had better demonstration value than films in black and white. It was agreed that all the State Governments would arrange for the production of coloured films on the pattern of the film produced by West Bengal. In view of the difficult foreign exchange position, it was enquired whether coloured films could be obtained from Japan under the aid programme. Mr. Yoshida of the O.T.C.A. agreed to arrange for the supply of coloured films provided they were produced under the supervision of Japanese technicians. It was agreed that a formal request would be made by the Government of India to the Japanese Embassy in this regard.

ITEM 8: Training of Indians counter - parts in Japan

Mr. Miki from Japanese Embassy stressed the need for expediting the nomination of Indian technicians connected with the Japanese Demonstration Farms for group training course in rice cultivation in Japan under the Colombo Plan. He pointed out that training would start from April, 1966 to enable the trainees to take part in the preparation of nursery beds and transplanting operations. If the nominations were not sent to the Japanese Government immediately before the end of March the utility of the training would be very much reduced. It was informed that the nominations had been received from the Government of Bihar, Gujarat, Maharashtra, West Bengal, Mysore, and Andhra Pradesh. These were being scrutinied by the Government of India and would be forwarded to the Japanese Embassy very shortly.

ITEM 9: Future of old demonstration farms established under the First Agreement.

It was agreed that the farms established under the First Agreement would continue to function as demonstration centres and would retain their separate identity. It would not be desirable to

merge them with larger institutions. In fact, it would be desirable to upgrade these famrs by appointing more qualified higher level staff to work there. It was suggested that after the Japanese Technicians left, these farms should maintain liaison with the Japanese technicians and arrange to obtain the latest techniques and improvements. Most State Governments indicated that the farms would be suitably strengthened to enable them to cope with a more vigorous training programme in the future.

In this connection it was pointed out that a lot of machinery had been imported for the use of these farms which was surplus for the actual requirements of the existing farms. It was suggested that the surplus machinery etc. should be utilised at the nearby farms.

OTHER POINTS:

Mr. Miki from Japanese Embassy pointed out that the Farm Managers at some of the Demonstration Farms were class III officers and did not even have the power of disbursement. It was generally felt that the Farm Managers should be gazetted officers as far as possible and in case the State Governments were unable to post a gazetted officer, the existing Farm Manager should be delegated adequate power of disbursement.

It was also decided that the State Governments be requested that the officers deputed for training abroad, while on training, should be treated as on duty and not on leave.

It was also suggested that the publications of the I.C.A.R. and the Directorate of Extension should be made available to the demonstration farms. Each farm should have good large-sized maps of the region in which they were located.

At the conclusion of the discussion extension Commissioner thanked the members of the Japanese Team, Officers of the Japanese Embassy, Japanese Technicians and the representatives of the State Governments for making it convenient to attend the meeting.

* Brief note on the matter as far a reply.

The annual fertilizer dosage, as well as cropped acreage, yield and variety used, are summarized by cropping seasons in Table A. Though the fertilizer dosages are different according to plots, even on the same variety, due to transplanting date, spacing or crop-rotations, figures in the table are adopted from the plots which are considered as standard, for simplification, so not represent the exact average, worked out from total acreage, respectively.

On the first cropping of the Farm, Aman in 1962, definite over-dosage was observed, as the result of it, the yield was so low as 815 kg/ac, suffered by severe lodging and diseases. By this bitter experience, the amount of ammonium sulphate to be applied was reduced year by year, in general, but any big change was not seen on the other two elements. On the other hand, the efforts were being made on soil improvement (physical property) by deep-ploughing, leveling and applying compost and green manures included in cropping scheme. Split-dosage of chemical fertilizers was also effective, as one of counter-measures for disease control. However accumulated experience and knowledge on the varieties are considered to have contributed mainly to yield increase despite fertilizer reduction. Brief accounts on it are as follows;

Aus... The varieties were same through 63 and 64, but sowing and planting dates were different. In 1964, yield of Dular, sown at May 1st was so high as 1967 kg/ac on 2.82 ac and promoted total yield of Aus.

Aman...The results were not satisfactory even in the second year. Though the varietal difference on the disease, bacterial leaf blight, were not so distinct, Roghusail showed good behaivour, but Churnakati and Jingasail resulted in crop-failure due to lack of straw stiffness. In the 3rd year, increased acreage of Roghusail and introduction of T-141 and Latisail contributed to the promotion of Aman production. The effect of varietal selection was clearly observed here, although the control of disease was still incomplete. Gradual decrease of total acreage under Aman, owing to cropping scheme, is worth mentioning because it is a main reason for the reduction of annual expense on fertilizers.

Table A. Annual results on fertilizer dosage and yield in Nadia Farm.

	1962	1963	1964
Aus			
Fertilizers			
Compost (md/ac)		120	120
Ammonium salphate (kg/ac)		45.4	22.7
Superphosphate (")		113.4	113.4
Potassium chloride (")		22.7	22.7
Total acreage (ac)		8.99	10.10
Yield (kg/ac)		1233	1462
Variety		Dular Charnock	Dular Charnock
Aman			
Fertilizers			
Compost (md/ac)	160	120	120
Ammonium salphate (kg/ac)	52.5	45.4	31.7
Oil-cakes (")	450.0		
Superphosphate (")	112.5	113.4	113.4
Ground bones (")	90.0		
Potassium chloride (")	45.0	22.7	22.7
Total acreage (ac)	17.94	10.73	9.11
Yield (kg/ac)	815	1104	1532
Variety	Patnai 23 Bhasamanik	Churnakati Patnai 23 Roghusail Jingasail Bhasamanik	Roghusail T-141 Latisail Patnai 23
Boro			
Fertilizers			
Compost (md/ac)	60	120	120
Ammonium salphate (kg/ac)	34.0	34.0	31.7
Superphosphate (")	68.0	113.4	113.4
Potassium chloride (")	-	22.7	27.2
Total acreage (ac)	3.00	2.84	2.82
Yield (kg/ac)	1002	1095	1785
Variety	C.B.-1	Latisail C.B.-2 Bhadkalmkati Norin-17	Latisail

Boro...The dosage for phosphate & potassium was rather increased, but introduction of Latisail, replacing C.B.1-2 was main reason for yield elevation. Even in the 2nd year, Latisail yielded 1380 kg/ac on 1.18 ac. On the other hand, Bhadkalmkati and Norin 17, which covered 0.9 ac were used only for experimental purpose, as the result of it they proved inadaptability, together with C.B.-2.

In the above mentioned, the amount of fertilizers used for green manures or other crops than rice was not taken into consideration, because it is not easy to calculate annual dosage, plot by plot, following its cropping pattern respectively, and documents were not so complete here. However total expense of fertilizers did not so differ between 2nd and 3rd year, as seen in Table IV on the circulation (No.F.5(17)/65-C&FE), arranged by Mr. Naqvi, March 1966, so it can be said that the manurial design has been almost settled after the 3rd year, at least for extension purpose. Positive increasement of dosage, aiming maximum yield from each plot, could be possible only after the completion of field re-arrangement (including soil-improvement) and varietal selection.

Names of the participants who attended the Joint meeting of the Japanese Technical Advisory Team etc. held on 8.3.66 in Committee Room No.I, Krishi Bhavan, New Delhi.

Ministry of Food and Agriculture (Department of Agriculture)
Krishi Bhavan, New Delhi

1. Shri J.C. Mathur, J.S. (A) Chairman
2. Shri D.V.Reddy, Extension Commissioner
3. Shri T.N.Saraf, Deputy Secretary, Foreigh Division

Directorate of Extension, Krishi Bhavan, New Delhi

4. Shri V.P.L. Tejpal, Director of Administration
5. Dr. T.R.Mehta, Director Farm Advisory Unit
6. Shri M.G.Kamath, Director Farm Information Unit
7. Shri P.D.Srivastave, Joint Project Director
8. Dr. D.S.Kang, Joint Project Director
9. Shri.P.Saetry, Crop Production Specialist
10. Dr. Ambika Singh, Crop Production Specialist
11. Shri J.N.Hota, Crop Production Specialist
12. Dr.H.S.Mann, Crop Production Specialist
13. Dr.R.D.Bhoumick, Soil & Fertilizer Specialist
14. Dr.K.N.Synghal, Soil & Fertilizer Specialist
15. Shri S.M.Pathak, Farm Management Specialist
16. Shri S.I.H.Naqvi, Deputy Director Coordination

Japanese Technical Advisory Team

17. Dr.S.Suzuki
18. Dr.T.Mizukami
19. Mr.K.Nagai
20. Mr.T.Sugiyama
21. Mr.T.Matsushima

Japanese Embassy

22. Mr.Y.Miki, Ist Secretary, Embassy of Japan
23. Mr.M.Ikeda, Ministry of Foreign Affairs, Tokyo
24. Mr.K.Yoshida, Chief of the External Operation Division of Overseas Technical Cooperation Agency
25. Mr.H.Takei, Coordinator, Marine Product Precessing Training Centre, Mangalore
26. Mr.S.IIBOCHI,Co-Director

27. Mr.S.Hirakawa, Vice Consul, Consulate General of Japan, Calcutta
28. Mr.K.Nomura, Consulate General of Japan, Bombay
29. Mr.M.Yoshida, Consulate General of Japan, Madras

Project Leaders

30. Mr.Y.Hirosaki, Indo-Japanese Agricultural Farm, Arrah, (Bihar)
31. Mr.Kohei Sato, -do- Nadia (W.Bengal)
32. Mr.T.Shimada, -do- Chakuli (Orissa)
33. Mr.K.Misawa, -do- Vyara (Gujarat)
34. Mr.S.Ota, -do- Khopoli (Maharashtra)
35. Mr.H.Nasu, -do- Bapatla (Andhra Pradesh)
36. Mr.N.Isono, -do- Chengamanad (Kerala)
37. Mr.H.Yasunaga, -do- Mandya (Mysore)

State Representatives

38. Shri H.P.Srivastava, Director, Intensive Cultivation Programme, Bihar, Patna
39. Shri S.F.Ahmad, District Agricultural Officer, Shahabad, Bihar
40. Shri A.T.Sanyal, Additional Director of Agriculture, West Bengal, Calcutta
41. Shri D.K.Ray, Superintendent, Ranaghat Farm, West Bengal
42. Shri J.K.Bhattacharya, Deputy Secretary, Department of Agriculture, Govt. of Orissa, Bhubaneswar
43. Shri B.Misra, Deputy Director of Agriculture, Sambalpur
44. Shri G.B.Kasad, Deputy Director of Agriculture (Extension) Ahmedabad
45. Shri N.K.Vanjaria, Farm Manager, Vyara Farm, Gujarat
46. Shri B.B.Patil, Agronomist and Farm Manager, Khopoli Farm, Maharashtra
47. Shri N.K.Adeni, Joint Director of Agriculture, Andhra Pradesh
48. Shri B.Sankara Rao, Farm Manager, Andhra Pradesh
49. Shri Ghouse Mohyuddin, Deputy Director of Agriculture, Mandya
50. Shri C.C.Gowda, Asstt Farm Superintendent
51. Shri M.Janardhan Nair, Director of Agriculture, Kerala, Trivandrum
52. Shri Abraham Cherian, Farm Manager, Kerala

8. Records of Discussions between the Japanese Agricultural Technical Advisory Team and the State Governments.

The Japanese Advisory Team made consulations with the State Governments concerning technical as well as administrative matters of the Agricultural Demonstration Farms in order to implement more efficient and smooth operation of the Farms.

In this chapter, the administrative matters of each Farm will be stated, as the technical matters were already mentioned in the previous chapters.

1) WEST BENGAL

The meeting was held on February 19 between the Japanese Team and the State Government.

Present

(leave out prefixes from the names)

R. Ghose — Commissioner & Secretary, Agriculture & Community Development,

H.K.Nandi — Director of Agriculture
A.T.Sannyal — Additional Director of Agriculture

Ambika Singh — Liaison Officer

Others.

S.Suzuki — Team Leader with 6 officers.

Gist of Discussions

The Team made requests to the State Government that in order to effectuate more efficient and smooth operation of the Ranaghat Agricultural Demonstration Farm that the necessary measures would be taken for the arrangements of permanent irrigation channels and construction of covered threshing floor in the Farm.

The State Government replied that the program is now under the examination of the Government and a due consideration would be given. The State Government, on the other hand requested the Team that the Government is at present planning to establish ten more satelite farms similar to the Ranaghat Farm in its function, and in this respect Japan would be requested to give assistance by providing the services of two Agricultural extension specilists and expressed the desires for the extension of the Ranaghat Farm five years more after the present Agreement terminates on next April. To this requests, the Japanese Team promised to convey it to the Government of Japan on return.

2) ORISSA

The meeting was held on Febuary 25 between the Team and the State Government.

Present

R.P.Padhi	Development Commissioner
A.Ahmed	Secretary, Agriculture & Animal Husbandry
J.K. Bhattachayja	Dy. Secretary, Agriculture & Animal Husbandry
K.C. Chandrasekharan	Director of Agriculture
A. Das	Director of Community Projects
D. Behura	Jt. Director of Agriculture (Extension)
B. Mishra	Dy. Director of Agr., Sambalpur
J.N. Hota	Liaison Officer
S. Suzuki	Team Leader with 6 officers.

Gist of Discussions

Different points were discussed with regard to the operation of the Chakuli Agricultural Demonstration Farm. Firstly, concerning the technical side of farm management, at present the Japanese project leader is discharging that function with assistance of Junior Farm Manager. The Agronomist in charge of the Irrigation Research Center at Chakuli is acting as the Liaison Officer.

It was suggested that it will be desirable and necessary to have a whole time officer in the rank of class-II gazetted status who must be fully associated with the project leader so that he may be in a position to carry out the overall management of the farm. To this, the State Government replied that it will be very difficult to provide whole time officer for the Farm because of its smallness in farm acreage.

Secondly it is stated that it is desirable that agricultural machinery are properly kept in operation and in good repairs, for being able to discharge this function and also to extend the idea of management of the Japanese types of machinery, it is necessary to have a whole time mechanic in charge of the machinery at the Farm. To this, the State Government agreed to provide a full time mechanic.

Apart from these two officers, the Team felt that the following staffs members will be necessary in addition to staffs already existing.

(1) Training of extension workers and farmers had been taken up at Chakuli Farm during the current year. 9 field demonstrations of Japanese method of paddy cultivation have also been taken up in the different blocks. This scheme is getting popular and the scope of the Farm will be considerably increased during the coming crop season. Due to the introduction of this scheme, the office work has increase and the volume of work will further increase as soon as the area of operation of the demonstration programme is extended to other blocks. It is therefore felt necessary to appoint a typist under the scheme. To this point, the State Government agreed.

(2) A jeep is in position already for the execution of the programme. It is stated by the Team that some more additional agricultural machinery including a station wagon are expected to arrive shortly. So far no driver has been appointed for running the jeep. It was suggested that two drivers may be sanctioned for running the jeep and the station wagon, and also garages for two vehicles. To this, the State Government agreed.

(3) It was also felt that the services of an agricultural overseer would be necessary in connection with the demonstration programme in the cultivator's fields. To this, the State Government said that it would be very difficult to provide the personnel.

Lastly, the Team said that telephone connection to the Farm will be useful and necessary. In the agreement for the establishment of the Farm, it is stated to be installed but so far not yet

installed. To this, the State Government said that it would be very difficult to install the telephone in view of the long distance.

3) BIHAR

The meeting was held on March 3 between the Team and the State Government.

Present

Karam Singh	Commissioner of Agricultural Production
P.S. Kohli	Dy. Secretary of Agriculture
B.N. Sinha	Director of Extension Service
H.P. Srivastava	Director of Agriculture (P.P.)
J.N. Hota	Liaison Officer
Others	
S.Suzuki	Team Leader with 5 officers

Gist of Discussions

Both the Team and State Government expressed satisfaction over the results of the operation of the Arrah Agricultural Demonstration Farm which has been running smoothly encountering no particular difficulties in both technical as well as administrative fields. Apart from this Farm, the State Government requested to the Team that it is considering to establish two more demonstration farms alike the present Arrah Agricultural Demonstration Farm in the Package Program Districts of the State. Therefore it would be very appreciated that if Japan would cooperate in the establishment of the new farms. To this, the Team promised to convey the State's desire to the Government of Japan on return.

4) GUJARAT

The meeting was held on January 22 between the Team and the State Government.

Present

S.M. Dudani	Secretary of Cooperation & Agridulture Dept.
H.C. Jethi	Dy. Secretary "
G.A. Patel	Director of Agriculture
T.R. Mehta	Liaison Officer
Others	
S.Suzuki	Team Leader with 5 officers

Gist of Discussions

The Secretary confirmed the discussions previously held between the Director of Agriculture and the Team. Secretary expressed that after termination of the Agreement, the Farm will be utilized for the purpose of extension and research work. Efforts will be made for the expansion of new technique and methods evolved at Vyara Farm. New variety found out at the Farm will also be released for extension, and construction work now being undertaken will be expediated.

(1) Training of Indian Counterpart

About the training of Indian counterparts in Japan, the Secretary agreed to send the nomination form of counterparts to the Government of India very immediately. It was also confirmed by the Secretary and the Director of Agriculture that counterpart means the farm manager of Vyara Demonstration Farm.

(2) Creation of the posts of the typist and driver on the Farm

Secretary agreed that the Government will take necessary steps to create the posts of typist and driver on the Farm.

(3) Extension of the existing phone or installation of separate phone at the residence of the Project Leader

Secretary agreed to provide telephone facility at the residence of the Project Leader.

(4) Agricultural Machinery burn out in National Agricultural Fair

The Secretary agreed to expedite this matter after realy necessary proposal is received from the Project Leader.

(5) Modern Rice Mill

About the possibility of creating a Modern Rice Mill on commercial base in Gujarat, the Team has taken a note of it and the desire of the Gujarat Government will be conveyed to the authority concerned.

(6) 16mm coloured movie film

In this regard, the Team ask for the opinion of the Central Government, Dr. Mehta,(Liaison Officer,Director, Farm Advisory Unit, New Dehli), expressed that for the movie film, Indian Council of Agriculture Research has to depend upon the Film Division, Ministry of Information and Broadcasting and hence the final position will be discussed in the Joint Meeting at New Delhi, in March 1966.

The members of the Team were also called on by the Minister for Agriculture Shri, Utsavbhai S. Parikh. and the Deputy Minister for Agriculture at the residence.

The Secretary gave a brief report of the discussions held with the Team to the Ministers. The Minister expressed that as the State at present is in need of food stuffs, every efforst will be made by the State Government to cooperate with the Government of Japan in solving the food problems of the State.

5) ANDHRA PRADESH

The meeting was held on February 12 between the Team and the State Government.

Present

H.Samba Murthy	Secretary of Agriculture
T.V. Reddy	Director of Agriculture

M.K. Adeni	Joint Director of Agriculture
Ambika Singh	Liaison Officer
S.Suzuki	Team Leader with 5 officers.

Gist of Discussions

On the Administrative side, The Team desired the following items to be improved.

(1) At present the office and the field laboratory are situated one mile away from one another and difficulty is experienced in contacting office staffs during working hours. It is desirable to enclose the covered space used for washing machinery in the field laboratory and concert it into a room for Indian staffs and have an open platform for washing machinery, the present office room can be used for storing valuable articles.

(2) An overhead tank and a filter point with motor may be put up to supply water to the field laboratory.

(3) The field laboratory is situated in the midst of fields a mile away from the residential quarters. As costly equipments like cameras etc. are kept on the laboratory, four steel almirahs and ten steel chairs may be provided, the latter will be used for visitors.

(4) The 3 implements shed at present are having only expanded metal over walls $2\frac{1}{2}$ feet high and with slight wind send particles are entering the rooms. As machinery is likely to be spoilt by sand the expanded metal frames may be covered by glass panes. The sheds are facing west and in the afternoons there is too much sunlight which is causing inconvenience to staffs who work there and also affecting machinery. This is likely to be worse in the coming summer. Hence the roofing may be extended by about 9 feet to prevent the sunlight, the bottom halves of doors may be fitted up with GP sheets.

(5) A servicing bridge 3 feet high may be provided so that vehicles and tractors can be serviced by taking them over the bridge.

(6) Three internal roads may be gravelled and made fit to take machinery over them.

(7) The embankment of the new field channel may be raised and strengthened as there is a leakage of water.

(8) As neighbouring farmers are putting obstructions over the channel and crossing into their fields, a cuvert may be constructed.

(9) A compost shed 15' x 20' may be constructed with asbestos rooting.

(10) A fieldman may be appointed to supervise work of labourers (This is to be done in consultation with Government of India)

(11) Due to fall in the water table of the locality, filter point provided to supply drinking water is not working satisfactorily. Another filter point may be sunk deeper and connected to the present one to augment water supply.

(12) A permanent advance of Rs. 200 may be provided to the Farm manager to meet immediate needs.

(13) Medical facilities from private doctors may be provided to the Japanese staffs and families (This is to be discussed at Joint meeting in New Delhi)

6) MYSORE

The meeting was held on February 5 between the Team and the State Government.

Present

P.J.Ramakrishnan	Secretary of Agriculture
H.R. Arakere	Director of Agriculture
C.P. Sastry	Liaison Officer
Others	
S.Suzuki	Team Leader with 5 officers.

Gist of Discussions

It was discussed about the administrative problems of the Indo-Japanese Agricultural Demonstration Farm, Mandya which is as follows.

(1) Delegation of powers to the Assistant Farm Superintendent (Farm manager)

The Director of Agriculture has agreed to give some similar powers for the Assistant Farm Superintendent just as the Seed Farm Manager.

(2) Deputation of Assistant Farm Superintendent to Japan for advanced training in rice cultivation.

The Director has agreed and he has already forwarded the application to the Government for further needful.

(3) Providing the Additional Staffs to the Demonstration Farm

1.One Mainstry, 2. One watchman, 3. One peon, 4. Three permanent labourers.

Regarding the appointment of one mainstry and one peon, the Director suggested the Deputy Director of Agriculture, J.A.D.T. Maydya, to send one peon and one fieldman from the J.P.C. Establishment at Maydya, to Indo-Japanese Agricultural Demonstration Farm.

Regarding the appointment of 3 permanent labourers, the Director suggested to engage the casual labourers occasionally instead of permanent labourers and to give them higher weekly wages on the merit of their work. Regarding the appointment of a watchman, the Director suggested to engage a casual labourer temporarily as a watchman.

(4) Regarding the T.A. and D.A. of the Japanese experts for their tour made on official, the Director agreed to give the T.A. and D.A. just as Project Leader for other members also and requested the Deputy Director of Agriculture to take further action in the matter.

(5) Residential Qurters

Director of Agriculture was kind enough to state that

he has already passed orders authorizing Deputy Director of Agriculture to allot vacant qurters of the Fooder Research Scheme to the officers of the Demonstration Farm for immediate occupation. He further suggested to intimate the vacancy position of quarters in the Agricultural Research Station Colony as well as Sugarcane Research Station Colony and along with the requirement of quarters for the officers working in the Demonstration Farm to Director of Agriculture so as to enable him to approach the authority of the Agricultural University. He also suggested further that the construction of the quarters exclusively for the occupation of the officers of the Demonstration Farm could be considered, provided, they give in writing their readiness for their stay in the Farm and The Deputy Director of Agriculture, I.A.D.T. Maydya, requested to take further action on the matter.

(6) Training Program

After discussion, the Director of Agriculture suggested that the Hostel and other facilities are already made available in Grama Sevaks' Training Center, which is situated in Agricultural Research Station Area. The training of Farmer's son and extension people in the Demonstration Farm can also be arranged, taking advantage of the facilities available in Gram Sevaks' Training Center for boarding and lodging of their trainees. He suggested that the Project Leader and Deputy Director of Agriculture, and Principal of Gram Sevak's Training Center, can go into the question of the type of training and duration.

(7) Insuring the Machineries

The Director accepted insuring such of the machineries which are moved from place to place for exhibition purpose.

7) KERALA

The Meeting was held on January 29 between the Team and the State Government.

Present

K.K. Ramankutty Commissioner for Agriculture

M. Janardanan Nair	Director of Agriculture
C.P. Sastry	Liaison Officer
Others	
S. Suzuki	Team Leader with 5 officers.

On the Administrative side, the Team desired the following items to be improved.

(1) As the soil conditions of the Farm is poor, it is felt necessary to improve its condition by means of soil dressing.

The Team expressed the desire that necessary measures would be taken for the needful. The State Government replayed that this will be put under examination.

(2) Tube-well to be made which is necessary for irrigation.

At present there are three shallow wells on the Farm which are being used for irrigation as well as drinking purpose. The water supplying capacity of the three wells to irrigate paddy fields covers only 1.5 acre, but the Farm requires more irrigation water to cover more larger acres of the fields and also to be able to implement the cultivation of 3 crops a year. Therefore it is felt quite necessary from the present position to convert one of the three shallow wells into a tube well thereby improving the supplying capacity of irrigation water.

To this point, the State Government assured that it will be under consideration of the Government and will be looked into favourably.

(3) Laying out of pipes for irrigation water preferably 4" wide.

(4) 2 Light traps preferably with fluorescent lamp to be set up on the Farm.

(5) Posting a mechanic to the Farm so that he can get trained by the Japanese Technical staff to be able to handle and repair the agricultural machinery and equipments,and also posting a maistry.

(6) Installation of telephone at Project Leader's quarters and Office from Alwaye Exchange.

(7) Provision of street lights in front of quarters on the Farm.

(8) Providing Medical facilities to the Japanese Technical staffs as per the Agreement.

(9) Provision of T.A. on official trips both in Kerala and outside.

(10) Treatment of drinking water by setting up filter in the well and also deepning the well by 1 meter.

The Director of Agriculture said that regarding the item (3) he agreed to have pipes laid out made of earthen one. Regarding item (6) for installation of telephone, it is very difficult to acquire necessary material but promised to look in favourable. With regard to remaining items, the Director of Agriculture promised to take necessary action to implement them.

8) MAHARASHTRA

The meeting was held on January 18 between the Team and the State Government.

Present

A.U.Shaikh	Secretary of Agriculture
S.S. Shukre	Dy. Secretary of Agriculture
M.V. Deshpanda	Under Secretary of Agriculture
M.B. Ghatge	Director of Agriculture
S.I.H. Naqvi	Liaison Officer
S. Suzuki	Team Leader with 5 officers

Gist of Discussion

The necessity of demarcation of demonstration area and the area under developmental process was explained by the Team. This suggestion was accepted.

The team stressed the importance of the training of counterparts in Japan for advanced study in the techniques of rice cultivation, and explained the procedure of sending applications for this training. The secretary, Agriculture & Co-operation Department, Government of Maharashtra agreed to this and told that the Government of Maharashtra would nominate two participants for training in Japan, the Director of Agriculture Maharashtra State agreed to this.

Dr. A.U. Shaikh, Secretary to Government of Maharashtra, requested the Team to consider the desire of the Government of Maharashtra to open two sub-centers on similar lines of the Indo-Japanese Agricultural Demonstration Farm at Khopoli.

The Team expressed that they would convey the desire of this Government to the Government of Japan on its return. However, the Team was of the opinion that the establishment of these sub centers might involve the necessity of entering into separate agreement between the Governments of Japan and India. Shri Naqvi, representative of the Government of India, revealed that similar requests have been received from other estate Governments, also, it was decided that this point may be discussed in the meeting on 8th March 1966 at New Delhi.

Dr. A.U. Shaikh, further requested the Team that on its return to Japan, the Government of Japan or the Manufacturers of Agricultural Machinery in Japan may consider the possibility of manufacturing agricultural machinery that is found suitable under Indian conditions in collaboration with the enterprises in India. He also expressed that the newly formed Agro-Industrial corporation in the State of Maharashtra would be eager to collaborate with Japanese manufacturers in this respect. The Team promised to convey this desire to the proper authority concerned on its return.

The point of providing additional staffs i.e. one agricultural officer and one mechanical engineer, was discussed and the Secretary to Government assured that it is under consideration of the Government and will be looked into favourably. The question of providing funds for entertaining visitors at

the Indo-Japanese Agricultural Demonstration Farm, Khopoli was brought out and the Secretary to Government affirmed that funds would be provided by the Director of Agriculture for this purpose.

Mr. Ota. Project Leader, of the Farm expressed the need of providing semi-circular cement pipes for irrigation channels to prevent leakage of water in adjoining low lying fields of the Farm. However, he told that one inquiry with one or two manufacturing firms it was revealed that such pipes are not readily available. Dr. Shaikh, Secretary to Government, assured Mr. Ota, that he would arrange to make these pipes available from the manufacturers of cement pipes by providing special quota of cement to the firms. The agronomist, Khopoli farm was instructed to look into this.

While concluding the discussions, Dr. M.B. Ghatge, Director of Agriculture, Poona brought to the notice of visiting Team that Japanese Technicians at Khopoli have done remarkable work inspite of their short stay at the Farm. where the conditions are quite different from those which existed in their home country. He also expressed that the technicians have been very good and cooperative in all respects with the officers of this Government.

Dr. A.U. Shaikh, Secretary to the Government also expressed to the Team that the Japanese technicians at Khopoli are so adjustable and accommodative that they has suffered some inconveniences in the houses provided to then at Khopoli ungrudgingly.

Shri. P.K.Savant, the Minister for Agriculture desired to meet the members of the Team. Dr. A.U. Shaikh and Dr. M.B. Ghatge, led the Team to the Hon. Minister.

Dr. A.U. Shaikh, Secretary to Government briefed the Minister about the points on which discussions took place at Khopoli and in his chanmber. The Hon. Minister consented to the suggestions brought out during the course of these discussion. In the end, the Minister expressed his hearty thanks to the Team and the Government of Japan for their efforts in helping India and especially the State of Maharashtra, whose main food deficit is of rice, in increaseing rice production.