

No.

PROGRESS REPORT
OF ABU GASABA RICE
DEVELOPMENT PROJECT
IN SUDAN

MARCH, 1981

JAPAN INTERNATIONAL
COOPERATION AGENCY

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Preface

This is the final report of the writer, Hikaru Niki, Japan International Cooperation Agency (hereinafter, JICA), expert in the field of rice cultivation. He has been assigned to the Government of Democratic Republic of the Sudan, (hereinafter, Sudan Government) on 6th, Oct., 1978. His stay was two years and terminates on 3rd, Oct., 1980.

His assignment in Sudan Government was Abu Gasaba Rice Project Section, Agricultural Engineering Administration, Ministry of Agriculture, Food and Natural Resources.

At the moment this final report is submitted, he wishes to emphasize the important roles of these projects in Sudan and the effectiveness of cooperation work between Sudan and Japan. Besides this rice project, other new project must be initiated.

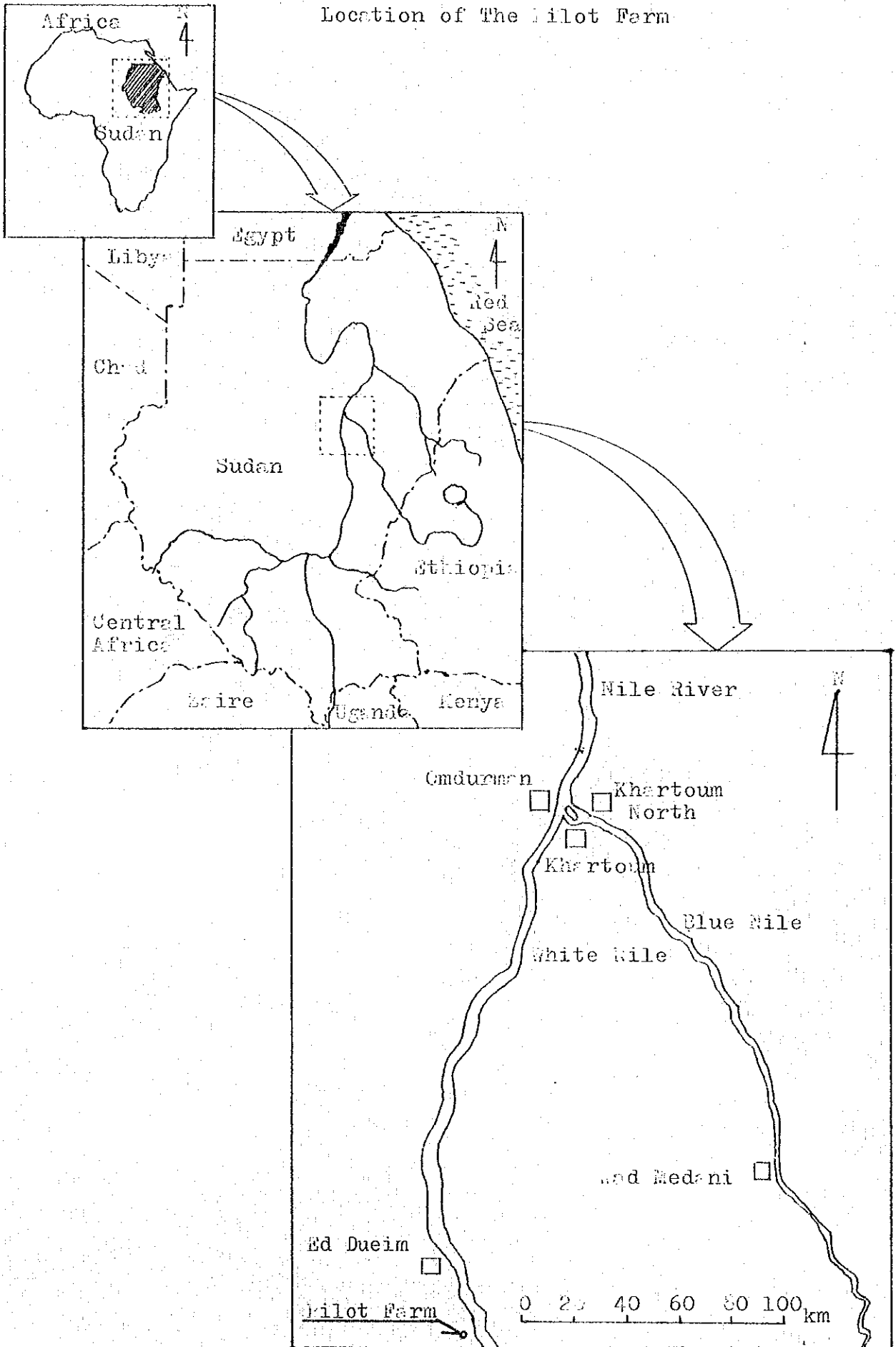
He is grateful from his heart for receiving big favors from many groups and persons. Among them, he wishes to express his gratitude to Mr. El Rayah El Zubeir. (Project Manager), all his counterparts and Japanese experts who worked with and encouraged him in his two years' stay. He has had much precious advices from Dr. Seizo Matsushima and was quite happy to be able to work under his guidance.

The Project is progressing. He hopes there shall be a big advance and prosperity in future of this Project.

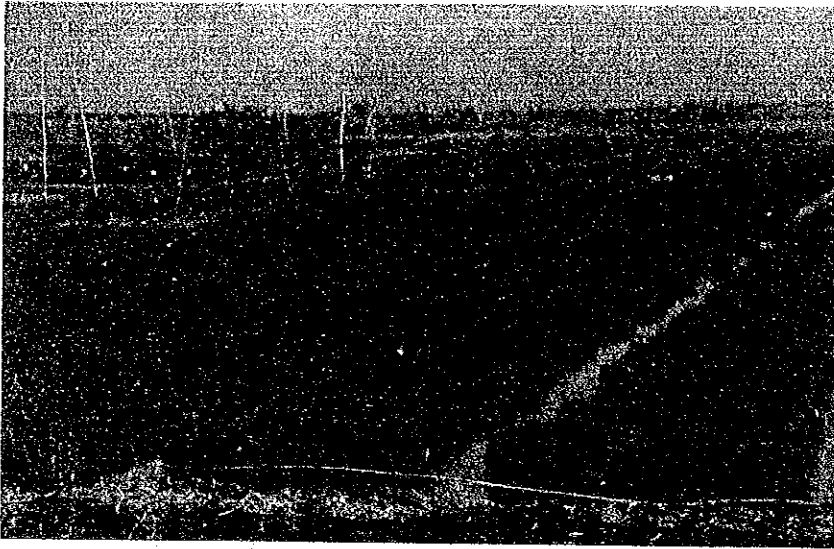
3rd, Oct., 1980

Hikaru Niki

Location of The Pilot Farm



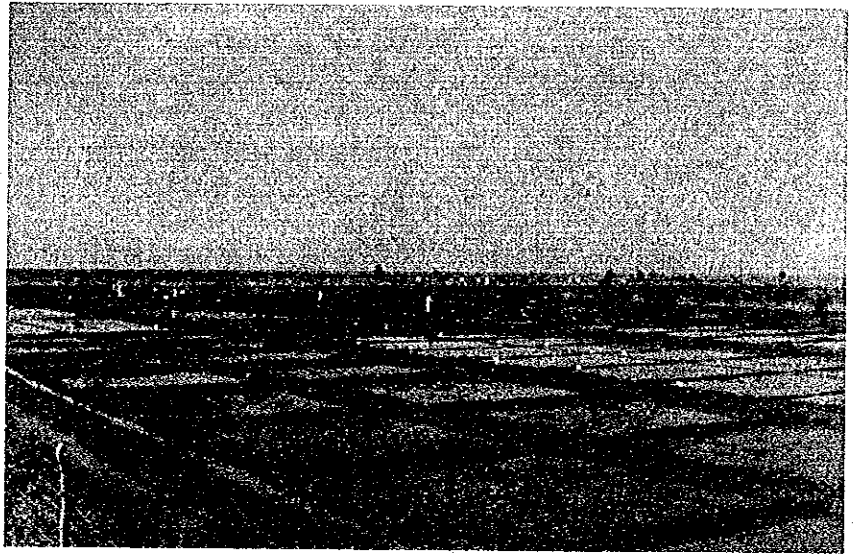
RICE EXPERIMENTAL FARM IN ED DUEIM



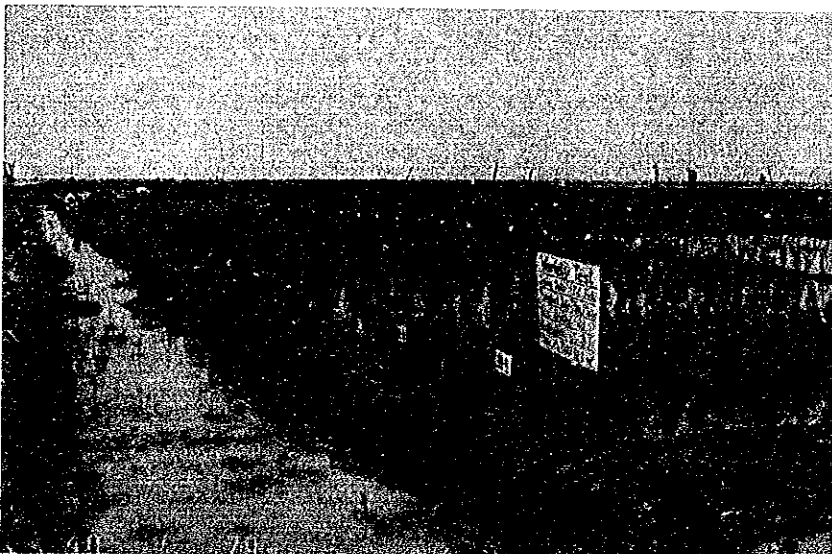
Off seasonal experiment in 1979
(February)

Seed bed for Variety Experiment,
Fertilizer Experiment, etc.

Transplanting



Field investigation in Variety
Experiment.



PILOT FARM
(ABU GASABA RICE PROJECT)

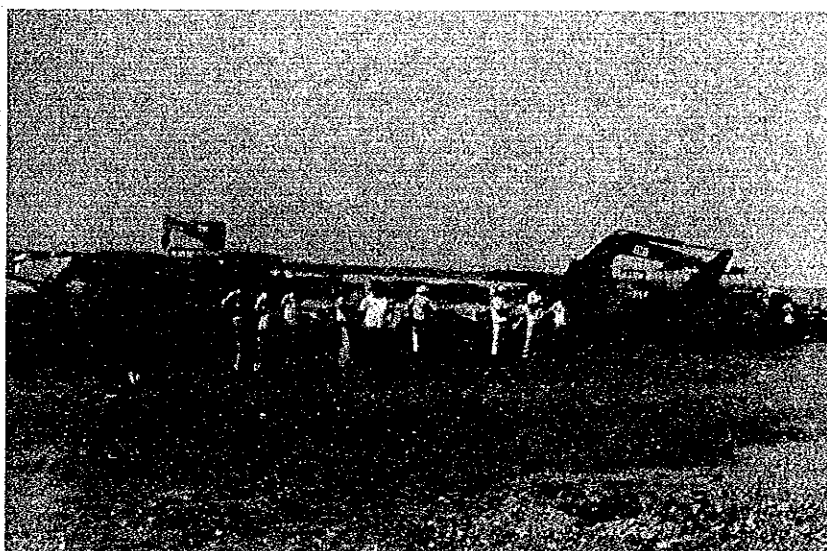


↑↑
Training Center

↑↑ ↑↑
Work Shop Office

↑↑
Store House

September 1980..... Training Center, Staff Quarter, etc. are still under construction.



30th, June 1979
50 ha Pilot Farm and implements
have been handed over to the
Sudan Government.

FIRST OPERATION IN THE PILOT FARM (1979)



Seed Multiplication
Ordinary seedlings have been
transplanted by Kohchi method.

Trial Cultivation Dapog method
to raise seedlings were employed.



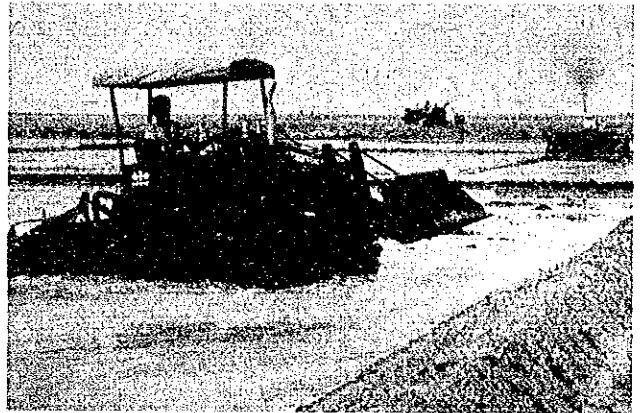
Seedlings could be raised quickly
by this method, and advantageous
when there is laborer shortage.

SECOND OPERATION IN THE PILOT FARM (1980)



Seed Multiplication

Seed pots have been used to raise seedling. Picture is the preparation work of seed pot by mixing machine.



Puddling work by Komatsu D 21-P Crawler Tractor (Front), and Shibaura SD 4000-AO Wheel Tractor.



20 days seedlings have been transplanted by broadcasting.



Trial Cultivation Direct seeding by Tractor.



Broadcastable seedlings have been uprooted at farm road, and carried to the field by container.



With Counterparts in Crop Operation Section after finishing all plantation work.

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I Introduction

This report may be considered as a operation progress report of Abu Gasaba Rice Development Project as well as the writers' final report. Several feasibility reports about this Project have been submitted by JICA from 1977, and the writer had been concerning on the supplementary study through rice growing experiments, which was a extention of feasibility survey work. He had been working in this study until the pilot farm operation has been started on July, 1979.

These experimental works have been conducted by Nippon Koei Co., Ltd. under technical guidance of Dr. S. Matsushina, and all experimental results have been well summarized in "Preliminary Experiments on Rice Cultivation Under Hot and Dry Climate in Sudan--Annex to Supplementary Report III-- (October, 1979)"

Accodngly, technical report in annex of this report is restricted to the experiments in the Pilot Farm, and some technical advices. Refer the technical discussion to that report.

I-1 Background of the Project

"The Feasibility Report on Rice Development Project in Abu Gasaba Basin, Annex, Volume I, June, 1978(JICA)", gives more detailed explanation about general state of Sudan. So, only some touch of the country may be required to explain the Project.

Being approximately 2,500,000 square kilo meter in total area, Sudan is largest country in Africa. The population is 16,500,000 and density is 6.6 person per square kilo meter.

Most of the country is belonging to tropical arid or tropical semi-arid climate except its southern part of tropical forest climate. The important area for agriculture is mostly belonging to semi-arid zone which is called savanna. These area is characterized by having two distinct seasons, rainy and dry season.

It is not abundant of mineral resources. Oil resource has been found recently in south-west of the country, but the capacity seems to be small and future aspect is not known so far.

The predominant industry is agriculture and its product is consisting more than 90 per cent of export of the country. And 60 per cent of it is cotton.

The statistic shows that Sudan is agricultural country. As a matter of fact, its arable land is about 30 per cent of the country. Unfortunately, however, only 13 per cent is being used as cultivation field and pasture land. It seems that the limiting factor of opening land is not a availability of land but water and investment.

While, domestic consumption of rice is much bigger than its production. The need of increasing rice production has been the theme of the country.

From these social and agricultural background, the

development of rice project along the White Nile River has been argued and the feasibility study was carried out.

I-2 Feasibility Study

The Feasibility Study for a rice project along the White Nile River has been started on 1976 with the cooperation of JICA. After sending a preliminary survey mission on Nov, 1976, JICA organized main survey mission on May, 1977, headed by Mr. Y. Yamamoto, Nippon Koei Co., Ltd.

All circumstances including economy, agriculture, geography, climate, market and etc. have been well studied, and also outline of project design and construction programme has been established by the mission.

While, rice is a new crop for Sudan and rice field cover only approximately 10,000 hectare with the production of 12,000 ton annually. The cultivated area of rice are concentrating to three places, i. e. Gezira, Bahr El Ghazal and Equatoria. There had been no rice project in this schemed area along the White Nile River except limited flood area where immigrated Nigerian people cultivate rice with primitive method.

These were the motives for JICA to send a supplementary study team for rice cultivation experiments. The supplementary study began on Dec, 1977 and 4th supplementary study terminated on Oct, 1979. Quite integrated studies have been carried out on during these two years by the effort of the team.

Throughout these studies, the possibility of double

cropping with high yield has been proved with full confidence.

I-3 JICA Aid for The Pilot Farm

On the viewpoint that a pilot farm is essential before the Project is started in large scale, Sudan and Japan have reached to the agreement for the cooperation work to construct a pilot farm. The objectives of the Pilot Farm are as follows;

- 1-. To reconfirm the possibility of double cropping with high yield in large scale farm.
- 2-. To find out ideal systematic machinery operation for irrigated rice cultivation
- 3-. To give experience about rice farm operation the organization and staffs
- 4-. To train field worker and operator for rice cultivation
- 5-. To multiple and purify rice seed

The construction work of the Pilot Farm has been initiated on Jun, 1978. It has been consulted by Nippon Koei Co., Ltd. In parallel with the construction work, the implementation, which is essential for the Pilot Farm operation, had been taken care.

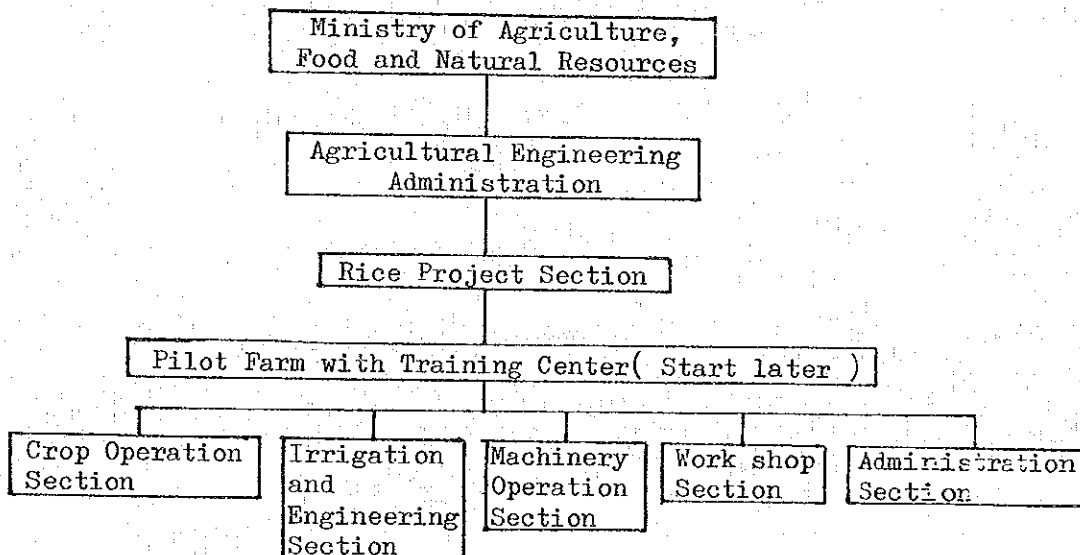
First phase of the construction has been finished on 30th, Jun, 1979, and had a inauguration with the attendance of the commissioner of the White Nile Province. 50 hectare of rice field, pump station with a pump, office, warehouse and workshop were officially handed over from Nippon Koei Co., Ltd. to Sudan Government on the day.

The expansion of the Pilot Farm to 130 hectare rice field with other facilities, especially training center, has been discussed and decided on much earlier days than the inauguration. This second phase construction has been started on Oct, 1979, and is still under construction work at present. It will be terminated on Mar, 1981.

I-4 Organization

This Project is belonging to Agricultural Engineering Administration, Ministry of Agriculture, Food and Natural Resources. Following is the organization chart:

Organization Chart



The staffs working in this Project are listed below;

<u>Name</u>	<u>Position or Speciality</u>
Mr. El Rayah Zubeir	Project Manager
Mohmed Fauzi	
Izzedlin Hassan	(under training in Japan)
Ismail Mustafa	(under training in Japan)
Ahmed Sidig	Farm Site Manager
El Amin Karifa	Irrigation Engineer
Ali Abdel Rahman	Engineer (Work shop)
A/Bagi Agla	Engineer (Machinery Operation)
Hassan Omar	Assistant Agronomist
Abdella Sheikh	Assistant Agronomist
Elaish Yousif	Assistant Agronomist
Ali Yousif	Assistant Agronomist
Hassan Ahmed Bashir	Assistant Engineer
Hamad Mohmed	Assistant Engineer
Abd El Muniem	Laboratory Assistant
Safia Idris	Typist
Lashida Hassan	Typist

I-5 Assignment of Japanese Expert

As mentioned in Chapter I-2, rice is rather a new crop in Sudan. They have few experience of rice cultivation and data for it except the one in Agricultural Research Station, Gezira Scheme.

On that viewpoint, JICA has come to a conclusion to send

experts in concerning specialities. One rice specialist, the Writer, was sent first in order to support feasibility study on Oct, 1978, and further to work in the Pilot Farm.

Main objectives for his assignment can be summarized as follows;

1. To engage and support the rice experimental work of the supplementary work of the feasibility study so as to get more data for rice cultivation.
2. To introduce rice cultivation technic to the staffs of Sudan Government through on-job-training.
3. To teach field workers and operators about x field technics.
4. To lead the Pilot Farm to have a successful accomplishment.

Another expert group has been assigned to the Project on Dec, 1979. Their names and specialities are as follows;

Mr. Akio Maeda	Agronomist
Mr. Takayuki Mizuno	Agricultural Engineer(Irrigation)
Mr. Kanzi Aoki	Machinery Operation Engineer

Besides these experts, one more mechanical expert was nominated to come, but unfortunately, he got too serious sick to come just before he would leave. JICA is seeking now for another suitable person for this speciality.

The objectives of this expert group are mainly as follows;

1. To engage to the Pilot Farm operation in order to bring a successful result.

2. To give a on-job-training to the staffs, field workers and operators.
3. To advice to the staffs to prepare a operational programme and to establish a firm organization.
4. To establish the future aspect of the Project.

II Personal Activity

Following to the objectives, the writer has been working in the Project for two years. His monthly activities during these two years are shown below, but, his two years' stay can be roughly divided into two periods; the former period, staying in the experimental farm in Ed Dueim in order to support the Feasibility Study, and the latter one, staying in the Pilot Farm.

Only main items of field activities are listed, and the training of his counterparts have been constantly carried out through his two years' activities.

<u>Month</u>	<u>Activity</u>
Oct, 1978	* Assignment to the Project on 10th, Oct. * Experimental work .....Harvesting and yield assessment of main-seasonal test(Feasibility Study)
Nov, 1978	* Experimental work .....Sowing and planting of off-seasonal test in November, harvesting and yield assessment of main-seasonal test
Dec, 1978	* Experimental work .....Growth observation of off-seasonal test in November * Compiling and reporting main-seasonal test results
Jan, 1979	* Experimental work .....Growth observation of off-seasonal test in November * Making Programme for off-seasonal test in February, 1979

<u>Month</u>	<u>Activity</u>
Feb, 1979	* Experimental work .....Sowing seed for off-seasonal test in February, growth observation of off-seasonal test in November
Mar, 1979	* Experimental work .....Transplanting of off-seasonal test in February, harvesting and yield assessment of off-seasonal test in November
Apr, 1979	* Experimental work .....Observation of off-seasonal test in February, harvesting and yield assessment of off-seasonal test in November
May, 1979	* Experimental work .....Observation of off-seasonal test in February * Pilot farm operation .....Preparatory work (Planting schedule, materials and budget requirement)
Jun, 1979	* Experimental work .....Harvesting and yield assessment of off-seasonal test in February * Pilot Farm operation .....The Pilot Farm has been handed over from construction company to Sudan Government * Budget requisition for operation of the Pilot Farm has been worked
Jul, 1979	* Experimental work .....Harvesting and yeild assessment of off-seasonal test in February * Pilot Farm operation .....Struggle for fuel and

<u>Month</u>	<u>Activity</u>
	other materials
	* Tractor training for new staffs (22nd, Jul. to 31st, Jul.)
Aug, 1979	* Pilot Farm operation .....Start sowing seed for first plantation of the Pilot Farm (Seed Multiplication and Trial Cultivation)
Sep, 1979	* Pilot Farm operation .....Transplanting work
Oct, 1979	* Annual leave to Japan
	* At the Pilot Farm .....Field management after planting
Nov, 1979	* Resume to work after annual leave
	* Pilot Farm operation .....Field and water management
Dec, 1979	* Pilot Farm operation .....Field and water management, preparation for harvest
Jan, 1980	* Pilot Farm operation .....Field and water management, harvesting
	* Compiling the record of first plantation of the Pilot Farm
Feb, 1980	* New organization start
	* Review the previous operation of the Pilot Farm
	* Budget preparation for another operation in new fiscal year from Jul, 1980
Mar, 1980	* Experiment .....Direct seeding test, Seedling box test

<u>Month</u>	<u>Activity</u>
Apr, 1980	* Experiment .....Get results of direct seeding test and continue seedling box test, herbicide test
May, 1980	* Operation programme of the Pilot Farm for main seasonal plantation * Experiment .....Seedling box test
Jun, 1980	* Preparation of seedbed for main seasonal operation * Seed cleaning for seed driller * Final discussion about operation programme
Jul, 1980	* Field preparation * Soil and sand preparation for seedling box * Re-arranging the programme
Aug, 1980	* Pilot Farm operation .....Second operation start, Sowing seed (seedbed for Seed Multiplication and direct seeding of Trial Cultivation), Transplanting (Seed Multiplication and Experiment)
Sep, 1980	* Pilot Farm operation .....Transplanting and direct seeding. Water and field management.

III Progress of the Pilot Farm

III-1 First operation in 1979

50 hectare Pilot Farm was inaugurated with necessary implements on 30th of Jun, 1979. The operation of this Pilot Farm this year had been anticipated, and the Administration had been taking action to be financed for it in new fiscal year starting from July.

While, main seasonal sowing date of rice is considered to be during June, July and first half of August. The yield of rice which is sown after the middle of August will diminish it's yield rapidly with the delay of sowing date. All data from the feasibility study and Gezira Rice Reserch Center are indicating this tendency. Early maturity varieties, although, are showing tolerable results in spite of late sowing after the middle of August, it may be up to the end of August.

There was another factor which was concerning to the start of this operation.

200 hectare Pilot Farm is finally to have two water inlet channels(No.1 and No.2). During the water level of the White Nile River is high(higher than 375.75 meter m.s.l.), water flows over the check gate automatically to No.2 inlet channel and is pumped up by No.2 pump to the main field canal. When water is lower than that level, (Approximately April to July) No.1 inlet channel, where water always comes in from the White Nile River, will supply water to No.1 pump station, and

water, which is pumped up by No.1 pump, goes into No.2 inlet channel. Then it goes to the main field canal by the same manner of the former case.

No.2 inlet channel with No.2 pump station had been facilitated in first phase construction, but No.1 inlet channel and No.1 pump station are to be prepared in second phase construction, which will terminate on Mar, 1981.

There was no No.1 inlet channel then and the plantation in 1979 was obliged to start after water level in the White Nile River becomes higher than 375.75 meter m.s.l, which usually comes between 1st and 10th of August.

All in all, the plantation in 1979 was programmed. Those detailed schedule was reported by the writer's previous report. First programme and actual progress are shown in Fig III-1 A.B. Rough outline is as follows

	Area	No of Variety	Start of Sowing Date
Seed Multiplication	7.65 ha	17	8th, Aug
Trial Cultivation			
(1) Direct seeding	9.45 ha	2	11th, Aug
(2) Transplanting	25.65 ha	9	5th, Aug
Machinery Practice (and for seed bed)	5.85 ha		
	48.6 ha		

Actually, water reached to the level of 375.75 meter m.s.l. on 1st, Aug, 1979, but, first sowing date was 15th, Aug. The reasons to have delayed are as follows;

- (1) The budget information was released from Ministry of Planning on 11th, Aug.
- (2) There was serious fuel shortage that time in Sudan
- (3) Budget was released from Ministry of Planning on the base of receipt

The last problem was so serious that this operation had been suffered from less finance up to the end.

On the other hand, the plantation area was decreased from 50 to 20 hectare. The reasons are as follows;

- (1) The budget was cut into one third of the request, and the plantation area has been re-arranged to 25 hectare.
- (2) There was no budget for the preparation
- (3) Sowing date was limited(Up to the end of August)
- (4) The construction of the Pilot Farm was rough since this was first time for the local construction contractor, which conducted the construction, to make this kind of rice farm.

Some of those instances are as follows;

- (1) The elevation of main canal bank was not high enough
- (2) The bank of water courses was not compacted and was weak

- (3) The pipes under farm approach were too small to let enough amount of water pass
- (4) The shape of division boxes was not suitable
- (5) Most of the plots were not level enough that same water depth could not be given to all rice plants
- (6) Consequently, it was quite difficult to supply enough amount of water to rice plant with less finance that year

(By the way, all of these defects are being renovated gratuitously by Nippon Koei Co., Ltd. in second phase of the Pilot Farm construction. And the local contractor is gaining skills gradually.)

The plantation area was decreased up to 20 hectare by such reasons. But, by the time of transplanting on September, all staffs were still believing to receive the approved amount of budget at their hand soon. And they were expecting to manage the field properly by those budget. The fact was negative, and the budget was to be released from Ministry of Planning on the base of receipt. The most serious problem was casual laborers salary, and their August salary was payed on November. The carefull field management were neglected. Further 10 hectare had been obliged to be cut out and yield was diminished. Next are those causes;

- (1) Sowing date of some varieties were too late
- (2) Farm was so new that it needed much conservation and maintenance work
- (3) Inspite of it, there were budget problems mentioned above

- (4) Carefull field management could not be taken place
- (5) Some key staffs were out of the Project then to have training or further study

Concerning to staff shortage then, next are the movement of the personnel in this operation

Name	Position	Destination	Duration	
			From	To
Mr. El Rayah Zubeir	Project Manager	Japan	Apr, 1979	Sep, 1979
Mr. Isam Mustafa	Site Manager	England	Sep, 1979	two years
Mr. Ahmed Sidig	Agro-Engineer	Japan	Jul, 1979	Sep, 1979
Mr. Mohmed Fauzi	Agro-Engineer	Japan	Jul, 1979	Sep, 1979
Mr. Ali Amin	Only one agronomist	other project	Sep, 1979	
Mr. Fath El Rahman	Machinery Engineer	other project	Nov, 1979	

The final operation progress report with the results of this first operation have been submitted on Feb, 1980 by the writer. The results were, although, poor by many of the problems mentioned above, some parts of some varieties have recorded quite tolerable yield. Only if field management would have been properly with enough budget, much yield could have been anticipated.

III-2 Preparation of Second Operation in 1980

Reviewing the first operation, all staffs have realized the importance of the preparatory works in much early time. In accordance with the advices of four JICA experts, they prepared the schedule of the preparatory works as follows;

<u>Month</u>	<u>Work item</u>
Jan, 1980	* Compile and review the last operation
Feb, 1980	* Re-arrangement of the organization * Operation Programme, operation cost estimation
Mar, 1980	* Experiment(Direct seeding test, Seedling pot test, Herbicide test)
Apr. 1980	* Continue experiment * Field conservation(especially leveling)
May, 1980	* Field conservation * Seedbed preparation
Jun, 1980	* Field conservation * Re-arrangement of budget * All machinery adjustments(Especially tractor attachments) * Field preparation(Ploughing. Rotabating) * Preparation of detailed schedule * Seed cleaning for seed driller
Jul, 1980	* Field conservation * Field preparation * Re-arrangement of the programme and detailed schedule

Usually, newly opened farm has many defects and it must be gradually up-graded until it becomes a matured one. On the view point of it, the key for success of this operation have been considered to be a field conservation. Consequently, much efforts have been concentrated to these works during preparation time.

The preparatory works have been carried out following to the schedule, and most of the works were successfully done except few items. Machinery operation and adjustment is one of those exceptions. The practice of ploughing, rotabating and adjustment of seed driller were behind the scheduled time due to the shortage of tractor operator. This is all for less budget to compensate those operators with good salary. Though many operators were refusing to come to the Project, two more operators have been employed in mid-July by the efforts of the staffs, making operators number into three.

Thus, preparatory works have been completed just in time.

III-3 Second Operation Progress in 1980

Due to the shortage of tractor operator, several machinery works have been delayed. But, the sowing seed was not delayed because other preparatory works had been conducted quite smoothly. It started on 6th, Aug, exactly the date when water reached to No.2 pump station. The seedbed had been prepared already on the side of the pump station, and special small pump was set for the seedbed. While, direct seeding of Trial Cultivation was started late on 9th, Aug, due to the test of pump and canalization for two days. The actual progress is shown in Fig. III-3 (A B C ...)

As clear in Fig. III-3, programmed plantation area was 31.38 hectare, and it was decreased to 25.15 hectare finally. The plantation area in first operation programme was 50 hectare to be full used. (Seed Multiplication13.5 ha, Trial Cultivation 29.7 ha, Experiment2ha, Machinery Practice4.8 ha), 13.82 hectare was purposely cut out from the plantation area in this operation due to the difficulty of land leveling. This decision was made at the end of June, and 31.38 hectare had been aimed to be a plantation area in new programme.

The seeding for Seed Multiplication was started on 6th, Aug. Since 6,000 pieces of seedling pots for broadcastable seedling had been sent as one of the implements of the Pilot Farm, most of them were used for Seed Multiplication. (Some 200 pieces of seedling pots were used for Experiment)

The seeding had been practiced properly following to the schedule. But, some seedling pots had poor germination because of the laborer shortage and poor water management of the seedbed. The plantation area had been minimized from 11.7 to 9.0 hectare due to the seedling shortage, and also delay of the puddling work.

While, direct seeding of Trial Cultivation was started on 9th, Aug. It was practiced by tractor with seed driller. Machinery section scheduled in programme to sow the seed to four plots per day using two tractors. Unfortunately, seed drillers were not well adjusted, and only one seed driller, which was adjusted before, could be used. Total seeding area by this seed driller have been decreased finally due to these problems, and several plots have been sown manually. Total area for Trial Cultivation is 15.75 hectare.

Several experiments were cut because the preparation of the experimental field had been delayed. Variety test, Seed Purification and Seasonal test were commenced. These seedling could be raised in other place, and immediately after the experimental field have been completed, transplanting was conducted. It covers 0.4 hectare. Herbicide test is planned to be started recently.

The plantation in main season in 1980 had been completed. Though some plots were cut out and final cultivated area was decreased, there is a big progress in the preparation and operation of second operation in 1980 comparing to the

operation in last year. High yield and good experience are anticipated in this operation.

IV Future Aspect of the Project

IV-1 Pilot Farm

The Pilot Farm is still under construction, and is in developing process. The second phase of the construction will facilitate more buildings including training center and more 80 hectare of rice field will be added until Mar, 1981. After this second phase of the construction, Sudan Government is going to construct more 70 hectare of rice field making the area of the Pilot Farm 200 hectare. This farm is going to be considered as one of the development projects of Sudan after the completion. And total amount of the budget for the operation will be brought to the Project site after that. The aim of the operation until the completion of the construction is to multiple seed and to give more experiences to the staffs, operators and farm workers.

Considering the objectives of this Pilot Farm mentioned in Chapter I-3, future aspect is discussed item by item.

(1) Experiment

Eight plots in the Pilot Farm were designed for Experiment and prepared with the coordination of Nippon Koei Co., Ltd. One plot has 80 small experimental plots which is 3 m x 10 m (30 m²). Consequently, 640 experimental plots of 1,920 m² have been prepared for many kind of experiments. Next items of experiment are going to be conducted successively in this experimental farm.

a. Variety Test

Varietal potential abilities, although, have been well studied in the Feasibility Study, further study for the correlation between varieties and planting season or quality are needed. The introduction of new seeds from many places may be welcomed, and they will be experimented about productivity, resistance to disease and pest and quality in Abu Gasaba condition.

b. Seed Purification

Since seed tends to be deteriorated after several generations, it is required of renewal and purification. One seedling is transplanted in one hill carefully and only some hills, which accomplish to generate superior properties with uniform maturity, must be harvested manually.

c. Seasonal Planting Test

One of the objectives of the Pilot Farm is to establish the pattern of double cropping a year in large scale. And as mentioned above, varietal ability in different sowing date should be clarified more. Four varieties are sown twice a month throughout year.

d. Fertilizer Test

Several experiments up to now are all showing that important macro element to be applied as fertilizer is nitrogen. Other two main elements, phosphorous and potash, can affect rice yield a bit, but, still rice can tolerate without them. For phosphorous fertilizer, some more experiments are needed to clarify the advantage of using it in comparison

with the expenditure for this fertilizer. Some more experiments about nitrogen fertilizer are recommended.

e. Herbicide Test

Available herbicides in Sudan are limited. Only three chemicals, Stam(DCPA), Saturn and Basagran, can be purchased and used for rice at present, except some chemicals for experiment use. Further experiments for these three chemicals are essential to find the proper usage in connection with climate, varietal reaction and rice stage. On the other hand, it is important to seek another new chemical of good potential, especially the one for rice medium stage.

f. Milling Test

This test, though, is not conducted in experimental farm, it is important when rice from this Project comes to be distributed to market. The quality is depending on variety strongly. Superior variety with superior milling recovery and quality must be found in this experiment. While, moisture content of rice when it is milled is one of largest influential factors for occurrence of broken rice. Moisture content of rice must be traced from the field to milling process.

(2) Seed Multiplication

After the confirmation of varietal potentiality, those certified varieties are to be multiplied for cultivation of large area. Seeds are multiplied only for the Pilot Farm operation until the Project expands for big area. After the

expansion of the Project, the Pilot Farm may work as seed multiplication farm as well as training farm.

Transplanting method is suitable for Seed Multiplication and off-type should be eliminated from the field from time to time. Best timing for it is just before and after heading.

Threshing and storing must be done with best care for those pure seeds.

(3) Trial Cultivation

The possibility of double cropping with high yield in large scale is to be reconfirmed in this Trial Cultivation. Though the possibility to cultivate rice twice a year was certified, it was experiment scale. Besides, the Pilot Farm is on a first step at present to produce high yield in large area. Usually when the cultivation area is expanded, it becomes difficult to manage the field intensively.

The Pilot Farm itself is still new and, of course, three fourth of it is under construction, and it can be said that it takes time for rice field of the Pilot Farm to be matured.

One more factor is the skill of the field workers. One of the important objectives of the Pilot Farm is the training of the field workers, and it is practiced through on-job-training in this Trial Cultivation as well as in the Training Center in future. High yield from large area can not be expected unless those field workers are well trained.

Mechanized farming is tried in this Trial Cultivation as well. It is inevitable to cultivate large area with

full- mechanized system. Ploughing, rotabating, fertilizing, puddling, ridging, harrowing, seeding, spraying chemicals and etc. can be done by tractor with attachments. Harvesting is done by combine harvester. Each operation is to be well studied as well as the adjustment of these attachments. All of these mechanical operations, of course, are directly influential to rice yield. Especially, mechanical operation to maximize rice yield is going to be studied.

(4) Training Center

The construction of the Training Center will be finished on Mar, 1981.

Field workers and operators are trained mainly in this Training Center after then. Staff training will be taken part as well, but the problem so far is the instructors for them. The instructor for rice cultivation can not be made so suddenly irrespective of speciality. Japanese instructors for staff training are one of the countermeasures untill those trained staffs become good instructors.

Parallel to the invitation of Japanese Experts as the instructor, as many staffs from the Project should go to Japan to study. Three staffs from the Project have been to Japan to have JICA training courses fortunately, and two more staffs are also having the same training at present. More staffs are expecting to apply for this JICA training courses in future.

(5) JICA Aid for the Pilot Farm Operation

As mentioned up to now, this Pilot Farm is suffering from shortage of specialists for rice cultivation and finance for the operation. Three experts continue working in the Project, but the volume of their works are much exceeding their capacities. Another one agronomist and work shop mechanic are expected to join to the operation as soon as possible.

More Japanese Experts are anticipated to work in the Training Center as instructor. Their specialities and duration is to be argued carefully in the Project and requested to JICA as soon as possible.

If there would be more materials, like fertilizer, chemicals, tools and etc. the operation must be more smooth. And for those materials for the operation, the Project is expecting JICA Aid.

IV-2 Project

The practical project target is to open 15,600 hectare of rice field in Abu Gasaba Basin. The rice area, although, is expected to expand more to similar place with similar climate in future, this width can be considered to be a final goal of the Project so far. The potentiality of rice cultivation in this area have been well certified scientifically. Untill actual productive area is started to be opened, next target is to succeed the Pilot Farm operation and the technics are to be transfered well from Japanese Experts to local people.

It usually takes times for these procedures and requires much efforts and patiences for all people working in the Project.

V Recommendation

The writer has been working in the Project for two years. This duration is not enough to bring full understanding and to have a comment. The recommendation written under shall be referred as only one instance of many standpoints.

(1) Organization

The organization of the Project has not been well ripened. It is still in the process of reinforcement. Toward future reinforcement of the organization, next items can be recommended;

(a) Personnel in the organization should not be changed so frequently. Re-organizing sometimes brings stimulation for the personnel but also brings confusion. And it takes some time for the organization to be settled again. The personnel should not be transferred to other office or project.

(b) Horizontal communication in the organization must be improved by creating more rapid and sure means.

In other word, it is inter-sectional combination works. Some fixed form should be generated for it.

(c) Vertical relationship is noted as well. Each personnel should be always careful to control and regulate his under body.

(d) As understood from the word "Organization", it is a organic body. Some merits or precious results must be created by the action of each particle or personnel. Being as a summit, The Project Manager is recommended to check each one's

efficiency in the operation of the organization. He should receive report periodically from all parts of the body, and control it.

(e) Administration Section must be strengthened as soon as possible . It is so important that the organization can not be managed without it. This section always worry about input and output of materials, finances, laborer deployment, salary, office maintenance, regulation of the Project, propaganda and etc. Administration Section in the organization is as oil in machine.

(2) Management

Management or control of the Pilot Farm is not well done so far. For instance, workshop, warehouse and office are not always kept clean. This uncleanness corrupts the order of the work and is a big cause of many things to be lost.

Many materials are not purchased on time. Especially workshop is suffering from shortage of spareparts and materials like welding lod.

Management of rice field is not sufficient, neither. Many tools and materials are found in the field after work. Checking system is needed.

Management of organization has been discussed before.

(3) Reporting

It is required to understand the present situation completely to manage and give order for the organization.

To know the present situation, reporting from the spot is one of the best ways. Especially Project Manager should be sensitive to the transitory of the operation, and he must demand latest information from Farm Site Manager or each section directly. Some form should be considered for weekly and monthly report.

(4) Communication with main office

Project Manager stays Khartoum to proceed many official procedure. He may visit the Pilot Farm once in a while, and this is, of course, good chance to communicate. But considering the difficulty of transportation between the site and Khartoum, not so often can he visit. So, the communication between the Pilot Farm site or Ed dueim, where staffs stay, and main office in Khartoum, is needed.

The Project received wireless telecommunication devices, but it is still under procedure to have a permission to set and start using. It is really expected to be permitted as early as possible. Meanwhile, telephone can be utilized, but it is quite difficult to connect to Khartoum. Especially daytime, it is nearly impossible to communicate. It is still difficult at night, but is recommended to set special time at night for both office to communicate.

(5) Salary of farm worker

Many experienced laborers and operators have left the Project till now. One of the main reasons is salary. It is

too cheap and is distributed too late that they tend to lose their eagernesses to stay. It is fixed amount of Sudan Government, and it is not changed for the Project only. But considering the importantness of skilled laborer in the Pilot Farm operation, still it is expected to raise their salaries.

While, it is solved easily to pay salary on time by the staffs efforts. As long as it is payed periodically, not many laborers go out from this Project.

(6) Welfare of farm worker

The other way to keep experienced laborer is welfare. It is recommended to make a small hut in the farm for the laborers to rest in it. First Aid Kit must be prepared. Water for drink is to be supplied by some good container. Their physical conditions are to be checked periodically. Safety is taught always, especially for tractor operators. Recreation facility may be prepared, if possible.

(7) Staff training outside

The staffs of the Project are recommended to have training outside of the Project, especially to abroad. There are several courses in JICA training center, and as a matter of fact, many staffs from here have been trained in these courses. It is really a good chance for them to see not only rice or their specialities, but also other cultures different from Sudan.

The training, although, is recommended, the Project should send them out in good arrangement and order. Some other staff should take place of the man who is going to have a training. There should not be a confusion after he left. It is recommended to prepare a programme to send staffs to have a training in early stage.

(8) Increase staff

To send more staff to a training, the organization need new other staff to take place of a blank. Especially, instructor in the Project Training Center is expected to be created as soon as possible.

There is no graduate agronomist in the Project so far. Two agronomists used to work priviously, but they have transfered to other projects. It is quite strange that there is no senior agronomist in rice project. Experienced agronomist is expected to be assigned to the Project.

(9) Cherishing equipments and materials

Generally speaking, there is not many mineral resources in Sudan. Consequently, laborers and operators are obliged to use equipments and materials importantly. But, the facts are usually opposite, and they are using tools, materials and equipments roughly.

The staffs should control those workers to take good care of equipments and materials.

(10) Reception of JICA Expert

It is serious for newly assigned expert to decide a residence and settle in it. Generally, it is difficult to find suitable house in Ed Dueim. Also after finding it, quite tough work is waiting for him. The work is the negotiation with the house owner.

It is sometimes difficult to purchase materials, especially fuels, in Ed Dueim. So next items are sincerely requested to Sudan Government;

- (a) To find suitable house for a expert before he arrives to Ed Dueim.
- (b) To help negotiation with the house owner and let house owner follow the contract untill expert goes back.
- (c) To supply fuels, Benzin, Casoline, Kerosine and cooking gas to experts with reasonable price.
- (d) To try best to exempt tax for personal equipments of expert which is written in A-1 form of JICA Expert Assignment.

(11) Step by Step

It usually takes time for newly opened rice field to achieve high yield constantly. The Pilot Farm should be operated patiently and so sudden judgment of it should be avoided. It is sure to be grading up and bring brilliant result in future. Reviewing and improving will turn the failure to the success.

" Step by Step " is the last recommendation word.

VI Summary

The writer has been staying in Sudan for two years from 6th, Oct, 1978 to 3rd, Oct, 1980. His assignment was Abu Gasaba Rice Development Project in Abu Gasaba Basin along the White Nile River. He had been engaging to the Feasibility Study in the Experimental Farm in Ed Dueim at first. He had transferred to the Pilot Farm when the Pilot Farm operation started on August, 1979. He worked in the Pilot Farm to introduce the scientific rice cultivation. He instructed staffs and field workers through on-job-training as well.

His suggestions to the Project are as follows;

- (1) Organization is expected to be strengthened by improving horizontal and vertical combination
- (2) Management is expected to be taken care strictly
- (3) Periodical reporting is essential
- (4) To have some communication mean to Khartoum is needed
- (5) Salary for the farm worker would be better to be paid on time
- (6) Welfare of the staffs and the workers are to be considered
- (7) Staff training in JICA courses is recommended with good arrangement
- (8) More staffs to the Project are expected
- (9) Cherishing equipments and materials is essential
- (10) Residence and Fuels for expert are requested to be taken care by Sudan Government
- (11) The Project shall be succeeded surely with steady step

Flot Allocation of 50 ha Pilot Farm

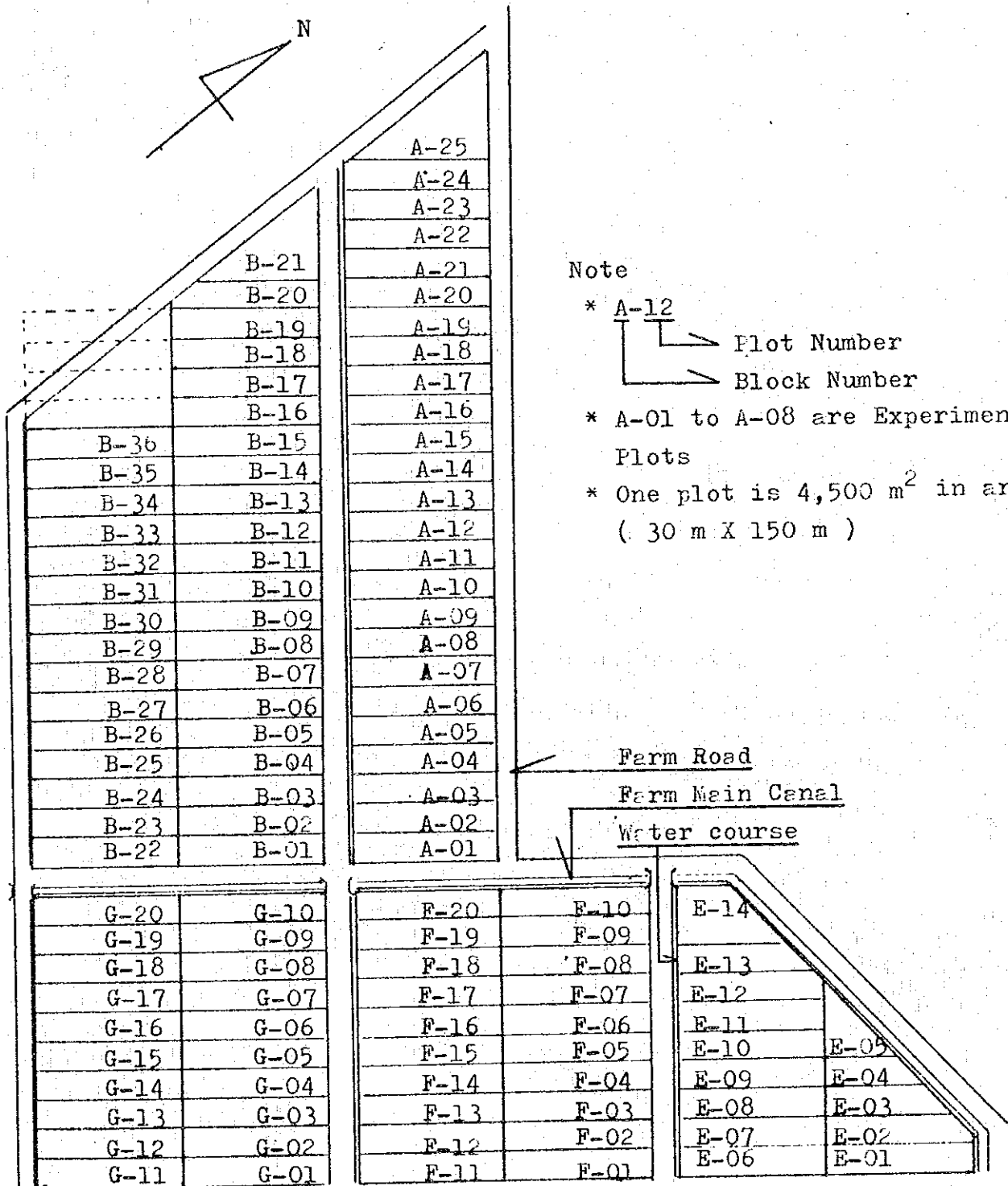


Fig. III-1 A Progress of the Pilot Farm Operation in 1979

Plot No.	Classification	Planting Method	Variety Name	Sowing Date	Planting Date
A-09	Seed	Ordinary	IR-24	18, Aug	14, Sep
10	Multiplication	Transplanting	IR-24	18, Aug	15, Sep
11			IR-22	18, Aug	16, Sep
12			IR-22	18, Aug	17, Sep
B-02	Trial	Direct	BG-34	30, Aug	--
03	Cultivation	Seeding in	IR-20	20, Aug	--
04		Upland	IR-20	20, Aug	--
05			IR-20	21, Aug	--
06			IR-20	21, Aug	--
07			BG-34	22, Aug	--
08			BG-34	26, Aug	--
09			BG-34	26, Aug	--
10			BG-34	30, Aug	--
11		Direct	IR-30	9, Sep	--
12		Seeding	IR-298	10, Sep	--
13		in Lowland	IR-298	11, Sep	--
14		Transplanting	C-11	18, Aug	2, Sep
15		by Dapog	C-11	18, Aug	4, Sep
16		Seedling	C-11	18, Aug	4, Sep
17			C-11	19, Aug	5, Sep
18			C-11	19, Aug	6, Sep
19			C-11	19, Aug	8, Sep
E-06	Seed	Ordinary	BG-34, BG-90	23, Aug	27, Sep
07	Multiplication	Transplanting	BG-34	23, Aug	27, Sep
08			Takao 21	23, Aug	27, Sep
09			IR-29	22, Aug	27, Sep
10			IR-28	18, Aug	26, Sep
11			Miriyon 23	21, Aug	26, Sep
12			Ishin	21, Aug	25, Sep
13			IR-38, IR-29	22, Aug	24, Sep
F-04			IR-2053	20, Aug	23, Sep
05			IR-40	19, Aug	22, Sep
06			IR-30	19, Aug	21, Sep
07			IR-36	19, Aug	20, Sep
08			IR-36, IR-28	19, Aug	19, Sep
09			IR-28	18, Aug	18, Sep
10			IR-28	18, Aug	18, Sep
16	Trial	Transplanting	IR-298	20, Aug	20, Sep
17	Cultivation	by Dapog	IR-298	20, Aug	19, Sep
18		Seedling	IR-298	20, Aug	18, Sep
19			C-11	19, Aug	16, Sep
20			C-11	19, Aug	15, Sep
G-07	Seed	Ordinary	Toitsu	21, Aug	24, Sep
08	Multiplication	Transplanting	Dawn	21, Aug	25, Sep
09			IR-298	20, Aug	23, Sep
10			IR-8	21, Aug	24, Sep

Fig. III-3 A Schedule of the Pilot Farm Operation in 1980

Plot No.	Classification	Planting Method	Variety Name	Sowing Date	Planting Date
A-02	Experiment on Variety				
03	Seed Purification				
04	Experiment on Fertilizer				
05	Experiment on Fertilizer				
06	Experiment on Herbicide				
07	Experiment on Seasonal Planting				
08	Experiment on Seasonal Planting				
09	Seed	Broadcast	IR-24	26, Jul	16, Aug
10	Multipli-	Transplanting	IR-24	26, Jul	16, Aug
11	cation		IR-24	27, Jul	17, Aug
12			IR-24	27, Jul	17, Aug
13			IR-24	27, Jul	18, Aug
14			IR-24	27, Jul	18, Aug
15			IR-2153	28, Jul	19, Aug
16			IR-2053	28, Jul	19, Aug
17			Tos 103	28, Jul	20, Aug
18			Tos 103	28, Jul	20, Aug
19			IR-298	29, Jul	21, Aug
20			IR-298	29, Jul	21, Aug
21			BG-34	29, Jul	23, Aug
22			BG-34	29, Jul	23, Aug
23			IR-29	30, Jul	24, Aug
B-09			BR-4, BR-5	30, Jul	24, Aug
10			IR-127, IR-40	30, Jul	25, Aug
11			IR-36	30, Jul	25, Aug
12			IR-36	31, Jul	26, Aug
13			IR-36	31, Jul	26, Aug
14			IR-22	31, Jul	27, Aug
15			IR-22	31, Jul	27, Aug
16			Taichung, Miriyan	2, Aug	28, Aug
17			IR-1514, S.M.L	2, Aug	28, Aug
18			IR-28	2, Aug	30, Aug
19			IR-28	2, Aug	30, Aug
02	Trial	Direct	BG-34	26, Aug	--
03	Cultiva-	Seeding in	BG-34	27, Aug	--
04	tion	Upland	BG-34	28, Aug	--
05			BG-34	30, Aug	--
06			BG-34	31, Aug	--
07			BG-34	1, Sep	--
08			BG-34	2, Sep	--
23			Tos 103	11, Aug	--
24			Tos 103	12, Aug	--
25			Tos 103	13, Aug	--
26			Tos 103	14, Aug	--
27			Tos 103	16, Aug	--
28			Tos 103	17, Aug	--
29			Tos 103	18, Aug	--
30			Tos 103	19, Aug	--

Plot No.	Classification	Planting Method	Variety Name	Sowing Date	Planting Date
B-31	Trial	Direct	Tos 103	20, Aug	--
32	Cultivation	Seeding in Upland	Tos 103	21, Aug	---
33			Tos 103	23, Aug	---
34			Tos 103	24, Aug	---
35			Tos 103	25, Aug	---
36			Tos 103	26, Aug	---
F-06					IR-20	26, Aug	---
07			IR-20	27, Aug	---
08			IR-20	27, Aug	---
09			IR-20	28, Aug	---
10			IR-20	28, Aug	---
16			BG-34	30, Aug	---
17			BG-34	30, Aug	---
18			BG-34	31, Aug	---
19			BG-34	1, Sep	---
20			BG-34	2, Sep	---
G-06			C-11	26, Aug	--
07			C-11	27, Aug	---
08			C-11	28, Aug	---
09			C-11	30, Aug	---
10			C-11	31, Aug	---
16			C-11	31, Aug	---
17			C-11	1, Sep	---
18			C-11	1, Sep	---
19			C-11	2, Sep	---

Fig. III-3 B Progress of the Pilot Farm Operation in 1980

Plot No.	Classification	Planting Method	Variety Name	Sowing Date	Planting Date
A-02	Experiment on Variety				
03	Seed Purification				
09	Seed	Transplanting	IR-24	6, Aug	28, Aug
10	Multipli- cation	by Broadcast- able seedling	IR-24	7, Aug	30, Aug
11			IR-24	7, Aug	31, Aug
12			IR-24, IR-30	7, Aug	1, 6, Aug
13			Tos 103	9, Aug	2, Sep
14			Tos103, IR2153	9, Aug	2, Sep
15			IR-298	13, Aug	3, Sep
16			IR298, IR2053	13, Aug	3, 4, Sep
17			BG-90, Miriyan, SML	13, Aug	4, Sep
18			BG90, IR29, IR40	14, Aug	4, Sep
19			Ishin, Toitsu	16, Aug	10, Sep
20			IR-36	14, Aug	6, Sep
21			IR-36	15, Aug	7, Sep
22			IR-36	15, Aug	8, Sep
23	IR-36	15, Aug	9, Sep		
B-09			IR-22	15, Aug	11, Sep
10			IR-28	16, Aug	12, Sep
11			IR-28	16, Aug	13, Sep
12			IR-28	18, Aug	14, Sep
13			IR-4, IR-1514	17, Aug	15, Sep
B-02	Trial Cultiva- tion	Direct Seeding in Upland	Tos 103	9, Aug	--
03			Tos 103	10, Aug	--
04			Tos 103	20, Aug	--
05			Tos 103	14, Aug	--
06			Tos 103	14, Aug	--
07			Tos 103	16, Aug	--
08			Tos 103	17, Aug	--
23			Tos 103	19, Aug	--
24			Tos 103	17, Aug	--
25			Tos 103	18, Aug	--
26			Tos 103	18, Aug	--
27			Tos 103	19, Aug	--
28			Tos 103	19, Aug	--
29			Tos 103	20, Aug	--
30			BG-34	20, Aug	--
31			BG-34	20, Aug	--
32			BG-34	21, Aug	--
33			BG-34	21, Aug	--
34	BG-34	22, Aug	--		
35	BG-34	22, Aug	--		
36	BG-34	22, Aug	--		

Plot No.	Classification	Planting Method	Variety Name	Sowing Date	Planting Date
F-09	Trial	Direct	C-11	4, Sep	--
10	Cultivation	Seeding in	C-11	4, Sep	---
19		Lowland	C-11	4, Sep	---
20			C-11	4, Sep	---
16		Direct	BG-34	22, Aug	---
17		Seeding in	BG-34	24, Aug	---
18		Upland	BG-34	24, Aug	---
G-07			C-11	29, Aug	---
08			C-11	28, Aug	---
09			C-11	28, Aug	---
16		Broadcast	C-11	31, Aug	---
17		Direct	C-11	31, Aug	---
18		Seeding in	C-11	30, Aug	---
19		Upland	C-11	30, Aug	---

JAPAN INTERNATIONAL COOPERATION AGENCY

F I N A L R E P O R T

ANNEX

(TECHNICAL REPORT)

October, 1980

HIKARU NIKI

(Rice Specialist)

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I. Design of Experiment in Ed Dueim
Ex. 1 to Ex. 16

Rice Growing Experiment

In Ed Dueim

No. & Theme	Ex. 1, Experiment on Varieties in off season
Term	18th, Oct. 1978 to March, 1979
Varieties	C-15, IR-22, IR-8, BG-34, IR-24
Objective	The objective of this experiment is to select out the varieties which are suitable as off season crops in the Gasaba area where is the site of the Pilot Farm. Detailed testing items are yielding ability and resistance to diseases, lodging and insect pests.

Design of Experiment

- (a) Design and replication: Randomized experiments with three replications.
- (b) Area of a plot: 35.9 m^2
- (c) Number of plot: $3 \times 5 = 15$
- (d) Amount of fertilizer and application method:
N150 kg/ha, N is split-applied at four times with equal amount, i.e. just before the transplanting, at the tillering stage (20 days after transplanting), the spikelet differentiation stage (23 days before heading) and full heading stage.
- (e) Spacing: 110 g of seeds per m^2 in the nursery, 30 cm x 15 cm and 3 seedlings per hill in the main field.

Investigation Items:

The following specific items will be examined.

The initial heading date, medium heading date, full heading date, maturity date, culm length, panicle length, disease resistance, insect pest resistance, lodging resistance, percentage of ripened grains, percentage of non-fertilized grains, 1,000 grains weight, quality of brown rice and grain yield per ha.

No. & Theme Ex. 2, Experiment on nitrogen amount and application timing.

Term 18th, Oct. 1978 to March, 1979

Variety BG-34

Objective Nitrogen is most influential on the yield, and it is very important when and how much we should apply it. This experiment is aimed to clarify on the off-seasonal planting.

Design of Experiment

(a) Design

No.	Total Amount	Basal	1st Top-dress	2nd Top-dress	3rd Top-dress
1	0	0	0	0	0
2	50	50	0	0	0
3	50	20	10	10	10
4	50	30	0	20	0
5	50	20	0	20	10
6	100	100	0	0	0
7	100	30	30	20	20
8	100	60	0	40	0
9	100	40	0	40	20
10	150	150	0	0	0
11	150	50	30	40	30
12	150	80	0	70	0
13	150	70	0	60	20
14	200	200	0	0	0
15	200	80	20	60	40
16	200	120	0	80	0

* Each 1st, 2nd and 3rd top-dressing timing is same as the timing of Ex. 1.

- (b) Area of a plot: 27 m^2
- (c) Number of plots: $3 \times 16 = 48$
- (d) Spacing: $30 \text{ cm} \times 15 \text{ cm}$ and 3 seedlings in the main field and 110 g seed per m^2 in the nursery

Investigation Items

Besides the items as in Ex1, the number of tillers, plant height and leaf colour at intervals of 7 days at only one block.

* This procedure is about same as the Ex. 1.

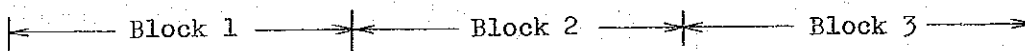
Layout of the experimental plot

Block No. NEC

4	7	1	13	15	7	3	13	8	2	13	6
12	15	6	3	9	11	8	2	4	9	15	1
5	9	11	16	1	14	6	5	16	11	5	12
10	2	14	8	10	4	16	12	10	7	3	14

↑
6.5 m
↓

← 4.15 m →



No. & Theme Ex.3, Experiment on Spacing
Term 18th Oct, 1978 to March, 1979
Variety IR-8
Objective The objective of this experiment is to find out the most suitable spacing for transplanting plants in off-season.

Design of Experiment

- (a) Design and replication: Randomized experiments with 3 replications.
- (b) Area of a plot: 35.9 m^2
- (c) Number of plot: $3 \times 7 = 21$
- (d) Amount of fertilizer and application method: N...150kg/ha, N is split-applied at four times with equal amount, i.e. just before the transplanting, on 20 days after transplanting, at the spikelet differentiation stage (on 23 days before heading) and full heading stage.
- (e) Spacing: 110 g of seeds per m^2 in the nursery.

Spacing

- A 30 cm x 10 cm (33 hills/ m^2)
- B 30 cm x 15 cm (22 hills/ m^2)
- C 30 cm x 20 cm (17 hills/ m^2)
- D 30 cm x 30 cm (11 hills/ m^2)
- E 25 cm x 10 cm (40 hills/ m^2)
- F 25 cm x 15 cm (27 hills/ m^2)
- G 25 cm x 25 cm (16 hills/ m^2)

Investigation items and this procedure is just same as the Ex. 1.

No. & Theme Ex. 4 Experiment on herbicide
Term 18th Oct, 1978 to March, 1979
Variety C-15
Objective The objective of this experiment is to establish
 the most effective and the most economical method
 for weeding on the off-season.

Design

- (a) Design and replication: Randomized experiments with 3 replications.
 - A. Control..... No application at all
 - B. Ronster..... Just after puddling and before transplanting.
 - C. Saturn (Gra.).... 2 days after transplanting
 - D. Saturn (Emu.).... 2 days after transplanting
 - E. MO (Gra.)..... 2 days after transplanting
- (b) Area of a plot: 41.5 m^2
- (c) Number of plot: $5 \times 3 = 15$
- (d) Amount of fertilizer and application method: N... 150 kg/ha
N is split-applied at four times with equal amount,
i.e. just before the transplanting, on 20th day after
transplanting, at the spikelet differentiation stage
(on 23 days before heading) and at full heading stage.

Investigation items and this procedure is just same as Ex. L.

No. & Theme Ex. 5, Experiment on Potash
Term 18th Oct, 1978 to March, 1979
Variety BG-34
Objective The objective of this experiment is to clarify
 the effectiveness of Potash to the rice yield
 in off-season.

Design of Experiment

(a) Design and replication: Randomized experiment with 3 replications.

A..... 0 kg/ha

B..... 50 kg/ha

C..... 100 kg/ha

D..... 200 kg/ha

(b) Area of a plot: 50.6 m^2

(c) Number of plot: $4 \times 3 = 12$

(d) Amount of fertilizer and application timing: N...150 kg/ha, N is split-applied at four times with equal amount, i.e. just before the trans-planting, on 20 days after transplanting, at the spikelet differentiation stage (on 23 days before heading) and full heading stage.

Potash is applied all just after the puddling.

(e) Spacing: 30 cm x 15 cm and 3 seedlings per hill and 110 g seeds per m^2 in the nursely.

Investigation items and this procedure is just same as the Ex. 1.

No. & Theme Ex. 6, Experiment on Sulpher
Term 18th Oct, 1978 to March, 1979
Variety IR-8
Objective The objective of this experiment is to clarify the effectiveness of Sulpher to the rice yield in off-season.

Design of Experiment

- (a) Design and replication: Randomized experiment with 3 replications.

A..... 0 kg/ha

B..... 50 kg/ha

C.....100 kg/ha

D.....150 kg/ha

(b) Area of a plot: 50.6 m²

(c) Number of plot: 4 x 3 = 12

(d) Amount of fertilizer and application timing: N...150 kg/ha. N is split-applied at four times with equal amount, i.e. just before the transplanting, on 20 days after transplanting, at the spikelet differentiation stage (on 23 days before heading) and full heading stage. Sulpher is applied all before puddling and mixed well with the soil.

(e) Spacing: 30 cm x 15 cm and 3 seedlings per hill in the main field and 110 g of seeds per m² in the nursely.

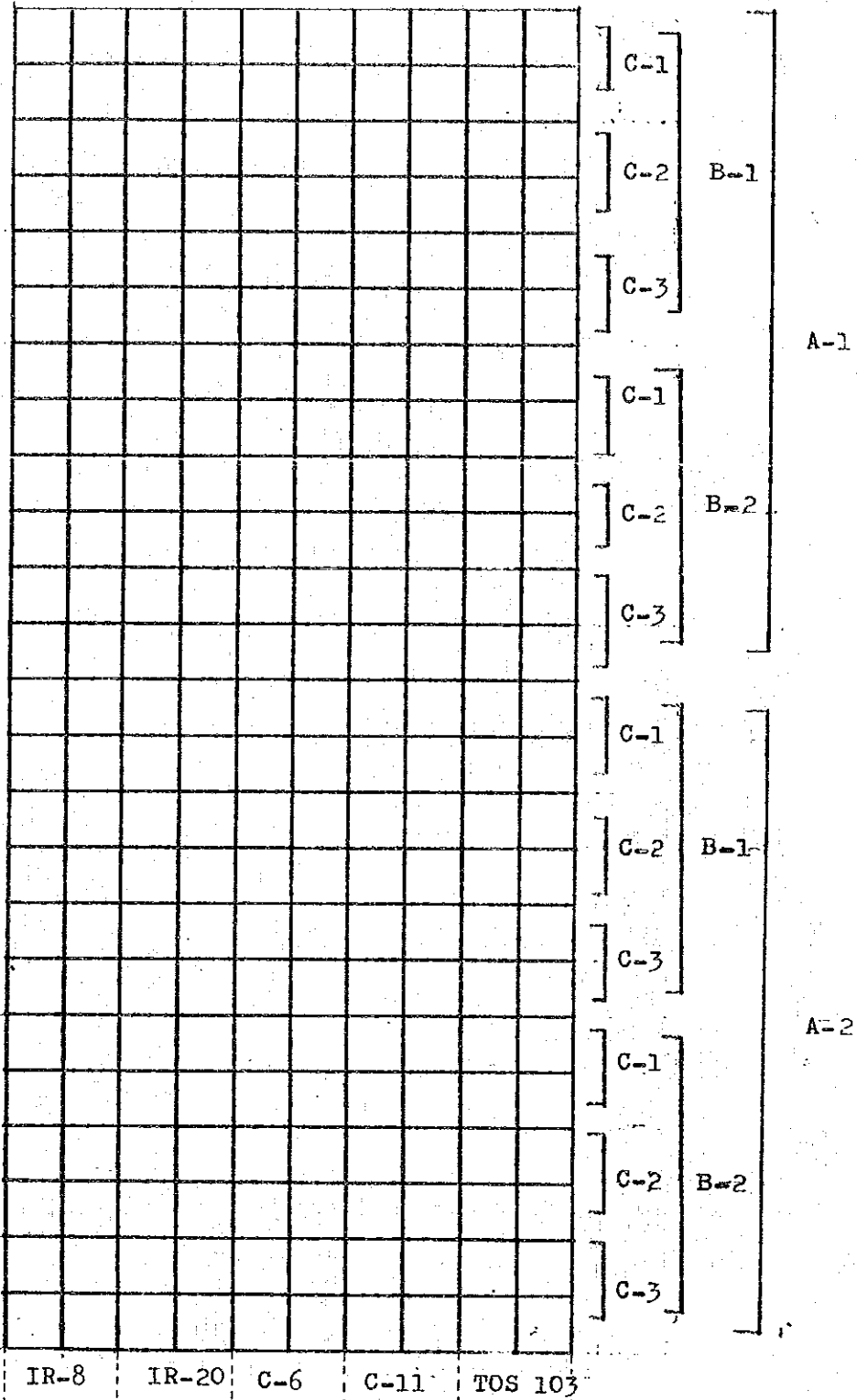
Investigation items and this procedure is just same as the Ex. 1.

EX No. & Theme	Ex. 7 Experiment on Sprouting Ability in Direct Sowing Method												
Term	20th Jan. 1979 to 3rd Feb. 1979.												
Variety	IR-8, IR-20, G-6, G-11, TOS 103 .												
Objective	In the future on the rice cultivation in Abu Gasaba Project, we cannot employ transplanting method but direct-sowing one. But the seeding method has not been established yet. This experiment is purposely to find out the best system of it.												
Treatments	<table border="0"> <tr> <td>A</td> <td>Degree of the incubation (soaking duration)</td> </tr> <tr> <td></td> <td> <ol style="list-style-type: none"> 1. Three days 2. Five days </td> </tr> <tr> <td>B</td> <td>Timing of puddling</td> </tr> <tr> <td></td> <td> <ol style="list-style-type: none"> 1. Just before the seeding 2. One day before the seeding </td> </tr> <tr> <td>C</td> <td>Submerging duration after seeding</td> </tr> <tr> <td></td> <td> <ol style="list-style-type: none"> 1. One day 2. Three days 3. Seven days </td> </tr> </table>	A	Degree of the incubation (soaking duration)		<ol style="list-style-type: none"> 1. Three days 2. Five days 	B	Timing of puddling		<ol style="list-style-type: none"> 1. Just before the seeding 2. One day before the seeding 	C	Submerging duration after seeding		<ol style="list-style-type: none"> 1. One day 2. Three days 3. Seven days
A	Degree of the incubation (soaking duration)												
	<ol style="list-style-type: none"> 1. Three days 2. Five days 												
B	Timing of puddling												
	<ol style="list-style-type: none"> 1. Just before the seeding 2. One day before the seeding 												
C	Submerging duration after seeding												
	<ol style="list-style-type: none"> 1. One day 2. Three days 3. Seven days 												

* Area of plot is one square meter, and replication is four. 10 g of each seeds are to be sown on each plot. (100 kg/ha).

Design

BLOCK NEF



Procedure

20th, Jan Selection of the seeds by salt water (1.06)

Soak to water.

22nd, Jan°	.....	Puddling (A1 - B2)
23rd, Jan.	.....	Puddling (A1 - B1)
		Sowing the seeds (A1 - B1, A1 - B2)
		Incubation (A2)
24th, Jan.	.....	Puddling (A2 - B2)
		Water off (A1 - C1)
25th, Jan.	.....	Puddling (A2 - B1)
		Sowing the seeds (A2)
26th, Jan.	.....	Water off (A2 - C1, A1 - C2)
28th, Jan.	.....	Water off (A2 - C2)
30th, Jan.	.....	Water off (A1 - C3)
1st, Feb.	.....	Water off (A2 - C3)
3rd, Feb.	.....	Judging the percentage and strength of those germination power for each plot.

Investigation

The percentage and strength of the germination power will be simply examined by eye estimation, and are contradistinguished into three groups, i.e. good, medium and bad.

Note Germination test shall be on parallel done for each varieties to examine exact germination percentage. Hundred seeds of each varieties are sown in the basin. Germinated rates up to 3rd, Feb. are considered as percentage of those germination.

29. Toitsu	35. Toyonishiki
30. Ishin	36. Norin No. 17
31. Hino	37. Dawn
32. Asominori	38. Blue Bonnet
33. Koganenishiki	39. Cowad Mali
34. Reimei	40. SML 18

Design of Experiment

- (a) Replication : Three replication
- (b) Area of a plot : 10.0 m^2
- (c) Number of plots : $3 \times 40 = 120$
- (d) Amount of fertilizer and application method :
 N 180 kg/ha, N is split applied at four times with equal amount, i.e. just before the transplanting, at the tillering stage (20 days after transplanting), the spikelet differentiation stage (23 days before heading) and full heading stage.
- (e) Spacing : 80 g of seeds per m^2 in the nursery, 25 cm X 15 cm and 3 seedlings per hill in the main field.
- (f) Layout of the experimental plot : Fig. 1
- * A, B and C correspond the replication No. I, II and III, respectively.

Investigation Items

The following specific items will be examined. The initial heading date, medium heading date, full heading date, maturity date,

culm length, panicle length, disease resistance, lodging resistance,
percentage of ripened grains, percentage of non-fertilized grains,
1,000 grains weight, quality of brown rice and grain yield per ha.

No. & Theme : Ex. 9. Experiment on Four Primary Elements of Fertilizer.

Duration of Experiment 1st, Feb. 1979 to June, 1979.

Objective The objective of this experiment is to clarify the effectiveness of N, P, K and S on the yield of rice in off-seasonal planting.

Variety to be used : TOS-103

Design of Experiment

- (a) Design : a. Non-N, b. Non-P, c. Non-K
d. Non-S e. Non-N,P,K and S
f. Standard (N..... 180 kg/ha,
P..... 200 kg/ha, S..... 200 kg/ha).

The total amount of S is applied one month before transplanting and mixed well with the cultivated soil, and the total amount of P and K are also applied basically just before the transplanting. N is split applied as in the case of Ex. 8.

(b) Replication : Three replication

(c) Area of a plot : 33.3 m^2

(d) Number of plot: $3 \times 6 = 18$

(e) Spacing : 80 g of seeds per m^2 in the nursely,
25 cm X 15 cm and three seedlings per hill
in the main field.

(f) Layout of the experimental plot : Fig. 2

* A, B and C correspond the replication No. I, II and III respectively

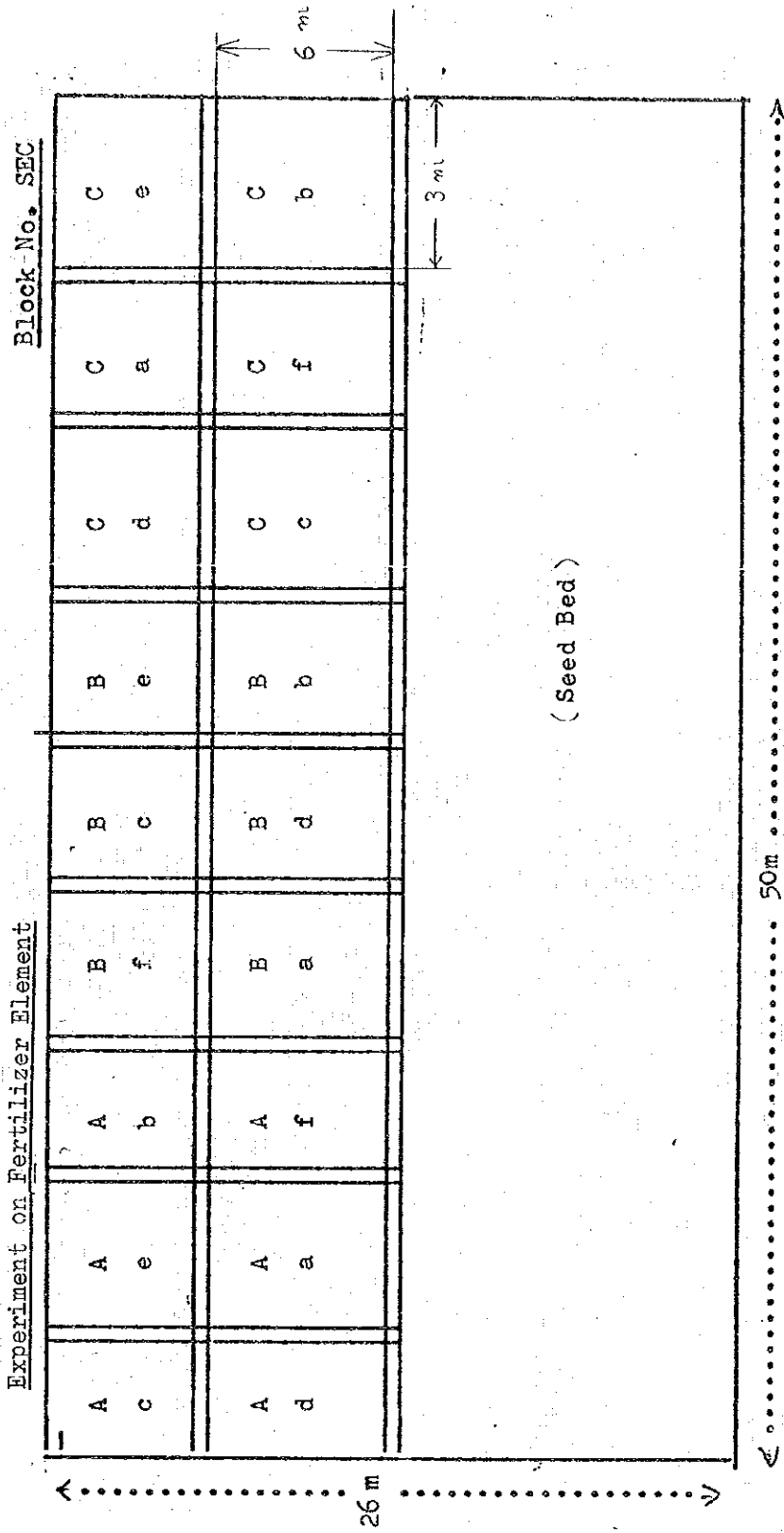
Investigation Items

Same as in the Ex. 8.

Fig. 2

LAYOUT OF THE EXPERIMENTAL PLOT

Ex. No. 9



* _____ Correspond the separation with a dyke

* _____ Correspond the separation without a dyke

No. & Theme : Ex, 10. Experiment on optimum amount
and timing of application of nitrogen.

Duration of Experiment : 1st, Feb. 1979 to June 1979.

Objective : The objective of this experiment is to
determine the optimum amount of nitrogen
and find out the best timing of its
application, in the off-seasonal planting.

Variety to be used : TOS-103

Design of Experiment

(a) Design

No.	Total Amount	Basal	1st Top-dress	2nd Top-dress	3rd Top-dress
1	0	0	0	0	0
2	50	50	0	0	0
3	50	20	10	10	10
4	50	30	0	20	0
5	50	20	0	20	10
6	100	100	0	0	0
7	100	30	30	20	20
8	100	60	0	40	0
9	100	40	0	40	20
10	150	150	0	0	0
11	150	50	30	40	30
12	150	80	0	70	0
13	150	70	0	60	20
14	200	200	0	0	0
15	200	80	30	60	30
16	200	120	0	80	0

- (b) Replication : Three replication
- (c) Area of a plot: 25 m^2
- (d) Number of plot: $3 \times 16 = 48$
- (e) Spacing : 80 g of seeds per m^2 in the nursery, 25 cm X 15 cm and 3 seedlings per hill in the main field.
- (f) Fertilizer : Other than nitrogenous fertilizer, 100 kg/ha of phosphorous is applied just before transplanting.
- (g) Layout of the experimental plot: Fig 3
- * A, B and C correspond the replication No.I, II and III, respectively.

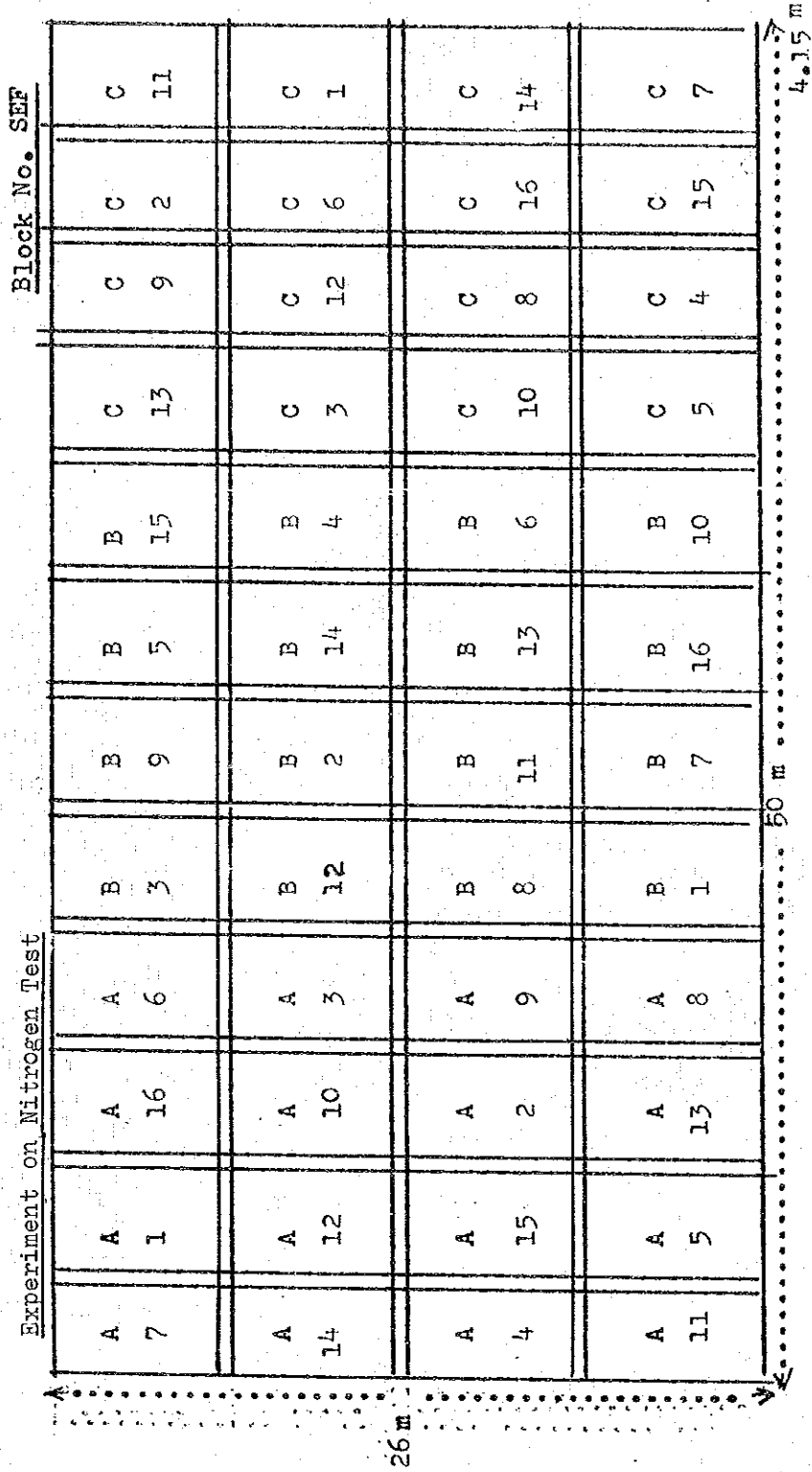
Investigation Items


Besides the items as in Ex. 8, the number of tillers, plant height and leaf colour is to be measured at interval of 7 days.


Fig. 3

LAYOUT OF THE EXPERIMENTAL PLOT

Ex. No. 10



*  Corresponds the separation with a dyke

*  Corresponds the separation without a dyke.

No. & Theme Ex. 11 Experiment on Cultivation Method and Spacing.

Duration of Experiment 1st, Feb, 1979 to June 1979.

Objective The objective of this experiment is to search for the best cultivation method as well as spacing in off-seasonal planting. There are three possible cultivation methods. i.e. transplanting, broadcast transplanting and direct sowing method. These comparison is also important objective of this experiment.

Variety to be used TOS-103

Design of Experiment

(a) Design

Cultivation Method	No.	Planting Method and Spacing	
Transplanting	1	15 cm X 15 cm	44 hills/m ²
	2	25 cm X 10 cm	40 hills/m ²
	3	25 cm X 15 cm	27 hills/m ²
	4	25 cm X 25 cm	16 hills/m ²
	5	30 cm X 10 cm	33 hills/m ²
	6	30 cm X 15 cm	22 hills/m ²
	7	30 cm X 20 cm	17 hills/m ²
	8	30 cm X 30 cm	11 hills/m ²
Broadcast transplanting	9	Broadcast	17 hills/m ²
	10		22 hills/m ²
	11		40 hills/m ²
Transplant Broadcastable Seedling	12	30 cm X 15 cm	22 hills/m ²

Cultivation Method	No.	Planting Method and Spacing
Direct Sowing	13	Upland (without puddling) 50 kg/ha
	14	75 kg/ha
	15	100 kg/ha
	16	Submerged (after puddling) 50 kg/ha
	17	75 kg/ha
	18	100 kg/ha

(b) Replication : 3 replications for ordinary and broadcast transplanting, and no replication for direct sowing method.

(c) Area of a plot : 33 m² for ordinary and broadcast transplanting, and 180 m² for direct sowing method.

(d) Number of plot : 12 X 3 = 36 (Transplanting)
3 X 1 = 3 (Direct sowing)

(e) Amount of fertilizer and application method:

N 180 kg/ha, P.... 100 kg/ha. P is applied basically, while N is split-applied as in the case of Ex. 8.

(f) Layout of the experimental plot : Fig 4, 5.

* A, B and C correspond the replication No. I, II and III, respectively. D.U. is direct sowing in upland, while D.S. is direct sowing in submerged condition.

Investigation Items

Same as the Ex. No. 11.

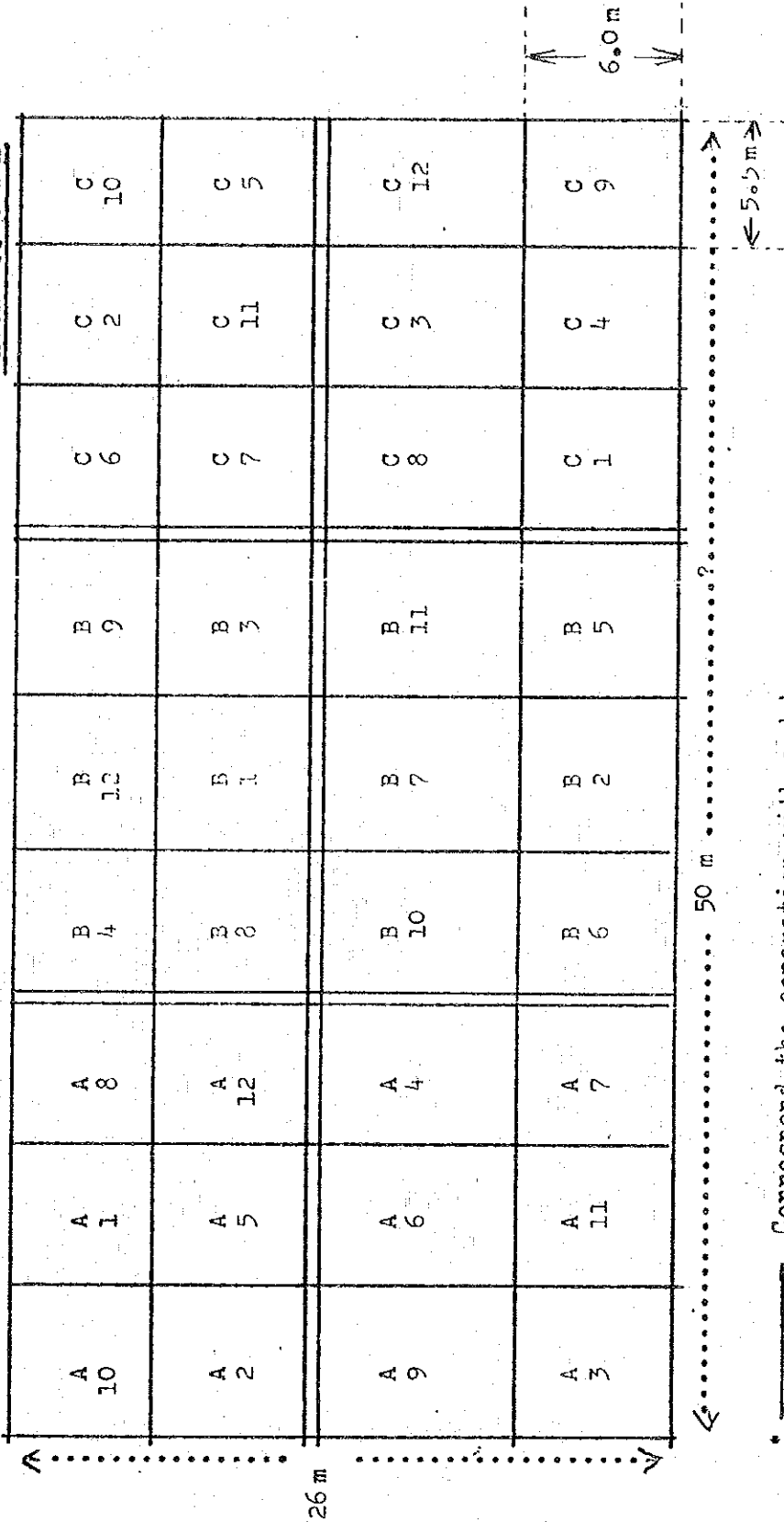
Fig. 4

LAYOUT OF THE EXPERIMENTAL PLOT

Ex. No. 11

Experiment on Cultivation Method (Transplant)

Block No. S W M

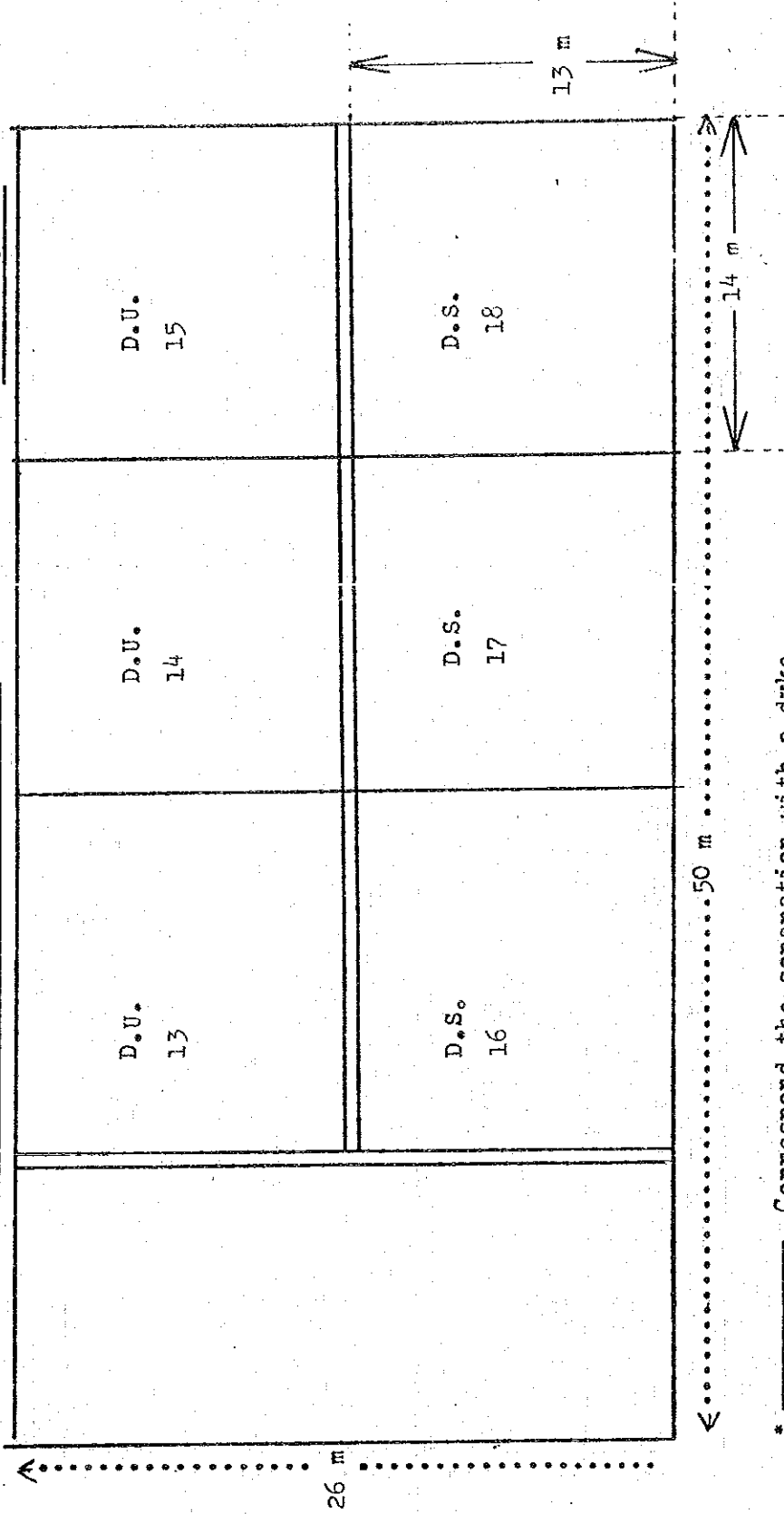


* ——— Correspond the separation with a dyke

* ——— Correspond the separation without a Dyke

Ex. No. 11 LAYOUT OF THE EXPERIMENTAL PLOT

Experiment on Cultivation Method (Direct Sowing) Block No. NWC



No. & Theme : Ex. 12. Experiment on the effectiveness of herbicides.

Duration of Experiment: 1st, Feb. 1979 to June 1979.

Objective : The objective of this experiment is to establish the most effective and the most economical method for weeding in off-seasonal planting on the transplanting rice cultivation as well as the direct sowing one.

Variety to be used : IR-8

Design of Experiment

(a) Design

1. In the case of transplanting

No.	Name of Herbicide	Application Time	Quantity
1	Saturn (Emulsion)	Just after puddling	1 L/10a
2	Saturn (granule)	Just after puddling	4 kg/10a
3	X-5-2	"	"
4	M.O.	"	"
5	Basagran	"	1 L/10a
6	Propanil	"	1 L/10a
7	Mixture of Basagran and Propanil	"	1 L/10a
8	Control	No Application	_____

2. In the case of direct sowing under submerged condition

No.	Name of herbicide	Application Time	Quantity
1	DCPA	10 - 15 days after sowing	1 L/10a
2.	Saturn (Emulsion)	15 - 20 days after sowing	1 L/10a
3.	Saturn (granule)	"	4 kg/10a
4.	Ronster (emulsion)	Just after puddling	500 cc/10a
5.	Basagran	15 - 20 days after sowing	1 L/10a
6.	Propanil	"	"
7.	Mixture of Basagran and Propanil	"	"
8.	Control	No Application	

(b) Replication : Three replication

(c) Area of a plot : 25 m²

(d) Number of plot : 8 X 3 + 8 X 3 = 48

(e) Spacing : 80 g of seeds per m² in the nursery, 25 cm X 15 cm and 3 seedlings per hill in the main field.

(f) Fertilizer : N 180 kg/ha is split applied as in the experiment No. 8. P 100 kg/ha, P is applied basically, just after the puddling.

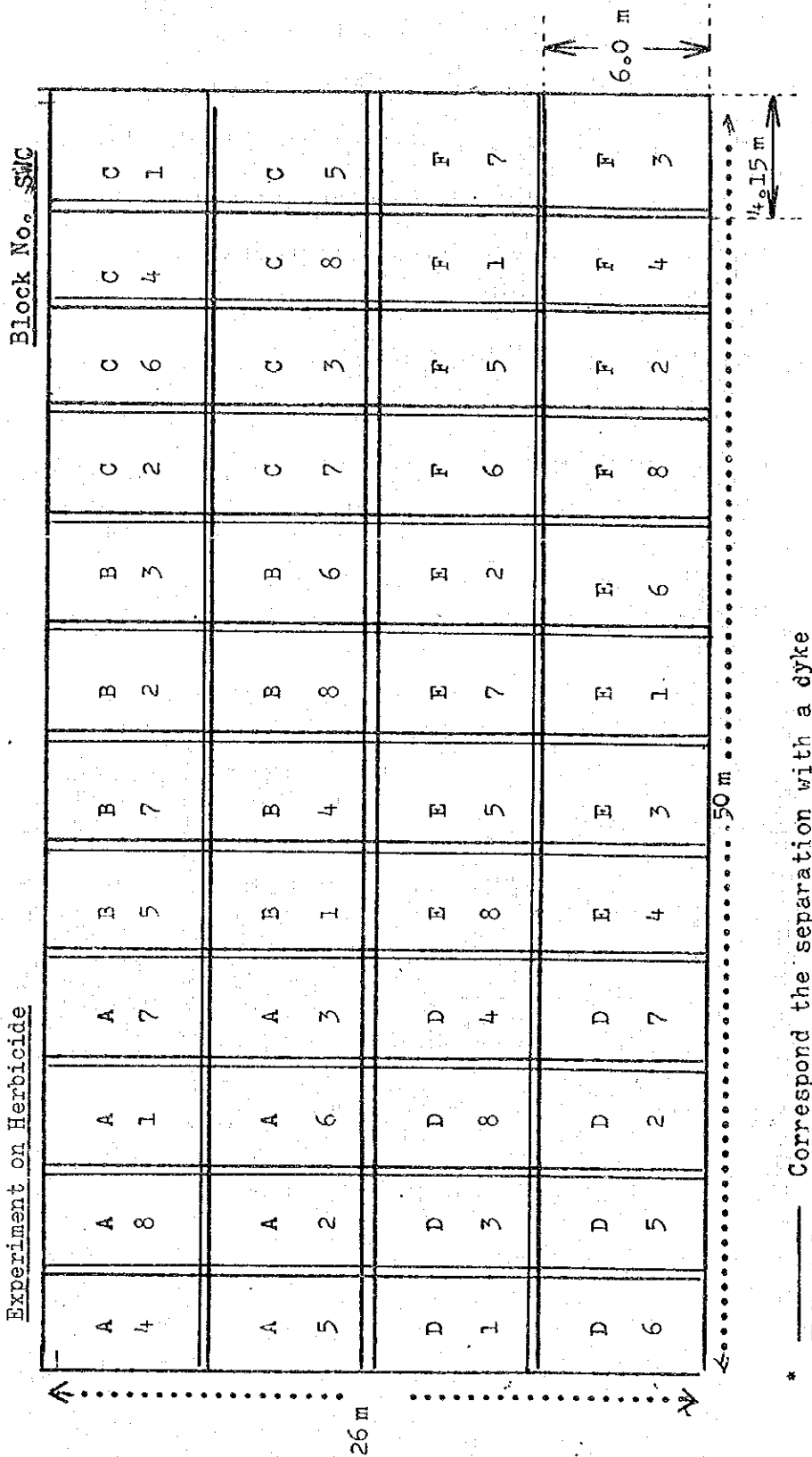
(g) Layout of the experimental plot : Fig. 6.

* A, B and C correspond the replication No. I, II and III for transplanting plot, while D, E and F correspond the replication No. I, II and III for direct sowing plot.

Fig. 6

LAYOUT OF THE EXPERIMENTAL PLOT

Ex. No. 12



* Correspond the separation with a dyke

* Correspond the separation without a dyke

No. and Theme Ex. No. 13 Herbicide Test
Term 25th, March, 1979 to April, 1979
Objective To select out the most effective and economical
medium stage herbicide in rice cultivation in
Abu Gasaba area. Which is granule in out looks
and systemic in character.

Design

1) Treatment ;

A. Control	_____
B. Sweb M	3 - 4 kg/10 a
C. Mamet SM	"
D. 2 - 4 - D	"
E. Basagran	"

2) Replication ; Three

3) Area of a plot ; 41.5 m²

4) Number of plot ; 5 X 3 = 15

* This test is to be done after Ex. 4 which all herbicide have
been applied long time ago and no residual possibility is
there.

No. & Theme Ex. 14 Experiment on Cultivation Method

Duration of Experiment 1st Feb, 1979 to June 1979

Objective The objective of this experiment is as next:

- 1- How much we can save the time and get yield by Kohchi Method Transplanting
- 2- Train labourers to Kohchi Method Transplanting
- 3- Seed multiplication.

Design of Experiment:

a. Varieties to be

be used : TOS-103, IR-8

b. Replication No replication

c. Area of plot : TOS-103 660 m², IR-8 470 m²

d. Amount of fertilizer and application method:

N 200 kg/ha, P 100 kg/ha, P is applied basically but N is split-applied at four times i.e. Basal (just before transplanting), at the tillering stage (20 days after transplanting), the spikelet differentiation stage (23 days before heading) and full heading.

The ratio is 100 kg, 50 kg, 20 kg and 30 kg, respectively.

e. Spacing

(1) 80 g of seeds per m² in nursery

(2) 6 rows by one labour in main field

(30 cm X 15 cm).

f. Layout of experiment

A corresponds TOS-103 variety

B corresponds IR-8 "

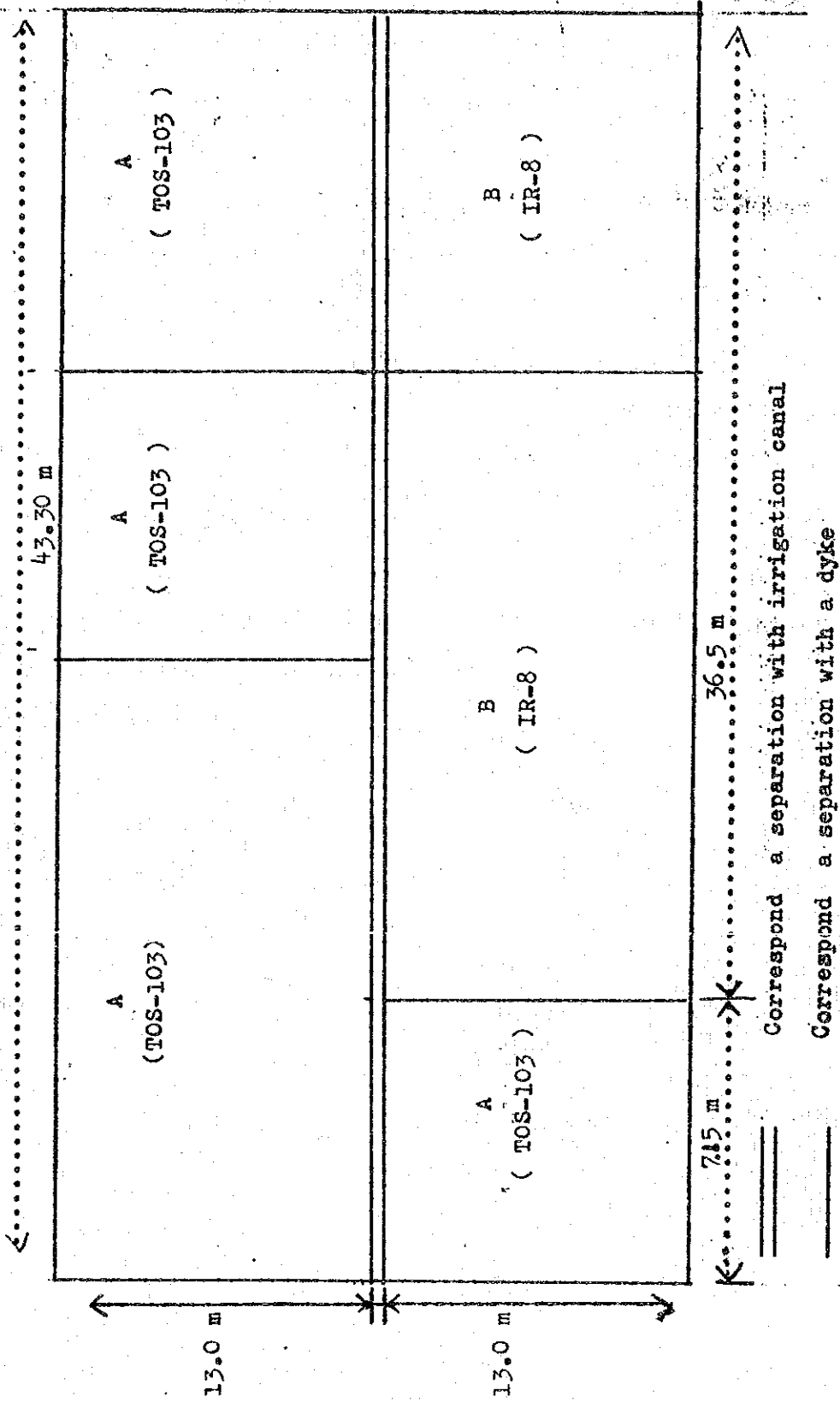
Investigation Items :

- I Initial heading date
- II Medium heading date
- III Full " "
- IV Maturity date
- V Yield component and yield

LAYOUT OF EXPERIMENTAL PLOT

Ex. No. 14

Experiment on Cultivation Method (Kohchi Method)



No. & Theme Ex. 16 Experiment on Cultivation Method

Duration of Experiment 15th, April - 15th June

Objective The objective of this experiment is as

next:

Investigate the possibility of new
cultivation method which is called Dapog

Method and is practiced in the

Philippines.

Design of Experiment

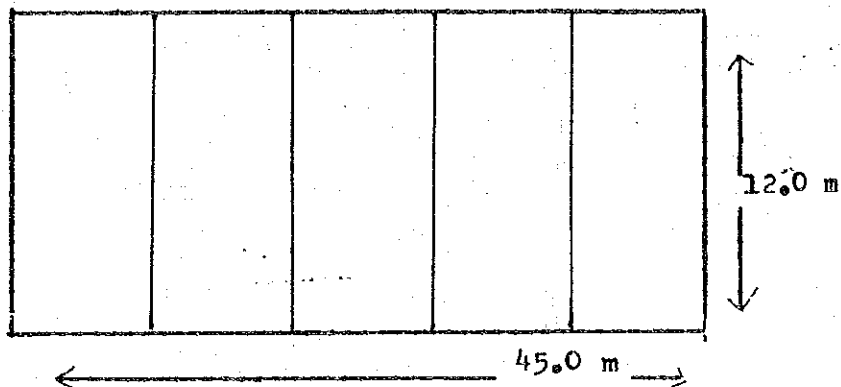
- a) Variety to be used C-15
- b) Replication No replication
- c) Area of plot 540 m²
- d) Amount of fertilizer and application method :-
 - N 150 kg/ha, P 100 kg/ha,
 - P ... is applied basically but
 - N ... is split applied at 100 kg
 - basically and 50 kg at the tillering
 - stage (20 days after transplanting)
- e) Spacing 22 hills/m² i.e. 30 X 15 cm
- f) Layout of experiment Shown in next page

Layout of Experiment

Ex. No. 16

Block No. NWCE

Experiment on Cultivation Method (Dapog Method)



g) Investigation Items :-

- 1- Time of sowing and transplanting compared to ordinary methods.
- 2- Tiller number after two months.

Tab.II-6 Some characteristics of each variety from the results of off-seasonal Experiment in February 1979

Variety	Sheath Blight Disease	Dry Wind Resistance	Grade of Quality	Grade of Broken Rice
IR-5	SS	S	B-B	N
IR-8	R	R	B-A	N
IR-20	S	M	B-B	M
IR-22	S	R	A-B	L
IR-24	S	R	A-A	L
IR-28	SS	M	A-B	N
IR-29	S	S	A-B	L
IR-30	SS	R	B-A	M
IR-36	SS	R	A-B	N
IR-38	M	M	B-B	N
IR-40	S	M	A-B	L
IR-298	M	M	A-A	L
IR-2053	M	R	A-B	N
IR-1514	S	M	A-B	L
IR-1561	S	R	A-B	N
IR-127	SS	SS	A-B	L
IR-2153	M	R	A-B	N
Tos 103	SS	M	A-C	N
C-6	M	R	C-A	N
C-11	SS	R	C-B	M
iriyan No. 23	S	R	-	-
C-15	M	R	C-B	M
BG-34-8	SS	S	C-A	M
BG-90-2	M	M	A-C	L
BG-11-11	R	R	B-A	N
Taichung 65	M	S	B-C	M
Taichung Ikukyu	SS	M	A-C	N
Takao-21	M	S	A-C	N
Hsinchu 56	M	S	A-C	N
Toitsu	SS	R	B-C	L
Ishin	SS	R	B-A	M
Hino	S	SS	B-B	M
Asominori	S	R	A-B	L
Koganenishiki	M	M	B-A	M
Reimei	S	M	B-B	N
Toyonishiki	S	M	A-C	M
Norin No.17	M	M	B-A	N
Dawn	S	R	A-B	N
Cavad Mari	-	SS	-	-
Blue Bonnet	M	SS	A-C	M
SML 18	M	M	A-B	N

Note

* SS..... Severely Susceptible, S..... Susceptible

M Moderate, R Resistant

* Grade of Quality

Nine grades are given to each variety.

A accords good quality, while C does bad, B comes medium. Accordingly, the order of the grade is A-A, A-B, A-C, B-A, B-B, B-C, C-A, C-B, C-C from the good quality to bad quality.

* Grade of Broken Rice M = Many Broken, N = Normal, and L = Little Broken

II. Results of Experiment in Ed Dueim

Tab. 11-1 VARIETY TEST IN OFF-SEASON (FEBRUARY)

Sowing date...1st, Feb. Transplanting date...12, Mar. Spacing...25cm X 15cm

Variety Rep.	No.	Start	Heading	Matu- rity	Culm Length	Ear Length	No. of Panicle per Hill	No. of Grain per Panicle	No. of Grain per Panicle	Percen- tage of Grain ripened	Percen- tage of Grain ripened	Yield (t/ha)		
													40%	90%	un-fer- tilized (g)	Weight
IR-5	1	20/5	26/5	31/5	19/6	42.5	19.7	16.7	81.9	47.3	57.7	30.0	20.3	4.3
	2	27/5	31/5	5/6	"	51.2	20.0	18.9	107.1	41.7	38.9	37.8	21.5	4.5
	3	27/5	31/5	5/6	"	53.6	21.0	17.3	108.2	54.0	50.0	38.3	22.6	5.7
IR-8	1	5/6	10/6	16/6	9/7	46.8	23.0	11.7	93.9	59.6	63.4	23.3	28.5	5.3
	2	5/6	10/6	16/6	"	49.8	22.7	14.1	102.8	68.6	66.8	24.1	26.8	6.9
	3	5/6	"	"	"	49.6	23.3	14.5	92.5	31.8	34.4	48.1	27.3	3.4
IR-20	1	29/5	5/6	13/6	30/6	48.3	24.7	11.7	150.7	79.4	52.7	24.2	15.0	3.7
	2	29/5	"	"	"	48.7	27.1	14.8	136.3	78.8	57.8	28.8	16.8	5.2
	3	29/5	"	"	"	53.5	25.7	13.3	131.1	89.0	67.9	19.8	17.8	5.6
IR-22	1	17/5	21/5	27/5	16/6	42.7	20.0	20.9	78.4	53.1	67.8	21.8	19.3	5.7
	2	17/5	21/5	27/5	"	46.0	22.1	18.5	131.8	98.5	74.7	15.3	19.6	9.5
	3	17/5	21/5	29/5	"	46.3	23.3	25.3	87.6	70.5	80.5	14.2	20.4	9.7
IR-24	1	27/5	5/6	14/6	4/7	43.3	20.1	12.2	106.1	69.2	65.1	23.9	20.5	4.6
	2	"	"	"	"	50.5	21.8	14.7	140.6	97.0	69.0	23.7	21.5	8.2
	3	"	"	"	"	47.4	21.3	12.4	105.3	72.0	68.4	20.8	24.3	5.8

IR-28	1	16/5	22/5	23/5	14/6	43.0	19.7	15.4	51.9	42.2	81.4	12.0	22.3	3.9
	2	16/5	22/5	23/5	14/6	50.6	20.7	18.1	69.4	59.7	86.0	9.0	20.5	5.9
	3	16/5	22/5	23/5	14/6	51.3	21.3	17.9	61.2	51.2	83.6	10.5	22.3	5.4
IR-29	1	29/5	5/6	5/7		49.1	20.0	17.9	69.6	47.5	68.3	22.2	21.6	4.9
	2	29/5	5/6			54.8	22.3	16.1	103.3	79.3	76.8	16.5	20.7	7.1
	3	29/5	5/6			49.6	20.1	14.7	89.1	62.3	69.9	16.2	20.7	5.1
IR-30	1	13/5	19/5	27/5	14/6	41.9	21.0	14.2	86.2	55.1	63.9	26.6	17.6	3.7
	2	13/5	19/5	22/5	14/6	49.2	22.0	17.3	97.3	69.7	71.7	16.3	19.2	6.2
	3	13/5	19/5	27/5	14/6	48.5	19.5	14.4	101.6	79.2	77.9	14.8	18.3	5.6
IR-36	1	6/5	19/5	27/5	15/6	36.2	19.5	16.6	65.1	35.2	54.1	30.0	20.7	3.2
	2	6/5	19/5	27/5	15/6	44.0	21.4	17.6	95.3	57.1	59.9	24.5	20.1	5.4
	3	6/5	19/5	27/5	15/6	42.0	20.8	20.5	52.0	33.9	65.2	22.9	19.9	3.7
IR-38	1	5/6	9/6	18/6	30/6	49.6	22.5	17.5	90.1	51.1	56.7	29.5	18.3	4.4
	2	5/6	9/6	18/6	30/6	50.4	24.0	15.4	93.5	69.0	73.8	18.8	21.9	6.2
	3	5/6	9/6	18/6	30/6	57.1	23.8	12.9	106.1	77.5	73.1	15.9	20.8	5.5
IR-40	1	25/5	28/5	9/6	30/6	49.7	21.5	17.3	76.0	43.3	57.0	22.8	22.3	4.5
	2	27/5	4/6	9/6	30/6	54.0	22.1	17.3	94.9	56.1	59.1	12.8	19.0	4.9
	3	29/5	4/6	9/6	30/6	56.9	22.7	12.9	129.9	103.5	79.7	14.7	18.5	6.6
IR-298	1	3/6	8/6	14/6	26/6	62.8	22.3	11.8					15.3	
	2	3/6	8/6	14/6	26/6	58.7	22.9	12.1	136.7	99.7	73.0	19.2	17.9	5.8
	3	3/6	8/6	14/6	26/6	60.7	23.3	12.1	116.2	100.2	86.3	8.6	18.0	5.8