PROGRESS REPORT
INDO-JAPANESE AGRICULTURAL EXTENSION CENTRES
(NO. 1)

AUGUST 1971

OVERSEAS TECHNICAL COOPERATION AGENCY

CONTENTS

PREFACE

The technical cooperation schemes in the field of agriculture between Japan and India were launched under the two Agreements concerning the establishment of Agricultural Demonstration Farms. At first, four Indo Japanese Agricultural Demonstration Farms were set up at Ranaghat in Nadia, West Bengal, Chakuli in Sambalpur, Orissa, Arrah in Shahabad, Bihar and Vyara in Surat, Gujarat according to the first Agreement signed on April 23, 1962, and then another four Agricultural Demonstration Farms were set up at Bapatla in Gunur, Andhra Pradesh, Chengamanad in Eranakulam, Kerala, Mandya in Mandya, Mysore and Khopoli in Kolaba Maharashtra according to the Second Agreement signed on December 17, 1964. The first group of Demonstration Farms had been operated for five years including two years' extension until April 22, 1967, while the second group had been for four years until December 16, 1968. These Agricultural Demonstration Farms, aiming at demonstrating modern agricultural techniques by Japanese technicians and serving as Centres for the field training of Indian farmers, were established with cognition that Japanese agricultural method could be adapted in Indian conditions as mentioned below.

"Under the scheme demonstrations will be made and training will be imparted to Indian farmers mainly on the improved Japanese method of paddy cultivation, that is to say, fuller utilization of irrigation facilities, seed selection, special methods of transplantation, soil preparation, intensive application of fertilizers, improved plant protection including weeding, and use of improved agricultural implements.

In order to increase agricultural production, improved seeds must be used first of all. To develop a new variety of seed the taste of the consumer and the question of high yield are to be considered, but the fertilizer-response and disease-resistance of the plant should also be studied carefully.

In order to use improved seeds effectively, special Japanese methods of seed selection, for example, salt water method and seed disinfection ought to be applied. To get strong and healthy nursery which are also essential to increase paddy production, special nursery bed must be devised.

For transplanting, a special method of transplanting known as 'square method of transplanting' or the 'straight line method of transplanting' depending upon the variety of paddy and the soil condition must be adopted. These methods help to get the necessary sunshine and ventilation for the plants.

Soil must be prepared to retain the fertilizer for a long duration for necessary plant nutrition, as sources of which organic matter like green manure and compost must be applied and then ploughed deeply. Japanese agricultural implements - small tractor, single bullock plough, etc.-- will be useful for this purpose. Indian plough seems to be in urgent need of improvements for deep tilling, saving time and animal labour.

During the infant nurture and subsequent growth of paddy it must be carefully protected from its various enemies. In tropical countries like India with its abundant sunshine the weeds tend to out-grow the crop itself. Here the Japanese weeder will be used with considerable advantage.

At present in India, pests and diseases claim to have a good chunk of the crop, almost about 10% of the total yield being damaged in case of rice production. Here again the Japanese duster and sprayer will be effectively employed because of almost similar land holdings of the Indian farmer to the Japanese farmer.

As for threshing operations, Japanese threshers will be used to avoid waste and save time and labour. The time and labour thus saved can be utilized for preparation of the next agricul-

tural operations and better crop rotation.

Thus the planned use of the Japanese technological improvements will bring prosperity to the Indian farmer.

In the past the so-called Japanese method of paddy cultivation was found at some places even in India. But in that case most of them seemed to mean isolated use of one or the other essential part of the Japanese method of paddy cultivation, for example, straight line method of transplanting at one place, intensive use of fertilizer at another place, the use of Japanese-type of weeder at the other and so on. But it must be emphasized that the Japanese method of paddy cultivation means a harmonious synthesis of all its essential parts. At the proposed Farms it will be endeavoured to demonstrate the true Japanese method of paddy cultivation.

Besides technological improvements, other ancillary factors like land reforms, cooperative movement, agricultural extension work, crop insurance, price support policy and other measures taken by the Japanese Government should be recognised to have greatly helped the Japanese farmers in accomplishing the miracle of boosting up agricultural production in Japan."

With such a cognition, 32 Japanese technicians in total, or four each at Agricultural Dem onstration Farms contributed much to setting up and implementing the Farms and performed their assigned duties satisfactorily in pursuance of the aims prescribed in the Agreements. In fact, Japanese technicians showed how more rice could be produced through the improved Japanese method of paddy cultivation and demonstrated double or more of rice production as compared to local production prevailing around the Farms at that time. In addition to the services of Japanese technicians, the Government of Japan provided $254,367.77 (Rs. 19.1 lakhs) worth of machinery, equipment, tools, spare parts and other materials required for setting up and implementing the Farms.

Considering that Agricultural Demonstration Farms achieved their expected results and desiring to further the economic and technical cooperation between the two countries in the field of extension of agricultural techniques to India, it was agreed upon between the two Governments that four Agricultural Demonstration Farms out of eight should be continued by changing their functions into those which lay a stress on "extension works", and they were renamed 'Indo-Japanese Agricultural Extension Centre'. The Centres thus converted are those at Arrah in Shahbad, Bihar and Vyara in Surat Gujarat under the first Agreement signed on March 5, 1968, and Mandya in Mandya, Mysore and Khopoli in Kolaba, Maharashtra under the second Agreement signed on December 13, 1968. These agreements remain in force for a period of four years whereas the services of Japanese Experts are provided for a period of three years during the term of validity of each Agreement.

In this way, Japan has been going in for "cooperation in area, or dynamic cooperation" from "cooperation in spot, or static cooperation" by converting the Agricultural Demonstration Farms into the Agricultural Extension Centres. This has been done taking into consideration the following facts:

(1) Generally speaking, it takes a long time, say more than 10 years, to make agriculture develop as much as we can recognize it.

(2) Needless to say, the aim of our cooperation in the field of agriculture is that all individual farmers master and absorb the improved agricultural practices imparted by the Japanese experts and then improve and raise their standard of living as high as possible through increase of agricultural production.

(3) In India, a wide gap has been seen between the improved and modernised agricultural techniques so far evolved in the world including India and local techniques used in

Indian villages, judging from the production figures available.

Keeping these facts in mind, the Japanese Experts and Indian Staff at the Centres have been conducting trials on agricultural techniques and extending their results to farmers, imparting technical training to Indian staff, officers concerned and farmers, and conducting trials and demonstrations through improved machinery and implements and extending their results to farmers.

Since the inauguration of Indo-Japanese Agricultural Extension Centres, more than two years have already passed with some useful effects being obtained. However, there is no doubt that some have been still left behind waiting for further development to be evolved. It is for taking a bold step in the next stage that a record of the activities as well as their results so far done and obtained have been compiled here as "Progress Report of Indo-Japanese Agricultural Extension Centres".

Last but not least, this Progress Report has been prepared by the Japanese experts with Indian staff at each Centre. Any comment on this Report will be received with pleasure.

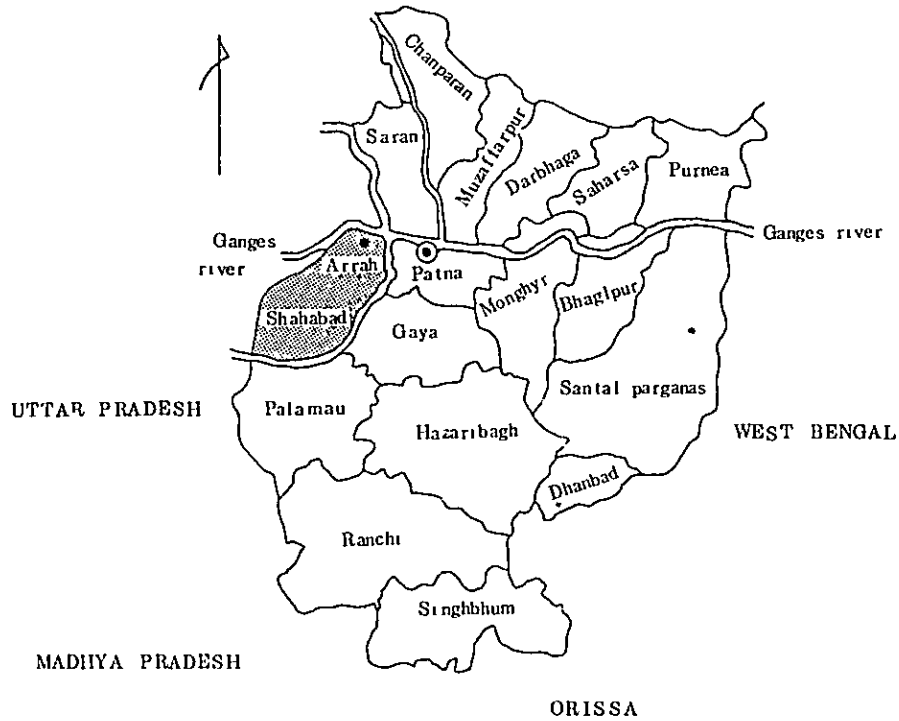
PART I INDO-JAPANESE AGRICULTURAL EXTENSION CENTRE
AT ARRAH IN BIHAR
(JULY 1968 - MARCH 1971)

I. SURROUNDINGS

1. LOCATION

The Centre is located at Arrah, district headquarter of Shahabad district in Bihar which map is shown in Map I.1. It is 67 kilometers west of Patna, being in latitude 25°5'N and longitude 85°E. The district is in a western part of Bihar, bordering on U.P. in the west. The soil in this district is composed mostly of alluvium. The Ganges and the Sone are two main rivers around the district.

Map I-1 Rough sketch around Arrah

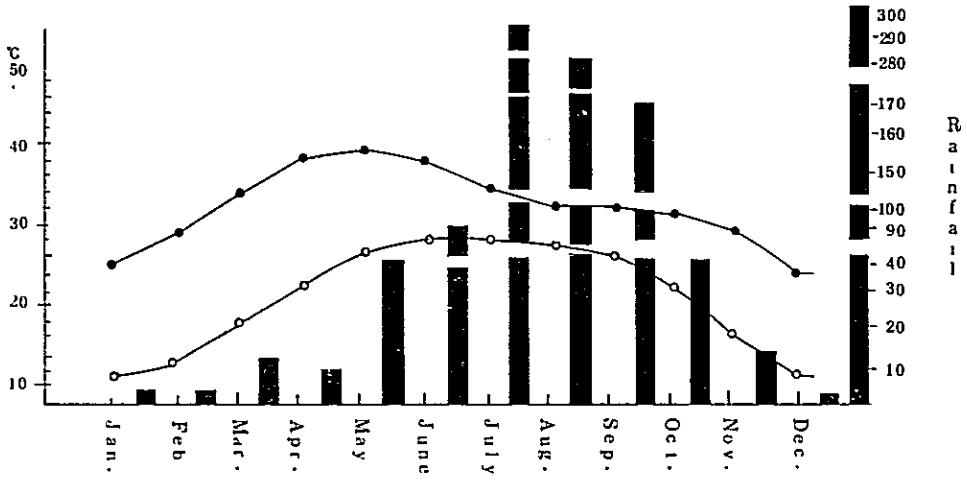


2. WEATHER CONDITIONS

As shown below in Graph I-1, it is the hottest season in April and May in a year. It is very difficult to go out during the day in these months, as the temperature exposed to the direct rays of the sun goes up as high as 45-50°C. Moreover, a hard wind and heat wave are very much harmful to standing summer paddy crops, particularly at their flowering stage.

Annual rainfall observed at the Center is 950 mm on five year average. Monthly temperature and rainfall are shown below in graph I-1.

Graph I-1 Maximum and minimum monthly temperature on eight years average and monthly rainfall on five years average (April 1962 - March 1970 and April 1965 - March 1970 respectively)



Generally, the south-west Monsoon sets in around the second week of June in the State, continuing to the last week of September.

The monthly rainfall in the years of 1969 and 1970 is shown below in Table I-1.

Table I-1 Monthly rainfall in the years of 1969 and 1970

Unit: mm

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1969	3.7	12.0	13.8	4.9	100.0	237.5	318.3	310.7	309.6	6.9	23.1	0	1340.5
1970	27.9	16.7	30.7	0	44.3	229.2	361.1	242.2	171.0	62.8	1.9	0	1187.8

The above table shows that almost all of rainfall in the years of 1969 and 1970 was seen during the periods from the last week of May to the end of September and from the second week of June to the last week of September respectively.

In 1969, rainfall during the period from the last week of May to the end of September was 95 per cent of total rainfall in the year and in 1970, rainfall during the period from the middle of June to the end of September was 85 per cent of total rainfall in the year.

There was heavy attack of Bacterial Leaf Blight (BLB) in 1969 whereas it was devoid of any attack in 1970. It is one of our understandings that whether such a disease occurs or not might depend on the difference of the time of commencement of the Monsoon, and also distribution of rainfall. In 1970, it rained not evenly but in patches all over the district. At some places in Shahabad, there was heavy rainfall, but in many patches there were scanty rains. Thus the year of 1970 can be said to have been abnormal, and so there might have been no chance of transmission of BLB spores.

3. AGRICULTURAL SITUATION

(1) Shahabad district is the most developed area in agriculture in the State of Bihar. The figures given below in Table I-2 and I-3 show the self-explanatory situations of agriculture in the district.

Table I-2 Land utilization

Unit: 1,000 ha

Item	Bihar State (A)	Shahabad dist. (B)	Ratio % (B/A)
1. Total geographical area	17,331	1,138	6.6
2. Total area under cultivation	10,895	735	6.7
3. Total paddy cultivation area	5,315	522	9.8
4. Total upland field area	5,580	213	3.8
5. Total area under irrigation	1,991	471	23.7
1) Canals	632	288	45.6
2) Tanks	175	41	23.4
3) Tube-wells	83	23	27.7
4) Other wells	206	14	6.8
5) Other sources	895	106	11.8

Note: - Totals may not tally due to rounding off.

Source: Directorate of Statistics & Evaluation, Bihar, Patna (Years 1965 - 66 Season & Crop Report)

Table 1-3 Agricultural production

	Bihar State (1965 - 66)			Shahbad district (1965 - 66)		
	Acreage (1000 ha)	Production (tons)	Yield/ha	Acreage	Production	Yield/ha
Kharif-paddy	5,243.0	4,190,730	799 Kg	521.0	466,894	896 Kg.
Summer-paddy	5.3	3,908	737	0.4	536	1,340
(Total)	5,248.3	4,194,638	799	521.4	467,430	896
Wheat	675.0	469,749	696	174.0	121,556	699
Gram	451.0	329,163	730	94.0	233,102	767
Barley	339.4	179,195	528	18.0	10,073	560
Maize	743.3	745,269	1,003	16.0	22,850	1,428
Jowar	14.0	11,782	842	7.0	7,964	1,138
Bazara	20.5	6,285	307	5.0	2,219	444
Sugarcane	170.0	5,949,421	34,997	13.0	428,968	32,998
Potato	97.0	775,942	800	8.0	82,918	1,036
Tobacco	16.0	10,778	674	0.02	8	400
Total Food Crops	10,210.0	-	-	1,166.0	-	-
Total Non-Food Crops	550.0	-	-	35.0	-	-

About 74 per cent of the paddy area in Shahabad consists of low land which is mainly suitable for production of local and improved varieties of paddy. The remaining 26 per cent of the area is suitable for High Yielding Varieties (HYV). It is not possible, however, that the HYV of paddy covers the whole remaining area because of the non-availability of the assured irrigation and drainage facilities. It has been observed that only 15 per cent of the area instead of 26 per cent is under HYV paddy cultivation.

It is understood that, if the assured irrigation and drainage facilities are made available to any portion of the low land, there should be much scope for increase of HYV area.

(2) As regards irrigation facilities, 9,280 acres in the Shahabad district has been covered by the Sone Canal and 82,000 acres has been irrigated by the State tube wells. In addition, a vast area is irrigated by E.R.P. Sets (Energized River Pump Sets) and private tube-wells. Thanks to these irrigation facilities Shahabad farmers have shared "Green Revolution" in the production of HYV Paddy and wheat.

Farmers, however, have been facing a difficulty in cultivating Summer paddy because just at the time of transplanting, the canal is apt to fail to supply water to the area due to scarcity of water from the Rehand Dam in U.P. On the other hand during the Kharif season, especially in the good year of rainfall, excess water is apt to overflow beyond canals, and spread over paddy fields, creating a situation like flood. Absence of drainage facilities, resulting in the stagnation of water, adversely affect standing paddy crops yet to be harvested.

In this connection, an expert is requested to arrive in the district in the month of June 1971 from Japan. He will survey and study about the availability and potentiality of irrigation and drainage at the Sub-Centres and the main Centre at Arrah.

(3) The purpose of increasing agricultural production, needless to say, is to feed the increasing population of the State as well as the district. According to 1961 Census, the population and others in the State and the district are as follows in Table 1-4.

Table I-4 Census 1961

Item	Bihar State	Shahabad District
1. Total population	464.56 Lacs	32.18 Lacs
2. Number of cultivators	103.62 Lacs	5.79 Lacs
3. Number of agricultural labourers	44.18 Lacs	2.81 Lacs
4. Total acreage under cultivation	108.95 Lacs ha.	7.35 Lacs ha.
5. Total cultivating household	57.85 Lacs	3.09 Lacs
6. Acreage per cultivating household	2.25 ha.	2.38 ha.

4. LOCAL RICE CULTIVATION TECHNIQUES

The area in the Shahabad district may be divided into three subareas, the up and slopy area of Bhabhua, the undulating area of some parts of Sasaram, and plain area, thus local cultivation techniques depending much upon these land conditions. In Shahabad, therefore, separate cultivation methods should be established on each type of land. At present, HYV are mainly introduced in the plain area. But most farmers in this area have not practiced the correct techniques for HYV. It is big farmers holding more than 20 acres who are capable of investing more money in fertilizers, machinery and equipment, irrigation facilities and others. The small farmers have neither capacity of investing more money, nor confidence of getting return of the investment.

The problems on local practices can be pointed out as follows:-

(1) SELECTION OF VARIETY: - This, of course, depends upon the land condition. At present nobody wants HYV to be designated as the recommended varieties by the authority because of their poorness in market price, quality and taste etc.

(2) CULTIVATION PRACTICE: - The HYV require only 2 to 2.5 inches of water in depth, but it is very difficult to maintain the depth of water without proper irrigation and drainage facilities for controlling water.

The time of transplanting, the density of plants, the depth of planting and the number of nursery plants per hill are also important. The farmers have much to learn about them.

(3) FERTILIZER APPLICATION: - It has been observed that due to the immediate effect of nitrogenous fertilizers most farmers apply only nitrogenous fertilizers in their fields. In order to get the more yield phosphatic and potassic fertilizers should be also applied.

(4) PLANT PROTECTION MEASURES:

1) There is no effective fungicides for plant diseases like virus disease and Bacterial Leaf Blight.

2) The farmers do not take up the plant protection measures from the very beginning of cultivation due to: - (i) high price of pesticides, and machinery

and equipment for plant protection (ii) lack of training on use of these pesticides and machinery and equipment.

It should be reported here that Shahabad farmers have been introducing High Yielding Varieties of wheat and getting the desired results without any difficulties as seen in paddy production.

II. FUNCTION AND OPERATION

In 1962, the Indo-Japanese Demonstration Farm was set up at Arrah for introducing Japanese techniques of paddy cultivation under Indian local conditions and demonstrating their effectiveness and usefulness to farmers in the area. Out of 35 acres of arable land of Sub-Divisional Agricultural Farm at Arrah, 10 acres were placed at the disposal of Japanese technicians for the purpose. The first Team of Japanese technicians stayed for five years from June 1962 to April 1967.

On arrival of four new Japanese experts in July 1968 according to the new Agreement signed in March 1968, the two units, namely sub-Divisional Agricultural Farm and the Indo-Japanese Agricultural Demonstration Farm were merged together, and renamed the Indo-Japanese Agricultural Extension Centre at Arrah. This was done with a view to maintaining uniformity of techniques in the entire 35 acres.

1. AIM OF ACTIVITIES

The aim of activities of the Centre is to popularise improved cultivation techniques for producing two tons as an average yield per acre which is supposed to be optimum.

(1) Activities at the main Centre:-

1) Analysing the farmers' problems and finding out their solutions.

2) Conducting varietal test on HYV of paddy and wheat, and also trials on planting distance, fertilizer application, improved agricultural machinery and traditional implements, etc.

3) Imparting technical training to Indian agricultural officers and farmers.

(2) Activities at the Sub-Centres:-

The six Sub-Centres in six villages, one each out of six different blocks have been set up since Kharif 1969 for the purpose of strengthening extension works. In each village 50 acres of land has been earmarked for the intensve agricultural programmes under the technical guidance of the Japanese experts. The sub-Centre in Suara village has been expanded since Kharif 1970 to the whole area of the village, the total area being 266 acres. Out of 50 acres in each village, 3 acres have been used as demonstration plot-cum-practical training site for local farmers, which area has been reduced to 2 acres since Kharif 1970.

For the use of the demonstration plots, fertilizers and pesticides are supplied free of cost. But other costs including those of seeds and agricultural machinery let out on hire are met by farmers. A set of agricultural machinery including power tillers, 4-wheel tractors, automatic power threshers, power mist dusters and ensilage cutters are

being let out on hire in the area of the Sub-Centers.

Main activities at these Sub-Centres are as follows:

1) Conducting demonstrations of improved agricultural practices

2) Imparting training to farmers

3) Letting out agricultural machinery on hire to the participating farmers

4) Observing the effect of adoption of improved agricultural techniques by farmers

2. ORGANIZATION

(1) Staff:

1) Japanese Experts:

(i)	Mr. C. Miyasaka	:	Chief Adviser-cum-Agronomist
(ii)	Mr. N. Chida	:	Agricultural Extension Expert
(iii)	Mr. M. Masuda	:	Agricultural Machinery Expert
(iv)	Mr. K. Ogasawara	:	Soil and Fertilizer Expert

The first three experts arrived at the Centre on July 3, 1968 and the fourth on March 31, 1969.

2) Indian counterparts to the Japanese experts:

(i)	Mr. Ishwari Prasad :	Special Deputy Director of Agriculture-cum-Special Officer, Shahabad, Arrah
(ii)	Mr. Braham Deo Sinha:	District Training Officer, Kisan Vidyapith, Arrah
(iii)	Mr. Malay Kumar Ghosh:	Assistant Agricultural Engineer, I.A.D.P. Workshop, Arrah
(iv)	Mr. Kanwar Lall Joneja :	Assistant Soil Chemist, Soil Testing Laboratory, Arrah

3) Indian Staff

Mr. Shukdeo Prasad Singh	:	Farm Manager-cum-Technical Assistant
Mr. Wilbur Norman Jones	:	Technical Assistant
Mr. Shree Prakash Tiwari	:	Technical Assistant
Mr. Sarad Kumar Sinha	:	Technical Assistant
Mr. Surya Nath Prasad	:	Technical Assistant
Mr. Naurangi Mahto	:	Farm Inspector
Mr. Lal Mohan Prasad	:	Accountant-cum-Storekeeper
Mr. Tarkeshwar Pandey	:	Farm Sardar
Mr. Bhusan Singh	:	Driver
Mr. Budhan Ram	:	Driver
Mr. Chandradip Mistry	:	Fitter
Mr. Uchit Lall Mehta	:	Assistant Fitter
Mr. Deo Lall Singh	:	Tractor Driver
Mr. Sheoyogi Singh	:	Tractor Driver

Mr. Akbar Khan	:	Power Tiller Operator
Mr. Jagnarayan Singh	:	- do -
Mr. Prakash Chandra Mishra	:	- do -
Mr. Gopal Prasad	:	- do -
Mr. Prabhu Ram	:	- do -
Mr. Ram Narayan Prasad	:	- do -
Mr. Prabhu Dayal Singh	:	- do -
Mr. Anant Prasad	:	- do -
Mr. Satyanarayan Prasad	:	Office peon
Mr. Md. Azad	:	Truck Cleaner
Mr. Bishwanath Prasad	:	Farm Chaukidar
Mr. Gopalji Singh	:	- do -
Mr. Bishwanath Ram	:	Cattle Attendant
Mr. Badri Musahar	:	Ploughman
Mr. Panna Lall	:	- do -
Mr. Sheo Kumar	:	- do -
Mr. Basudeo Singh	:	- do -
Mr. Jawahar Ram	:	- do -
Mr. Nimboo Lall	:	Sweeper

4) Indian Staff associated with the Sub-Centres:

Block	P.E.Q./B.D.O.	A.O.	S.M.S.	V.L.W.
Dehri block	Mr. R.S. Prasad	Mr. S.S. Roy	Mr. P.R. Dutta	Mr. S. Dwivedi
Bikramganj block	Mr. D.P. Srivastava	Mr. J.N. Misra	Mr. R. Mahto	-
Piro block	Mr. S.N. Sinha	Mr. H.P. Jaiswal	Mr. C. Singh	Mr. Deokrisna
Charpokhari block	Mr. B. Singh	Mr. P.K. Sinha	Mr. S.K. Sinha	Mr. C. Pandey
Udwantnagar block	Mr. B.D. Tripathi	Mr. P.B. Verma	Mr. S.P. Tiwari	Mr. R. Sahu
Koilwar block	Mr. G.P. Tiwari	Mr. U.S. Pandey	-	Mr. H.P. Singh

(2) Materials:

1) Buildings:

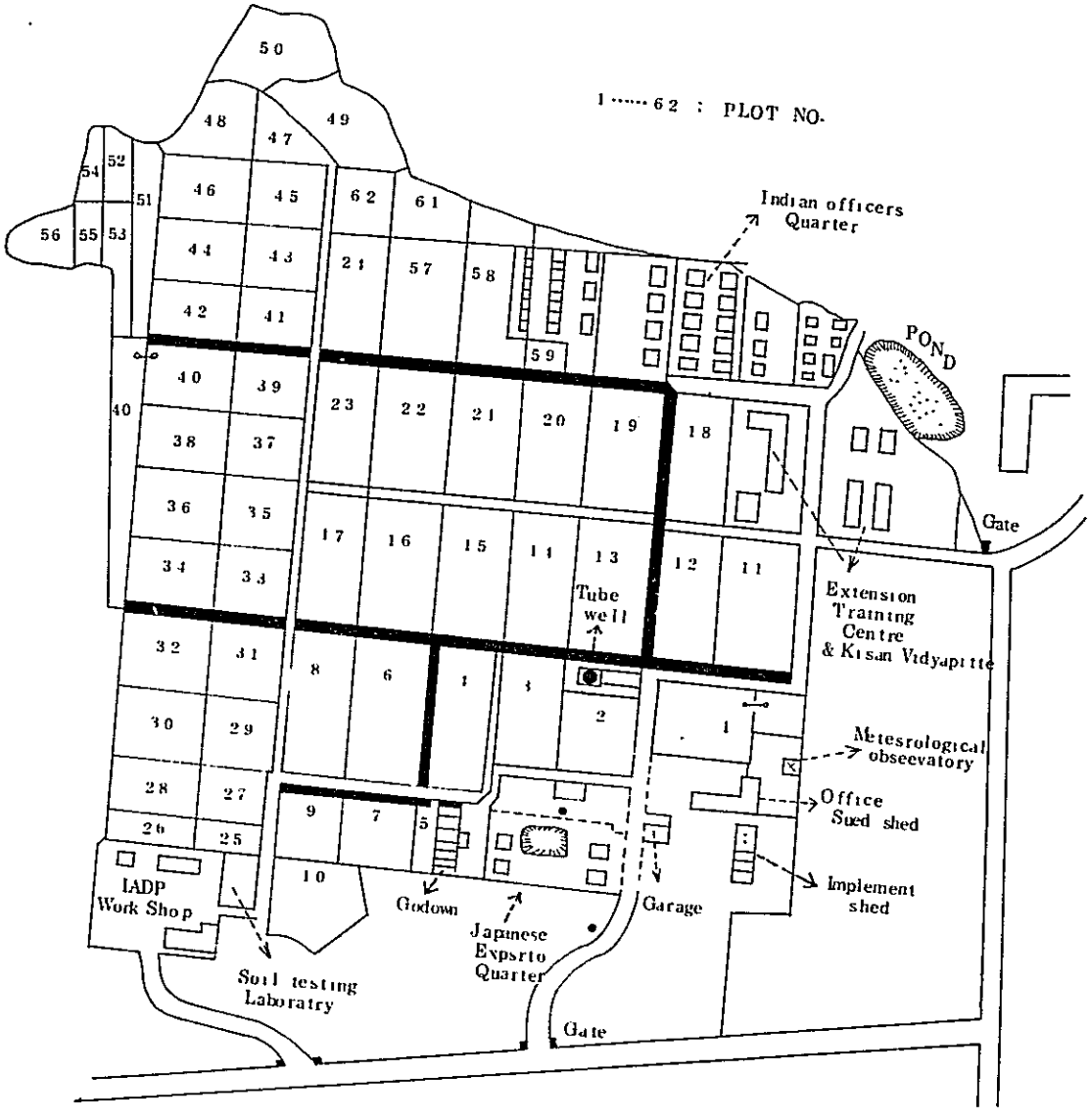
office and stores	:	379.07 m^2
implement shed	:	437.35
implement shed-cum-garage	:	163.88
four Japanese experts' quarters	:	466.56 (116.64 each)
cattle shed	:	135.30
tube well house (i)	:	7.29 (for drinking)
(ii)	:	54.44 (for irrigation)
Total	:	1,643.89

fenced area of four Japanese quarters : 1,559.92

2) Field

The field arrangement is shown below in Map I-2.

Map I-2 Field arrangement



Field area under cultivation	:	46.29 Acres
Orchards	:	7.37 "
Site for buildings and roads	:	13.61 "
		67.27 Acres

3) Machinery and equipment

S. No.	Name of Machineries/Equipments	Quantity received		
		1962 - 67	1968 - 70	Total
1.	4-Wheel Tractor 18/27 H.P.	1 set	8 sets	9 sets
2.	Power Tiller 10-13 H.P.	3 sets	11 sets	14 sets
3.	Garden Tractor 4-6 H.P.	2 sets	-	2 sets
4.	Automatic Paddy Threshers	3 sets	11 sets	14 sets
5.	Semi-Auto Paddy Threasher	1 set	-	1 set
6.	Paddle Threasher	1 set	1 set	2 sets
7.	Grain Dryers, Vertical	1 set	6 sets	7 sets
8.	Rice Huller	1 set	3 sets	4 sets
9.	Rice Polishing Machine	1 set	-	1 set
10.	Rice Huller cum Polisher	-	1 set	1 set
11.	Power Rice Transplanting Machine	-	1 set	1 set
12.	Power Harvester	-	1 set	1 set
13.	Winnowers-Manual	1 set	7 sets	8 sets
14.	Rope Making Machine	1 set	2 sets	3 sets
15.	Engine Gasoline 4-6 H.P.	1 set	-	1 set
16.	Engine Gasoline 3.5 - 4.5 H.P.	1 set	-	1 set
17.	Engine Kerosine 5-6 H.P.	1 set	-	1 set
18.	Engine Kerosine 3-5 H.P.	1 set	-	1 set
19.	Engine Diesel 5-7 H.P.	-	7 sets	7 sets
20.	Engine Diesel 4-5 H.P.	2 sets	11 sets	13 sets
21.	Engine Watercooled	-	1 set	1 set
22.	Vertical Pump 3.5 H.P.	2 sets	4 sets	6 sets
23.	Centrifugal Pump 3 H.P.	2 sets	-	2 sets
24.	Electrical Meter 1 H.P.	1 set	-	1 set
25.	Draft Animal Plow	10 sets	-	10 sets
26.	Draft Animal Harrow	10 sets	-	10 sets
27.	Draft Animal Rake	5 sets	-	5 sets
28.	Draft Animal Weeder	3 sets	-	3 sets
29.	Draft Animal Cultivator	4 sets	-	4 sets
30.	Rotary Weeders	30 pcs.	30 pcs.	60 pcs.
31.	Rear Car	1 pc.	3 pcs.	4 pcs.
32.	Push Car	6 pcs.	3 pcs.	9 pcs.
33.	Ensilage Cutter-Power	1 pc.	9 pcs.	10 pcs.
34.	Ensilage Cutter-Manual	1 pc.	1 pc.	2 pcs.
35.	Straw Softening Machine	1 pc.	-	1 pc.
36.	Sprinkler	1 set	-	1 set
37.	Reaper Manual	1 set	-	1 set
38.	Seed Drill-Manual	1 set	-	1 set
39.	Air Compressor 1/4 H.P.	-	1 set	1 set
40.	Welding Equipment	1 set	-	1 set
41.	Agricultural Tools	74 kinds	-	74 kinds
42.	Electric Drill	1 set	-	1 set
43.	Forging Tools	1 set	-	1 set
44.	Wood Working Tools	1 set	-	1 set
45.	Workshop Tools	-	1 set	1 set
46.	Refrigerator	1 set	-	1 set
47.	Room Cooler	1 set	-	1 set
48.	Jeep-Toyota	1 pc.	-	1 pc.
49.	Station Wagon-Toyota	1 pc.	1 pc.	2 pcs.

S. No.	Name of Machineries/Equipments	Quantity received		
		1962 - 67	1968 - 70	Total
50.	Truck (1.5 Tons capacity)	-	1 pc.	1 pc.
51.	Auto Bicycle	2 pcs.	-	2 pcs.
52.	Motor Scooter	1 pc.	-	1 pc.
53.	Bicycle	4 pcs.	2 pcs.	6 pcs.
54.	Printing Press	1 pc.	1 pc.	2 pcs.
55.	Copying Machine	-	1 pc.	1 pc.
56.	Typewriter - English	1 pc.	1 pc.	2 pcs.
57.	Calculating Machine	1 pc.	1 pc.	2 pcs.
58.	Abacus	-	2 pcs.	2 pcs.
59.	Camera-35 mm	1 pc.	1 pc.	2 pcs.
60.	Camera- 8 mm	1 pc.	-	1 pc.
61.	Slide Projector - 35 mm	1 set	1 set	2 sets
62.	Projector - 16 mm	1 set	-	1 set
63.	Projector - 8 mm	1 set	-	1 set
64.	Portable Generator	-	2 sets	2 sets
65.	Hand Microphone	1 pc.	1 pc.	2 pcs.
66.	Tape Recorder - Sony	2 sets	1 set	3 sets
67.	Dark Room Set	1 set	-	1 set
68.	Transformer	1 set	1 set	2 sets
69.	Recorded Films	6 vol.	14 vol.	20 vol.
70.	Tent House	1 set	-	1 set
71.	Steel Cabinet	1 pc.	-	1 pc.
72.	Rain Gauge	1 set	1 set	2 sets
73.	Stevension Screen	1 set	1 set	2 sets
74.	Max. & Min. Thermometer	-	2 pcs.	2 pcs.
75.	Sunshine Recorder	-	1 set	1 set
76.	Thermometer	-	2 pcs.	2 pcs.
77.	Hygrometer	-	2 pcs.	2 pcs.
78.	Thermograph	-	1 set	1 set
79.	Hygrograph	-	1 set	1 set
80.	Actinograph	-	1 set	1 set
81.	Anemograph	-	1 set	1 set
82.	Power Sprayer	4 sets	6 sets	10 sets
83.	Mist Duster	4 sets	7 sets	11 sets
84.	Sprayer-Manual 18 Litre Cap.	4 sets	15 sets	19 sets
85.	Breet Hand Duster	6 sets	9 sets	15 sets
86.	Granual Spreader	-	10 sets	10 sets
87.	Cynogas Pump	5 sets	-	5 sets
88.	Bird Scarers	5 sets	-	5 sets
89.	Shaker	-	1 set	1 set
90.	Rotary Vacuum Pump	-	1 set	1 set
91.	Electric Muffle Furnace	-	1 set	1 set
92.	Distillator	-	1 set	1 set
93.	Stamp Balance	-	1 set	1 set
94.	Bar Balance	-	1 set	1 set
95.	Table Balance	-	1 set	1 set
96.	Grain counter plate	-	2 sets	2 sets
97.	Chemical Balance	-	1 set	1 set
98.	PH Meter	-	1 set	1 set
99.	Portable PH Meter	-	1 set	1 set
100.	Grain Moisture Meter	-	1 set	1 set
101.	Wagnor's Pot	-	45 pcs.	45 pcs.

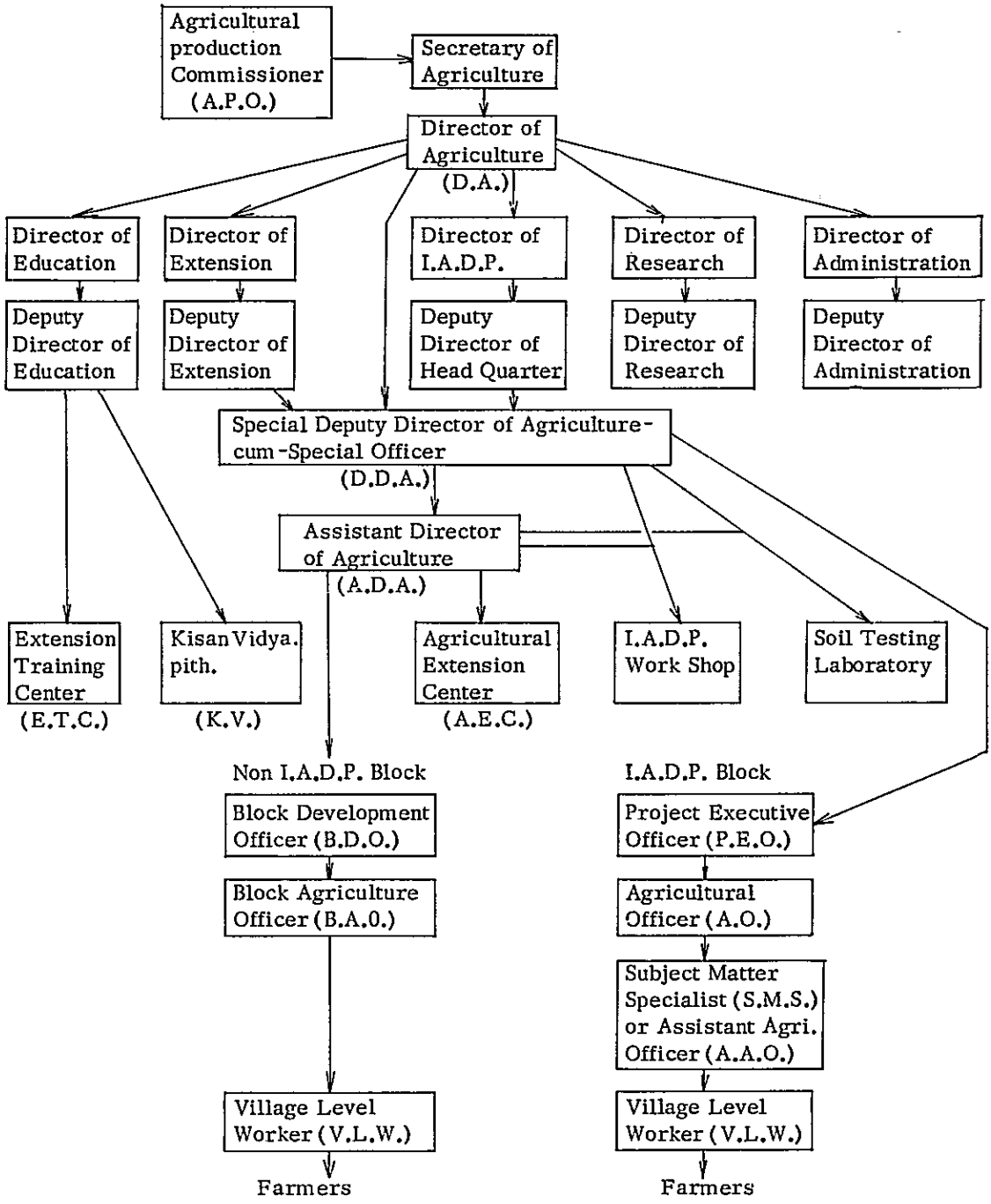
S. No.	Name of Machineries/Equipments	Quantity received		
		1962 - 67	1968 - 70	Total
102.	Photo Electric Colorimeter	-	1 set	1 set
103.	Flame Photometer	-	1 set	1 set
104.	Soil Seives	-	1 set	1 set
105.	Centrifuge	-	1 set	1 set
106.	Microscope	-	1 set	1 set
107.	Hydrometer	-	2 pcs.	2 pcs.
108.	Soil Tester	-	1 set	1 set
109.	Plant Tester	-	1 set	1 set
110.	Water Tester	-	1 set	1 set
111.	Portable Rodex Meter	-	1 set	1 set
112.	Litre-weight Determinator	-	2 sets	2 sets
113.	Soil Size Analyser	-	1 set	1 set
114.	Grain Divider	-	2 sets	2 sets
115.	Root System Sampler	-	1 set	1 set
116.	Evaporating Dish	-	1 set	1 set
117.	Water Bath	-	1 set	1 set

Remarks: These are all provided by the Government of Japan.

(3) Position of the Centre in the State Government

The Centre belongs to the office of Director of Agriculture. Its position is shown in Chart I-1.

Chart I-1. Position of the Centre



3. OPERATION

(1) Responsibility

Japanese Experts: The aim of the Agricultural Extension Centre at Arrah is to extend the improved agricultural techniques to the farmers for their getting higher yield. Trials are carried out at the main Centre and their results are demonstrated and extended to the farmers through Sub-Centres.

Mr. C. Miyasaka, Chief Advisor-cum-Agronomist is responsible for operating the Centre, conducting trials, imparting training to extension workers and farmers, arranging to make available agricultural machinery, etc. to the Sub-Centres, etc.

Mr. K. Ogasawara, Soil and Fertilizer Expert conducts trials and give necessary advice from time to time to the Soil Testing Laboratory.

Mr. N. Chida, Agricultural Extension Expert imparts training to extension workers and farmers, conducts demonstration at the Sub-Centres and survey on the effectiveness of the scheme.

Mr. M. Masuda, Agricultural Machinery Expert supervises the maintenance of agricultural machinery and implements and hiring system of agricultural machinery.

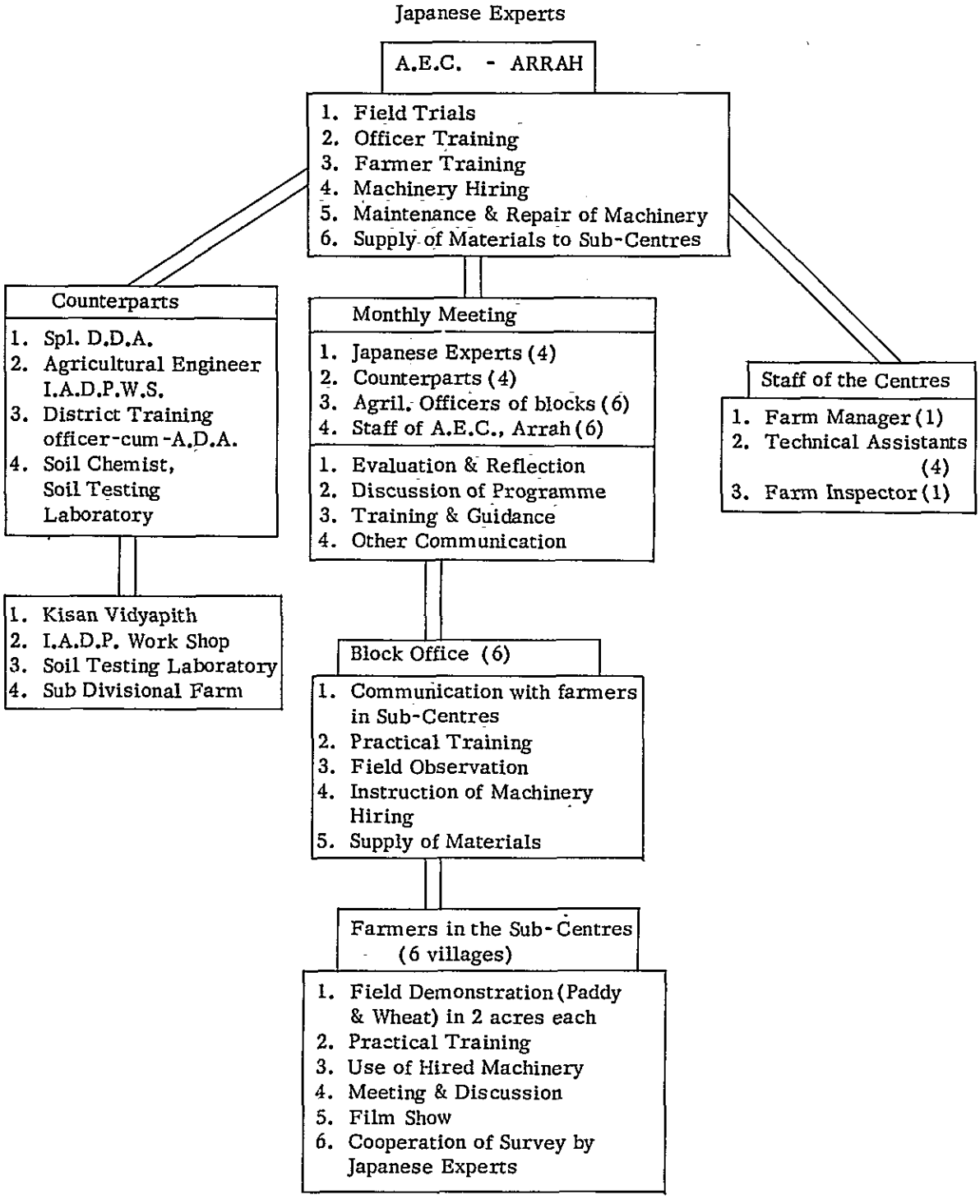
Indian Counterparts: The Japanese experts and the Indian counterparts consult from time to time with one another for the purpose of operating the Centre and the Sub-Centres smoothly.

Monthly Meeting: Once in a month, the Japanese experts, Indian counterpart staff of the Centre and block officers sit together at the Centre and review and discuss about their activities and future programmes.

Staff of A.E.C.: Farm Manager, Technical Assistants and other staff of the Centre assist the Japanese experts in carrying out their day to day works. Farm Manager looks after the farm works as well as general administration of the Centre. Out of 4 Technical Assistants who have been deputef from block officers, two assist Japanese experts in conducting observation of field trials, the rest being engaged in extension works at the six Sub-Centres.

These are illustrated below in Chart I-2.

Chart I-2. Operation of the Centre



(2) Budget

Particulars	1968 - 69	1969 - 70	1970 - 71
	Rs.	Rs.	Rs.
Pay of Staff	-	-	22,500
Contingency (Recurring)	20,500	25,000	51,500
Contingency (Non-Recurring)	4,000	107,060	130,000
Total	24,500	132,060	204,000

Remarks: The budget of Agricultural Extension Centre at Arrah was sanctioned as the independent scheme in the month of October, 1970. But the Budget allocation for the year 1970 - 71 was only for six months from October 1970 to March 1971.

III. ACTIVITIES AND RESULTS

The Centre is conducting various kinds of trials for evolving new cultivation techniques, analising and solving farmers' problems, and also training the concerned officers such as Agricultural Officers (A.O.), SMS and VLW.

At the same time, the Sub-Centres have been set up. These Sub-Centres are conducting demonstrations, training of farmers and hiring of agricultural machinery.

All activities of the Centre are closely connected with other organisation such as IADP workshop, Soil Testing Laboratory, Farmers Training Centre, etc.

1. AGRONOMIC ACTIVITIES AND RESULTS

After arriving here in India, the Japanese experts at first conducted the analysis on causes of low yield of paddy in the area and found that deep planting, ill-balanced application of fertilizers, use of degenerated varieties having low yield potentiality, inadequate plant protection measures and improper water management were causes of low yield. Problems of drainage during the rainy season and irrigation during the dry season are also acute ones to be solved.

In the light of these, first of all, trial on planting distance was conducted at the Centre (from Kharif-1968). The second was varietal test and then trial on application of fertilizers.

With regard to Bacterial Leaf Blight, a very serious disease of High Yielding Varieties of paddy, Sankel dust and Sankel wettable powder imported from Japan were tested in the Sub-Centres.

(1) Trial on planting distance (Kharif paddy)

Number of hills per square meter was found very few in local cultivation practices 50 per cent in case of HYV and 60 per cent in case of improved varieties less than recommended number as shown below in table I-5. The recommendation of the Centre is that the number should be 44.4 in case of HYV and 33.3 in case of improved varieties.

Table I-5. Plant population in the farmers fields in the area

	Max. No. of hills/sqm.	Min. No. of hills/sqm.	Average No. of hills/sqm.	No. of samples analysed
High Yielding Varieties	30	15	21 $\pm$ 5.8	15
Improved Varieties	22	15	19 $\pm$ 5.8	12
Other local varieties	30	13	20 $\pm$ 3.6	35

1) Trial method

Year	Variety	Plot area	Planting distance	Date of sowing	Date of trans-planting
1968	IR-8 (H) Malinja Malinja (I) Masuri (I) T-141 (I)	total number of plots - 12 no replication 49 m^2 each	A: -30 x 15 cm B: -20 x 15 cm C: -15 x 15 cm	June 28 July 4 June 22 June 28	July 27
1969	IR-8 (H) Jaya (H) Padma (H) Malinja (I) T-141 (I)	total number of plots - 15 no replication 49 m^2 each	- do -	June 28 June 26 June 26 June 28 June 28	July 30
			**********		
1970	IR-8 (H) Malinja (I)	total number of plots - 6 1300 m^2 each	the same trial at the Sub-Centres with planting distance A: local trans-planting (ramdom) B: line trans-planting (15cmx15cm) C: random trans-planting (but number of hills was the same as that of B above)		July 15 July 16

Remarks: (H) High Yielding Variety
(I) Improved Variety

Fertilizer application (per acre)

		N	P_2O_5	K_2O
HYV	nursery bed	20 kg	10 kg	10 kg
	main field	40 kg	25 kg	20 kg
Improved	nursery bed	10 kg	6 kg	10 kg
Variety	main field	25 kg	20 kg	20 kg

2) Observation

i	at the time of transplanting	- maximum height of hills & number of tillers -
ii	20 days after transplanting	(10 plants earmarked for the
iii	40 days after transplanting	purpose)
iv	at the maximum tillering stage (1968 only)	
v	at the heading stage (eye estimation)	
vi	investigation of uprooting samples: At the harvesting time, 10 plant samples were being uprooted for analysing the yield component factors.	

3) Summary of observation of paddy growth (Kharif 1968)

Item	Unit.	IR - 8			Malinja			Masuri			T - 141		
		A	B	C	A	B	C	A	B	C	A	B	C
at the time of transplanting													
height of nursery plant	cm	26.4		30 days in	40.6		23 days in	30.1		36 days in	32.9		38 days in
No. of tillers	No.	1.4		nursery	1.6		nursery	1.5		nursery	1.6		nursery
20 days after transplanting													
height	cm	60.7	55.2	53.2	53.4	52.8	50.1	63.1	59.5	63.4	57.8	62.4	58.8
tillers.	No.	22.0	15.3	13.9	19.3	16.1	13.2	19.1	14.9	14.3	19.7	16.5	13.4
40 days after transplanting													
height	cm	89.0	77.0	75.6	80.9	79.0	83.0	104.0	90.0	89.0	92.0	94.0	85.0
tillers	No.	19.2	13.6	12.9	16.7	15.3	11.8	17.1	11.6	10.5	11.7	10.5	7.9
at the maximum tillering time	date	23/8	20/8	19/8	3/9	30/8	28/8	27/8	25/8	23/8	5/9	31/8	28/8
tillers	No.	25.0	16.3	14.4	21.1	17.8	14.3	21.0	15.8	15.5	21.1	17.8	16.6
heading stage (40 - 50%)	date	16/9	11/9	9/9	20/10	18/10	17/10	16/10	14/10	14/10	30/10	28/10	27/10
harvesting	date	2/11	28/10	27/10	26/11	27/11	25/11	19/11	17/11	17/11	3/12 (estimation)		
duration (from the time of transplanting to the maximum tillering)	days	27	24	23	38	34	32	31	29	27	39	35	32
duration (from the maximum tillering time to heading)	days	25	23	21	47	49	50	50	50	52	55	58	60
duration (from the heading time to harvesting)	days	47	47	48	37	40	39	34	34	34	34	36	37
total duration	days	129	124	122	145	146	144	151	149	149	166	167	167
plant disease condition		Bacterial Leaf Blight									Serious damage of Rats.		
		-	+	+	-	-	-	-	-	-			

Remarks: A... 30 x 15 cm B... 20 x 15 cm C... 15 x 15 cm

4) Results
(Kharif 1968)

variety	planting distance	culm length	panicle length	number of tillers max. tillers per hill	number of tillers effective tillers per sqm.	number of spikelets per panicle	number of spikelets per sqm.
	cm	cm	cm	No.	No.	No.	100 No.
IR-8	30 x 15	107.2	23.0	24	382	80	306
	20 x 15	104.0	24.0	16	410	97	324
	15 x 15	100.4	22.9	13	426	76	324
Malinja	30 x 15	120.8	19.8	17	315	91	289
	20 x 15	120.1	18.6	13	346	64	291
	15 x 15	124.2	20.3	11	395	62	245
Masuri	30 x 15	126.4	21.1	13	233	95	221
	20 x 15	107.7	18.3	10	253	79	200
	15 x 15	129.4	20.4	9	306	68	208

variety	planting distance	percentage of matured grains	weight of 1000 grains	yield of grain per sqm. weight of total grains	yield of grain per sqm. weight of perfect grains	yield of perfect grains per acre.
	cm	%	grams	grams	grams	in 100 kg
IR-8	30 x 15	77.7	26.0	702	618	25.0
	20 x 15	80.3	25.4	732	660	26.7
	15 x 15	84.2	25.0	711	679	27.5
Masuri	30 x 15	95.8	24.2	533	511	22.3
	20 x 15	97.1	23.0	458	445	18.0
	15 x 15	95.4	22.4	468	446	18.0

From the above, the followings were observed.

(a) Number of effective tillers per square meter was found maximum in case of 15 cm x 15 cm.

(b) Number of spikelets per panicle was almost the same among three different planting distances.

(c) Percentage of matured grains of IR-8 and Malinja was higher in case of 20 x 15 cm and 15 x 15 cm than in case of 30 x 15 cm, but that of Masuri was almost the same in all distances.

(d) Weight of 1000 grains was in the same tendency that the thinner in planting distance, the heavier in weight.

(e) As regards yield per square meter: -

a) 15 cm x 15 cm brought the highest yield, being followed by 20 cm x 15 cm and 30 cm x 15 cm in case of IR-8.

b) But in case of Indica varieties like Malinja & Masuri, the result was just the opposite.

c) In case of Malinja, 20 cm x 15 cm was found best, followed by 30 cm x 15 cm. 15 cm x 15 cm was poor.

d) In case of Masuri, the highest yield was obtained in 30 cm x 15 cm, followed by 20 cm x 15 cm and 15 cm x 15 cm both of which brought almost the equal yield.

5) Few comments on planting distance (Kharif 1968)

(a) The time of maximum tillering stage: It was found earlier in case of dense planting on all the varieties.

(b) The time of heading stage: Duration of IR-8 from the maximum tillering stage to heading was found longer in case of dense planting whereas that of other improved varieties was just the opposite.

(c) The time of harvesting: There was not much difference among all types of varieties.

(d) The total crop duration: Total crop duration of IR-8 was found shortest in case of dense planting. In case of other improved varieties, the difference was quite insignificant. It can be said that there was not a significant difference in crop duration by planting distances in case of improved varieties (Indica), whereas it was significant in case of IR-8 (HYV).

6) Summary of observation of paddy growth (Kharif 1969)

Padma, a new variety, was introduced Kharif 1969 in the State of Bihar for the first time. Just two weeks after transplanting leaves of Padma started yellowing, and yellowing spreaded to other high yielding varieties like Jaya and IR-8 later on. This yellowing of leaves was more serious in case of early planted paddy. The yellowing was diagnosed as Bacterial Leaf Blight. In this connection, Dr. S. Wakimoto, the National Agricultural Research Institute, Tokyo, visited Bihar for a week from November 4, 1969. According to his finding, it was not only Bacterial Leaf Blight but there must have been a primary infection of virus, or some physiological diseases which caused the secondary infection of Bacterial Leaf Blight of Kresek type.

As a result of such diseases, there was no heading in case of Padma. Even if there was some, it was quite abnormal. In case of IR-8 and Jaya, the infection was about ten days later whereas in case of varieties like T-141 and Malinja it was not infected before heading. These diseases, by and large, very adversely affected the per acre yield of these improved varieties.

In this experience it has been observed that these High Yielding Varieties are very susceptible to Bacterial Leaf Blight, and the damage is more serious in

case of dense planting.

Accordingly further observation was impossible in Kharif 1969.

7) Result (Kharif 1969)

variety	planting distance	culm length	panicle length	number of tillers		number of spikelets	
				max. tillers per hill	effective tillers per sq.m	per panicle	per sq.m.
	cm	cm	cm	No.	No.	No.	No.
IR-8	30 x 15	65.6	20.8	15	162	101	164
	20 x 15	64.2	20.7	16	140	101	141
	15 x 15	61.5	19.1	13	195	85	166
Jaya	30 x 15	72.6	21.3	12	151	116	175
	20 x 15	71.3	22.1	12	163	112	183
	15 x 15	66.2	19.5	11	275	87	239
Malinja	30 x 15	113.0	23.0	13	142	138	196
	20 x 15	104.9	22.3	10	170	122	207
	15 x 15	110.3	22.5	8	151	117	177
T-141	30 x 15	139.9	22.2	12	118	143	169
	20 x 15	132.5	22.3	9	103	148	152
	15 x 15	137.7	20.5	10	120	134	161

variety	planting distance	percentage of matured grain	weight of 1000 grains	yield of grains/sq.m		yield of perfect grains per acre
				weight of total grains	weight of perfect grains	
	cm	%	grm	grm	grm	in 100 Kg.
IR-8	30 x 15	67.4	25.3	336	279	11.3
	20 x 15	77.6	24.5	319	267	10.8
	15 x 15	64.7	24.6	321	267	10.8
Jaya	30 x 15	71.5	26.2	400	329	13.3
	20 x 15	65.8	25.2	358	306	12.4
	15 x 15	61.5	24.7	440	361	14.6
Malinja	30 x 15	73.1	20.9	351	301	12.2
	20 x 15	72.1	21.9	400	329	13.3
	15 x 15	77.3	22.6	351	306	12.4
T-141	30 x 15	84.7	18.6	351	264	10.7
	20 x 15	75.3	17.6	311	205	8.3
	15 x 15	78.7	17.6	388	225	9.1

From the above, the followings were observed.

(a) Padma was not included in this trial because of its serious damage by BLB at a very early young stage. Other varieties were also attacked by BLB. Accordingly yields were very poor in this trial.

(b) Bacterial Leaf Blight in the first case attacked Padma and spread over to Jaya and IR-8. Malinja and T-141 were slightly damaged. There was no heading in case of Padma.

8) Trial on planting distance in Kharif 1970 were conducted in the sub-centres as mentioned later.

(2) Instructions to the State Government officers on cropping schedule of Sub-Centres:

Instructions were issued to the State Government officers on cropping schedule of each season from Kharif 1969 onwards.

Contents of instructions for the last three seasons are given below:

1) Schedule of growing HYV of paddy in Kharif 1970

A. NURSERY BED

(a)	Varieties	:	IR-8 and Malinja
(b)	Quantity of seeds	:	15 Kgs. per acre
(c)	Area of nursery bed to be sown for transplanting in 1 acre	:	0.1 acre
(d)	Seed selection	:	Specific gravity selection by using salt water
	(specific gravity)	:	1.05 to 1.10 This should be checked with fresh egg.
(e)	Seed treatment	:	To prevent disease-bearing-seeds, it is essential to soak the seeds in water with 2 ozs of Areton or Ceresan for 4-5 hours. Such soaked seeds should be dried in the shade for 12 hours.
(f)	The time of sowing to nursery bed	:	June 10 - 25
(g)	Preparation of nursery bed	:	The nursery bed should be 4 feet in width and raised 3 inches high. 1 foot drainage channel should be prepared between two beds.

(h) Manuring in nursery bed for HYV :

	base	top dressing
A/S...	50 Kgs/acre	50 Kgs/acre (or Urea 25)
S.S.P.	50	
M.P.	20	

for improved variety : A/S...40 40 (or Urea 20)
S.S.P. 40
M/P 20
Top dressing should be done about 3 weeks after sowing

(i) Plant protection measures : When the nursery plants are 3 weeks old, spray 45 C.C. of Endrin dissolved with water (by low volume sprayer)

(j) Irrigation whenever necessary

B. FIELD PREPARATION FOR TRANSPLANTING (1 acre)

(a) Apply 5,600 Kgs. to 7,500 Kgs of F.Y.M. per acre, if available, about 3 weeks before transplanting, and plough the field with soil turing plough.

(b) Plough again one week before transplanting

(c) Fertilizer application
For HYV the recommended amount of fertilizers is 40 Kgs. of N, 25 Kgs. of P205 and 20 Kgs of K20. For improved varieties the recommended amount is 20 Kgs of N, 20 Kgs of P205 and 15 Kgs of K20. Accordingly, the amount in terms of A/S, S.S.P. and M/P is as follows:

Name of fertilizer		For HYV	For improved varieties
a)	A/S	200 Kgs	100 Kgs
b)	S.S.P.	150 Kgs	130 Kgs
c)	M/P	40 Kgs	30 Kgs

A/S should be applied divisionally three times as follows:

In case of HYV
1. Base: 120 Kgs at the puddling time
2. 1st top dressing: 40 Kgs. 35 days after transplanting
3. 2nd top dressing: 40 Kgs. 20 days after 1st top dressing

In case of improved varieties
1. Base: 60 Kgs. at the puddling time
2. 1st top dressing: 20 Kgs. 35 days after transplanting
3. 2nd top dressing: 20 Kgs. 30 days after 1st top dressing

(d) Transplanting Transplant 3-4 nursery plants per hill straight and not deeper than an inch when the puddled soils settled down

(e) Planting distance 6" x 6" for HYV
10" x 6" for improved varieties

(f) Plant protection measures:-

a) Apply Aldrin 5% dust @ 10 Kgs per acre at the time of puddling.

b) Spray the following chemicals at an interval of 2 to 3 weeks.

1st Spray	:	Paramar 100 C.C. Dithane-Z 78 1 Kg Urea 5 Kgs.	In 40-50 l of water
2nd Spray	:	Paramar 100 C.C. Aretan 250 grm Urea 5 Kgs.	In 40-50 l of water
3rd Spray	:	- do -	- do -

C. OBSERVATION

One each should be selected among all the three plots A, B, and C for general observation and 10 plots each in total should be earmarked for this purpose. Observation should be done at the stages as stated below.

(a) Maximum tillering stage
(b) Botty stage (Panicle primordial stage)
(c) Heading stage (50% of each plot)
(d) Harvesting
(e) Incidence of pests and diseases (Every week)

2) Schedule of growing HYV of Wheat in Rabi 1970-71

(a) Variety : RR 21

(b) Quantity of seeds : 40 Kgs per acre

(c) Land preparation : Plough the field twice by rotary power tiller. After ploughing land should be levelled by henga (Levelling plank)

(d) Soil treatment : If the termite or Cut-Worm is apprehended, 10 Kgs of 10% BHC or 5% Aldrin per acre should be spreaded just before the last ploughing. This will prevent termite and cut-worm attack.

(e) Fertilizer application : The following fertilizer application is recommended:

N	40 Kgs/acre	A/S	200 Kgs/acre
P205	25	SSP	150
K20	20	M/P	40

Half the nitrogenous fertilizers and all phosphatic and potassic fertilizers should be applied at the time of sowing, just before the final land preparation. The another half of Nitrogen should be equally divided

into two times and applied as top dressing at the time of the first and second irrigation.

(f) Sowing : Sow seeds in a depth of 4-6 cm in the soil and in a width of 25 cm between rows. This will ensure the uniform germination.

(g) Irrigation : Four time irrigation is necessary to get high yield of wheat. The first irrigation is at the "Crown Root Initiation" stage (between the third and the fourth week after sowing) the second, third and fourth should be done at the time of tillering, flowering and dough stage respectively.

3) Schedule of growing HYV of paddy in Summer 1971

A. NURSERY BED

(a) Varieties : Padma and BC-5
(b) Quantity of seeds : 15 Kgs per acre
(c) Area of nursery bed to be sown for transplanting in an acre : 0.1 acre
(d) Seed selection : Specific gravity selection by using salt water.
(Specific gravity) : 1.05 to 1.10
This should be checked with fresh egg.
(e) Seed treatment : Prophylactic measure against disease-bearing-seeds is essential. The seeds should be soaked for 4-5 hours in 50L. of water with 2 ozs of Areton or Ceresan and then dried in the shade for 12 hours after treatment.
(f) The time of sowing to nursery bed : March 10 - 15
(g) Preparation of nursery bed : The nursery bed should be 4 feet wide and raised 3 inches high. One inch drainage channel should be prepared between two beds.
(h) Manuring in nursery bed
base : A/S 50 Kgs/acre
S.S.P. 50
N/P 20
compost 2 tons
top dressing : A/S 50 (or Urea 25)
Top dressing should be applied 3 weeks after sowing.

(i) Plant protection measures : When nursery plants are 3 weeks old, spray 45 C.C. of Endrin dissolved with water (by low volume sprayer)

(j) Irrigation whenever necessary.

B. FIELD PREPARATION FOR TRANSPLANTING (1 acre)

(a) Apply 5,600 Kgs to 7,500 Kgs. F.Y.M. per acre, if available, 3 weeks before transplnating, and plough the field with soil turning plough.

(b) Plough again one week before transplanting. Apply BHC 6% dust @ 10 Kgs.per acre in soil before puddling.

(c) Fertilizer application

The recommended amount of fertilizers is 40 Kgs. of N, 25 Kgs of P205 and 20 Kgs of K20 per acre. Fertilizers should be applied as follows:

a) At the time of puddling:

N in terms of A/S	120 Kgs
In case of Urea	60 Kgs
P205 in terms of SSP	160 Kgs
K20 in terms of M/P	40 Kgs

b) The second application of fertilizers should be done 35 days after transplanting with the amount of A/S 80 Kgs. or Urea 40 Kgs.

(d) Transplanting — Transplant 4-5 nursery plants per hill straight and not deeper than an inch when the puddled soils settled down.

(e) Planting distance — 6" x 6"

(f) Spray pesticides twice after transplanting as follows:

Areton	500 grms
plus, Paramar (50%)	100 C.C.
and Urea	3 Kgs. (6%)

in 50-60 litres of water.

1st Spray: 3 weeks after transplanting

2nd Spray: 2 weeks after 1st spraying

(g) Harvesting — 30 days after full flowering

(3) Results obtained at the demonstration plots of the Sub-Centres

1) Cropping schedule (Kharif 1969)

Sub-Centre	Date of sowing	Date of trans-planting	Date of heading	Date of maturing (harvesting)	Crop duration			
					Nursery	Trans-planting	Heading-heading	harvesting	Total
Suara	21/6	14-18/7	11-14/9	1-5/11	23-27	58-59	51-52	131-136
Durgadih	22/6	16-19/7	7-9/9	1-3/11	24-27	52-53	55-56	131-133
Hasuadih	24/6	19-21/7	8-10/9	6-8/11	25-27	50-51	57-59	132-137
Garhani	23/6	16-19/7	8-9/9	5-6/11	23-26	51-54	58	132-138
Piania	26/6	31/7-2/8	15-16/9	13-14/11	35-37	45-46	59	139-142
Kulharia	26/6	19-24/7	9-11/9	6-8/11	23-28	49-52	58	130-138

Remarks: 1. There was severe attack of BLB in the demonstration plots, and Sankel dust and Sankel W.P., special pesticides imported from Japan, were tested, but the result was not so clearly identified.

2. Crop duration: - The crop was left in the field for a long time after ripening because of bad weather.

2) Analysis of factors of yield (Kharif 1969)

Variety: IR-8

Sub-Centre	plot No.	culm length	panicle length	weight of panicle	No. of hills per sq.m.	No. of panicle per sq. m.	total number of grains per sq.m.
		cm	cm	gram	No.	No.	100 No.
Suara	a	88.6	23.7	2.01	25.3	261	248
	b	81.7	24.4	1.82	37.8	325	263
	c	-	-	-	-	-	-
	Av.	85.2	23.4	1.92	31.6	293	256
Hasuadih	a	72.3	24.7	1.58	23.7	235	242
	b	68.9	25.8	1.05	25.8	319	287
	c	72.7	25.2	1.83	28.7	290	336
	Av.	71.3	25.2	1.49	29.4	282	287
Garhani	a	65.3	24.0	1.93	22.9	183	199
	b	65.6	22.2	0.96	33.2	305	253
	c	70.0	22.1	1.60	25.2	257	280
	Av.	67.3	26.1	1.50	27.1	248	244
Piania	a	67.9	23.0	2.51	28.7	227	328
	b	77.0	23.3	1.99	39.2	318	363
	c	75.4	21.8	2.31	30.9	253	316
	Av.	73.4	22.7	2.27	32.9	266	339
Kulharia	a	48.7	23.1	1.46	25.9	282	299
	b	50.3	22.9	1.22	31.9	201	155
	c	53.6	23.9	1.16	26.1	311	299
	Av.	50.9	23.3	1.28	28.0	265	251
Average	a	68.1	23.7	1.90	25.3	238	265
	b	68.7	23.7	1.41	35.6	244	264
	c	67.9	23.3	1.73	27.7	278	283
Total	Av.	68.2	23.6	1.68	29.3	253	271

Sub Center	plot No.	matured grain per sq.m 100 No.	percentage of matured grains %	weight of 1000 grains gram	theoretical yield per sq.m. gram	theoretical yield per acre Kgs.
1	2	3	4	5	6	7
Saura	a	230	92.6	20.1	463	1874
	b	230	87.4	21.0	484	1959
	c	-	-	-	-	-
	Av.	230	89.8	20.6	474	1918
Hasuadih	a	159	65.8	19.0	303	1226
	b	152	53.0	18.7	284	1149
	c	249	74.0	18.4	458	1853
	Av.	187	64.7	18.7	350	1416

1	2	3	4	5	6	7
Garhani	a	159	79.6	18.6	297	1202
	b	133	52.7	18.5	247	1000
	c	172	61.4	21.2	366	1481
	Av.	155	63.0	19.4	302	1218
Piania	a	242	71.6	19.5	472	1910
	b	255	70.4	21.0	536	2167
	c	253	80.1	20.3	514	2080
	Av.	250	72.9	20.3	508	2056
Kulharia	a	153	51.1	21.0	322	1303
	b	67	43.6	19.3	131	530
	c	151	50.5	18.8	283	1145
	Av.	124	50.5	19.7	244	987
Average	a	189	71.0	19.7	372	1505
	b	168	63.5	20.1	338	1364
	c	206	72.9	19.6	406	1639
	Av.	188	69.1	19.8	372	1505

Remarks: The figures of c plot in Suara and a, b and c plots in Durgadih were not available.

a: Random transplanting (local method)

b: Line transplanting (15 x 15 cm ... 6" x 6")

c: Random transplanting (but No. of hills was the same as that of the above b)

3) Cropping schedule (Summer 1970)

Sub-Centre	Date of sowing	Date of transplanting	Date of heading	Date of harvesting	Yield of test harvest (in Kg.)
Suara	14/3	13/4	16-18/6	18/7	a 1910 b 2340 c 1966 Av. 2072
Hasuadih	23/3	27/4	28-30/6	30/7	a 1368 b 1160 c 728 Av. 1085
Garhani	16/3	18/4	20-22/6	23/7	a 1640 b 1580 c 1671 Av. 1630
Kulharia	17/3	22/4	25-26/6	26/7	a 1268 b 1235 c 1054 Av. 1186
Average	14-23/3	13-27/4	16-30/6	18-30/7	a 1547 b 1579 c 1355 Av. 1493

Remarks:

a) Random transplanting (local method)

b) Line transplanting (15 x 15 cm)

c) Random transplanting (but No. of hills was the same as that of b above)

4) Analysis of factors of yield (Summer 1970)

Variety: TN-1

Sub-Centre	plot No.	culm length cm	panicle length cm	No. of hills per sq.m. No.	No. of panicle per sq.m. No.	total no. of grains per sq. m. 100 No.	No. of matured grains per sq.m. 100 No.	percentage of matured grains %	weight of 1,000 grains grm	theoretical yield per sq.m. grm.	theoretical yield per acre Kg.	test harvest yield per acre Kg.
Suara	a	65.6	21.2	29.0	592	491	319	65.5	24.5	787	3185	1910
	b	62.9	21.6	31.9	638	549	402	73.7	23.8	957	3873	2340
	c	59.0	21.1	17.6	324	253	198	77.5	23.4	460	1861	1966
	Av.	62.5	21.3	26.2	514	421	303	71.9	23.9	729	2950	2072
Hasuadih	a	58.6	21.4	19.3	270	230	184	80.2	23.2	427	1728	1368
	b	58.0	20.3	28.2	389	288	226	78.3	23.0	518	2096	1160
	c	56.9	21.1	20.0	244	200	163	80.8	24.2	393	1590	728
	Av.	57.8	21.0	22.5	299	242	192	79.8	23.5	449	1817	1085
Garhani	a	57.7	20.1	16.9	291	227	166	92.8	21.0	343	1388	1640
	b	53.6	18.5	28.4	608	377	267	71.9	22.2	602	2436	1580
	c	62.1	20.2	22.4	685	439	350	79.5	22.7	795	3217	1671
	Av.	57.8	19.6	22.6	581	389	290	75.4	22.1	645	2610	1630
Kulharia	a	50.9	20.2	28.7	218	166	116	69.5	22.5	260	1052	1268
	b	57.8	22.5	29.2	356	342	246	71.5	22.1	538	2177	1235
	c	55.6	19.3	30.1	391	239	172	71.0	22.0	376	1522	1054
	Av.	54.8	20.7	29.3	319	249	176	71.0	22.2	390	1578	1186
Average	a	58.2	20.7	23.5	343	278	199	91.6	22.9	456	1845	1547
	b	58.1	26.9	29.4	498	398	294	93.9	22.5	662	2679	1579
	c	58.4	20.4	22.5	411	292	230	98.8	23.0	530	2145	1355
	Av.	58.2	22.4	24.9	413	314	235	74.8	22.9	537	2173	1493

5) Few comments on crop of Summer 1970

It is the production target set by the Centre to get 2 tons of yield per acre. As per theoretical analysis, this has been achieved in case of Surara, Hasuadih, Kulharia (b plot only) and Garhani (b & c plots). According to test harvest, however, this was achieved only in Suara (a plot). This difference between the two results may be because of sample bias.

So far as theoretical analysis of yield is concerned, there is a cross co-relation between number of panicles per square meter and total number of grains. Again, there is co-relation between total number of grains and total number of matured grains. Supposing that other factors remain constant, it is the total number of panicles that ultimately determine the yield.

6) Yield of wheat in Rabi 1969-70

Demonstrations were conducted on wheat (variety of S-227) in the Sub-Centres. Yield was as follows according to test harvest.

Sub-Centre	yield per acre (in quintal)		
	Demonstration plot	General plot (other than demonstration plot)	Remarks
1. Suara (Dehri)	11.30	5.7	General plots also include local varieties
2. Durgadih (Bikramganj)	9.30	11.0	
3. Hasuadih (piro)	6.50	6.6	
4. Garhani (Charpokhari)	11.20	7.8	
5. Piania (Udwantnagar)	11.40	-	
6. Kulharia (Koilwar)	10.20	5.6	
Average	10.00	7.3	

7) Summary of observation (Kharif 1970)
Variety: IR-8

Sub-Centre	Date of trans-planting	Date of observation		Height of hills in cm			No. of tillers		
				A	B	C	A	B	C
Suara	19.7.70	1.	8.8.70	54.8	53.3	53.2	12.4	8.1	11.7
		2.	28.8.70	71.9	70.2	71.2	16.1	11.6	16.0
		3.	17.9.70	104.3	102.1	102.3	16.6	13.6	15.4
Durgadih	23.7.70	1.	10.8.70	45.5	46.6	49.8	8.7	8.2	10.2
		2.	31.8.70	57.5	65.0	63.9	13.4	12.8	16.9
		3.	20.9.70	58.1	64.6	64.9	14.5	13.6	18.5
Hasuadih	4.8.70	1.	21.8.70	39.7	46.8	47.7	8.0	8.1	12.2
		2.	11.9.70	68.1	70.9	71.6	13.9	16.0	14.7
		3.	30.9.70	84.0	96.3	89.4	11.9	14.3	13.0
Garhani	18.7.70	1.	12.8.70	44.3^	42.5	43.8	9.0	9.7	10.4
		2.	31.8.70	62.8	58.5	66.3	18.9	14.2	18.3
		3.	20.9.70	79.1	75.2	85.6	22.3	15.2	23.2
Kasap	27.7.70	1.	18.8.70	65.0	47.5	46.2	13.8	7.3	5.7
		2.	7.9.70	69.8	65.6	64.7	14.4	11.5	13.8
		3.	23.9.70	89.7	77.7	79.6	14.3	11.5	13.4
Kulharia	26.7.70	1.	14.8.70	49.8	48.0	47.3	8.9	11.0	11.5
		2.	3.9.70	65.5	62.5	63.7	19.8	19.5	19.2
		3.	24.9.70	80.3	78.9	80.5	17.4	18.2	20.5
A.E.C. Arrah	15.7.70	1.	7.8.70	49.2	58.6	47.4	11.7	14.1	11.4
		2.	26.8.70	60.4	79.6	64.2	13.2	12.0	13.4
		3.	15.9.70	77.7	89.3	76.6	10.6	9.5	10.6

Variety: MALINJA

Suara	18.7.70	1.	8.8.70	58.9	61.4	61.5	10.9	12.7	11.5
		2.	28.8.70	63.6	82.8	83.5	17.3	19.2	18.4
		3.	17.9.70	140.4	150.9	140.9	17.7	19.5	18.8
Durgadih	22.7.70	1.	10.8.70	53.1	53.7	57.4	8.2	8.9	11.2
		2.	31.8.70	75.4	73.7	86.2	14.1	15.2	15.5
		3.	20.9.70	77.2	75.4	87.9	17.5	18.3	18.8
Hasuadih	30.7.70	1.	21.8.70	62.6	64.0	66.1	9.5	13.7	15.2
		2.	11.9.70	97.8	94.9	115.0	16.6	13.8	14.7
		3.	30.9.70	133.5	p28.4	161.2	11.2	10.0	12.0
Garhani	24.7.70	1.	12.8.70	51.5	51.7	53.4	7.2	9.2	7.0
		2.	31.8.70	67.4	74.2	72.6	16.2	21.2	15.4
		3.	20.9.70	101.9	110.5	101.2	17.9	20.4	13.9
Kasap	5.8.70	1.	25.8.70	52.8	47.7	-	11.7	8.2	-
		2.	14.9.70	66.2	61.2	-	13.0	9.2	-
		3.	4.10.70	79.7	72.4	-	13.1	9.2	-
Kulharia	27.7.70	1.	14.8.70	57.4	58.8	51.1	11.1	8.3	12.3
		2.	3.9.70	69.0	59.1	78.9	26.7	17.9	26.3
		3.	24.9.70	107.2	95.5	110.1	26.5	19.0	24.6

Sub-Centre	Date of trans-planting	Date of observation		Height of hills in cm			No. of tillers		
				A	B	C	A	B	C
A.E.C. Arrah	16.7.70	1.	7.8.70	58.1	63.4	62.2	12.5	15.4	14.1
		2.	26.8.70	71.7	103.2	86.3	25.6	20.5	20.9
		3.	15.9.70	107.8	138.6	118.4	21.7	15.4	16.3

8) Observation of heading stage (Kharif 1970)

	IR - 8			Malinja		
	1 - 3%	40-50%	90-100%	1 - 3%	40-50%	90-100%
Suara	21. 9.70	25. 9.70	29. 9.70	11.10.70	16.10.70	20.10.70
Durgadih	22. 9.70	28. 9.70	10.10.70	5.10.70	15.10.70	21.10.70
Hasuadih	6.10.70	9.10.70	12.10.70	12.10.70	16.10.70	21.10.70
Garhani	17. 9.70	26. 9.70	29. 9.70	8.10.70	12.10.70	16.10.70
Kasap	29. 9.70	6.10.70	17.10.70	23.10.70	28.10.70	3.11.70
Kulharia	2.10.70	9.10.70	15.10.70	20.10.70	25.10.70	28.10.70
A.E.C. Arrah	15. 9.70	26. 9.70	3.10.70	3.10.70	11.10.70	20.10.70
Range	15.9-6.10	25.9-9.10	29.9-17.10	3.10-23.10	11.10-28.10	16.10-3.11

9) Result of test harvest (quintal per acre) (Kharif 1970)

	IR - 8				Malinja			
	A	B	C	Av.	A	B	C	Av.
Suara	15.1	14.5	16.5	15.4	15.4	14.7	15.2	15.1
Durgadih	16.3	19.0	15.2	16.8	16.7	14.5	12.9	14.7
Hasuadih	18.3	20.8	18.3	19.2	22.3	18.7	17.1	19.5
Garhani	19.1	19.8	19.1	19.3	15.3	16.8	13.0	15.0
Kasap	17.3	21.7	17.4	18.8	15.5	17.9	-	16.7
Kulharia	14.4	13.9	14.1	14.1	13.0	13.7	-	13.4
Average	16.8	17.5	15.0	17.2	16.4	16.0	14.6	15.6
AEC Arrah	19.2	17.5	15.0	17.2	15.9	15.5	15.0	15.5
Total Average	18.0	17.9	15.9	17.3	16.3	16.0	14.6	15.6

10) Crop duration (Kharif 1970)

Variety IR-8 Sub-Centre	sowing.	trans-planting.	Max. tillering & young panicle stage (1 mm)	heading stage (40=50%)	maturing (harvest)	sowing.	trans-planting.	Max. tiller-ing & young panicle stage	heading	maturing	total days
Suara V.	•	×	•	+	×	18/6	19/7	29/8	25/9	24/10	128
Durgadih V.	•	×	•	+	×	26/6	23/7	31/8	28/9	1/11	128
Hasuadih V.	•	×	•	+	×	27/6	4/8	10/9	9/10	10/11	136
Garhani V.	•	×	•	+	×	22/6	18/7	28/8	26/9	2/11	133
Kasap V.	•	×		+	×	30/6	27/7	8/9	6/10	4/11	127
Kulharia V.	•	×	•	+	×	24/6	26/7	9/9	9/10	3/11	132
A.E.C. Arrah.	•	×	•	+	×	21/6	15/7	26/8	26/9	1/11	133
Variety Malinja. Suara V.	•	×	•	+	×	18/6	18/7	13/9	16/10	12/11	147
Durgadih V.	•	×	•	+	×	26/6	22/7	12/9	15/10	9/11	136
Hasuadih V.	•	×	•	+	×	27/6	30/7	13/9	16/10	20/11	146
Garhani V.	•	×	•	+	×	22/6	24/7	9/9	12/10	19/11	150
Kasap V.	•	×	•	+	×	30/6	5/8	23/9	28/10	21/11	144
Kulharia V.	•	×	•	+	×	24/6	27/7	18/9	25/10	17/11	146
A.E.C. Arrah.	•	×	•	+	×	21/6	16/7	8/9	11/10	18/11	150

15th. June. 30th. June. 15th. July. 30th. July. 15th. Aug. 31st. Aug. 15th. Sept. 30th. Sept. 15th. Oct. 31st. Oct. 15th. Nov. 30th. Nov.

11) Analysis of factors of yield (Kharif 1970)

Variety: IR-8

Sub-Centre	Plot No.	Culm length	Panicle length	Weight of Panicle	No. of hills per sq.m.	No. of panicles per sq.m.	Total no. of grains per sq.m.	No. of matured grains per sq.m.	Percentage of matured grains	Weight of 1000 grains	Theoretical yield	
											per sq.m.	per acre
1	2	cm 3	cm 4	grm 5	No. 6	No. 7	100 No. 8	100 No. 9	% 10	grm 11	grm 12	Kgs. 13
Suara	a	76.2	22.3	1.94	21.3	166	125	91	72.8	29.2	266	1076
	b	74.9	23.2	1.80	25.7	157	132	85	64.4	28.4	241	975
	c	76.8	24.8	1.69	26.4	211	175	79	45.1	30.3	239	967
	Av.	76.0	23.4	1.81	24.5	179	142	85	59.9	29.3	249	1008
Durgadi	a	78.1	23.0	2.50	17.3	183	167	132	79.0	30.1	397	1607
	b	80.4	22.9	2.85	23.0	196	185	159	85.9	31.3	498	2015
	c	74.1	25.0	3.35	20.8	196	232	201	86.6	29.5	593	2400
	Av.	77.5	23.6	2.88	20.4	194	196	165	84.2	30.2	498	2015
Hasuadi	a	73.7	23.4	2.15	20.5	242	270	149	55.2	26.7	398	1611
	b	75.9	22.7	2.58	30.4	258	251	200	79.7	29.1	582	2355
	c	78.5	21.7	2.07	21.0	212	173	138	79.8	28.3	391	1582
	Av.	76.0	22.6	2.25	24.0	242	237	163	68.8	28.0	456	1845
Garhani	a	77.9	21.7	1.89	22.2	202	145	109	75.2	28.6	312	1263
	b	71.1	20.4	1.46	35.1	312	169	131	77.5	28.8	377	1526
	c	74.7	22.4	1.96	20.0	254	191	148	77.5	29.8	441	1785
	Av.	74.4	21.5	1.79	25.8	266	180	138	76.7	29.2	403	1631
Kasap	a	73.1	23.6	2.51	27.2	234	248	211	85.1	24.4	515	2084
	b	73.4	21.4	2.13	27.2	215	162	135	83.3	29.7	401	1623
	c	72.9	21.9	1.43	18.8	177	113	64	56.6	29.3	188	761
	Av.	73.1	22.3	2.01	24.5	211	172	132	76.7	27.2	359	1453
Kulharia	a	72.0	21.4	2.14	19.8	248	217	165	76.0	27.2	449	1817
	b	69.6	22.6	1.77	28.4	344	281	179	64.7	28.0	501	2027
	c	68.9	22.1	1.57	21.0	231	155	112	72.3	29.5	330	1335
	Av.	70.1	22.0	1.83	23.1	275	217	153	70.5	28.0	428	1732

1	2	3	4	5	6	7	8	9	10	11	12	13
AEC Arrah	a	70.9	22.5	2.63	22.0	176	165	142	86.1	29.6	420	1700
	b	78.8	22.7	2.31	29.7	247	210	180	85.7	28.7	517	2092
	c	71.8	23.3	2.71	24.2	227	242	195	80.6	28.1	548	2218
	Av.	73.8	22.8	2.55	24.9	214	204	171	83.8	28.8	492	1991
Average	a	74.5	22.6	2.24	21.5	211	194	144	74.2	27.8	400	1619
	b	74.9	22.3	2.12	28.5	245	233	188	80.7	29.4	553	2238
	c	74.0	23.0	2.10	21.7	217	182	135	74.2	29.2	394	1593
	Av.	74.4	22.6	2.15	23.9	227	194	146	75.3	28.7	419	1696

Variety: Malinja

Suara V.	a	123.2	23.7	2.50	15.3	194	207	161	77.8	26.2	422	1708
	b	121.3	25.3	2.27	24.5	218	243	183	75.3	24.3	445	1801
	c	134.2	25.3	2.25	19.8	188	203	152	74.9	23.6	359	1453
	Av.	126.2	24.8	2.35	19.8	206	223	170	76.2	24.9	423	1712
Durgadi V.	a	112.4	28.3	2.19	18.8	177	186	128	68.8	26.1	334	1352
	b	106.0	24.7	2.37	17.3	168	175	149	85.1	24.3	362	1465
	c	112.2	25.4	2.52	16.8	128	143	101	70.6	26.1	264	1068
	Av.	110.2	26.1	2.35	17.6	157	167	125	74.9	25.3	316	1279
Hasuadih V.	a	129.0	26.6	3.29	20.5	148	174	152	87.4	25.6	389	1574
	b	133.9	27.4	3.39	17.1	127	175	143	81.7	26.5	379	1534
	c	151.1	25.7	2.17	18.3	165	198	119	60.1	23.9	284	1149
	Av.	137.5	26.6	2.94	18.6	145	182	138	75.8	25.4	351	1420
Garhani V.	a	123.0	24.9	2.84	14.8	188	247	215	87.0	22.6	486	1967
	b	124.0	24.9	2.52	19.8	234	245	181	73.9	25.9	469	1898
	c	122.0	25.0	2.68	16.1	198	192	156	81.3	23.5	367	1485
	Av.	123.0	24.9	2.67	16.9	208	231	188	81.4	23.8	447	1809
Kasap V.	a	110.0	23.2	2.71	15.6	112	130	110	84.6	24.4	268	1085
	b	121.8	25.8	3.39	22.7	175	236	208	88.1	25.4	528	2137
	c	-	-	-	-	-	-	-	-	-	-	-
	Av.	115.9	24.5	3.04	19.2	144	187	156	83.4	25.0	390	1578

1	2	3	4	5	6	7	8	9	10	11	12	13
Kulharia V.	a	112.9	24. 2	2.13	14.3	225	253	187	73.9	22.0	411	1663
	b	101.3	23.8	2.30	22.0	215	242	189	78.1	23.0	435	1760
	c	-	-	-	-	-	-	-	-	-	-	-
	Av.	107.1	24.0	2.20	18.3	232	261	197	75.5	22.4	441	1785
AEC. Arrah	a	142.1	24.9	2.55	15.6	207	228	189	82.9	23.4	442	1789
	b	149.9	26.2	2.37	17.3	227	237	193	81.4	24.8	479	1938
	c	134.6	25.4	2.37	17.3	221	232	201	86.6	23.7	476	1926
	Av.	142.2	25.5	2.42	16.7	219	233	195	83.7	24.0	468	1894
Average	a	121.8	25.1	2.54	16.4	184	203	168	82.8	24.0	403	1631
	b	122.6	25.4	2.58	20.1	197	223	179	80.3	24.9	446	1805
	c	130.4	25.4	2.36	17.7	186	194	147	75.8	24.0	353	1428
	Av.	124.3	25.3	2.50	18.1	190	209	167	79.9	24.3	406	1643

12) Few comments on results of paddy crop, Kharif 1970

During the season of Kharif 1970, there was no serious occurrance of any pests, virus or diseases on paddy crop. Bacterial Leaf Blight and Tungro Virus, which are very common and serious in the Shahabad district, had not been found in the season either.

It can be said that if there is no damage on paddy crop by pests and diseases, an ideal yield could be obtained depending on the varietal characteristics, which may be termed as the "Standard Yield". In a sense the crop of kharif 1970 has given a good chance for the agronomic studies.

(a) Plant growth observations were conducted by the VLW. They were trained by the Japanese Experts for the purpose. The first observations were done 20 days after transplanting. The subsequent observations were at an interval of 20 days. Such observations were started for the first time in these Sub-Centres.

(b) It is found through these observations that number of tillers was increasing in some Sub-Centres even at the third observation stage. This is in contradiction to the theoretical assumption that number of tillers stop increasing from 30 days before heading in case of IR-8 and 35 days in case of Malinja. This contradiction may be because of observation mistakes, and it is recognized necessary to train VLW more for the purpose from the next year.

(c) Heading Stage observations are all illustrated earlier in 10) above. Theoretically, heading of IR-8 is very slow, but in case of the Suara, and Hasuadih Sub-Centres this was very quick. Similarly, heading of Malinja can be also quick, but it was very slow in case of AEC, Arrah and Durgadih Sub-Centre. Detailed study on these aspects should be done more.

Total crop duration in case of IR-8 can be 120 days, but in all the Sub-Centres and the AEC, Arrah, it was about 130 days. In case of Malinja, maximum crop duration can be 140 days, but it was also longer in the observation report. Therefore, it can be said that because of a fine weather condition and no occurrence of pests and diseases the crop maturing must have been delayed.

(d) Result of test harvest (1/80th acre)

Test harvesting in all the sub-Centres was conducted before the Japanese experts and Indian technical assistants. Fresh weight was recorded on the same day. One Kg. of sample paddy was brought to the main Centre for weighing the dry grains. After weighing dry grains, final weight was calculated.

In case of IR-8, the production target is an yield of 2 tons per acre, but it was achieved only in the Hasuadih Sub-Centre(B plot) and Kasap Sub-Centre (B plot). As for plot-wise yield, B plot brought the highest yield followed by C and A. Therefore, more dense planting is recommended in case of HYV.

In case of Malinja, the highest yield was recorded in A plot, but the difference among plots was quite insignificant.

(e) In theoretical analysis of yield, the most important factor is the number of hills per square meter. The highest yield was obtained in B plot, because of the highest number of hills per square meter.

(4) Varietal trial

1) Summer 1969

There was only one High Yielding Variety, TN-1, suited for the Summer Season in this district. However, the taste as well as the market value was comparatively very poor, and so it was not attracting farmers. In the circumstances, it was desired to find a suitable substitute for this variety, and then varietal trial was conducted in the main Centre.

(a) Trial method

Variety: TN-1, T-3, T-65, B-15, Pl-215913 (from the Vyara Centre)

Replication: - Single replication

Fertilizer application: the same as mentioned earlier

Date of sowing: March 13

Date of transplanting: April 19

Planting distance: 20 cm x 15 cm (8" x 6")

Plot: 18.4 x 9.8 m (180 sq.m.)

Observation of growth: Difference in varietal characteristics was observed 40-50 days after transplanting.

(b) Observation on paddy growth

Variety	observation of nursery plant			40 days after transplanting		date of		Total crop duration
	height of nursery plant	No. of leaves	No. of tillers	height	No. of tillers	heading	maturing	
TN-1	19.4	4.9	-	44.4	16.2	17/6	29/7	137
T-3	25.5	4.9	-	59.8	12.8	18/6	30/7	138
T-65	19.9	5.1	-	44.7	12.8	21/6	31/7	139
B-15	18.9	5.0	-	54.9	18.8	17/6	31/7	139
Pl-215913	18.0	4.8	-	42.7	9.6	25/6	2/8	141

(c) Yield

Variety	culm length (cm)	panicle length (cm)	No. of panicle	grain yield	
				per sq.m. (grm)	per acre (Kg.)
TN-1	41.0	20.8	16.2	375	1518
T-3	73.5	19.9	9.2	333	1348
T-65	77.1	18.2	7.0	342	1384
B-15	50.3	18.4	12.4	206	834
Pl-215913	66.8	18.7	6.2	298	1206

(d) Few comments

a) It was observed that the crop duration was very long in case of all the varieties. Therefore earlier sowing is desirable so as to escape the monsoon at the harvesting time and also to transplant Kharif paddy earlier.

b) All these varieties, particulary TN-1 and B-15 are dwarf having many tillers.

c) As regards yield all the varieties showed good yield except B-15. Among these TN-1 was highest in yield.

2) Summer 1970

Varietal trial was continued in the season of summer 1970.

(a) Trial method

variety: - TN-1, Padma, T-65, T-3.

Replication: 4 (Randomised Block Method)

Total No. of plots: -16

Plot: 53 sq.m. each, Total 848 sq. m.

Date of sowing: TN-1 March 18
Other varieties - March 17

Date of transplanting: April 21

Planting distance: 15 x 15 cm (44 hills/sq.m.)

No. of nursery plants per hills: 3

Plot design

II Group				I Group			
TN-1 A	Padma B	T-65 C	T-3 D	Padma B	T-65 C	T-3 D	TN-1 A
T-65 C	T-3 D	TN-1 A	Padma B	T-3 D	TN-1 A	Padma B	T-65 C
IV Group				III Group			

(b) Observation of growth

a) Nursery plant at the transplanting time:- (20 samples)

Particulars	TN-1	Padma	T-65	T-3
Height (cm)	19.1	18.5	21.8	24.5
No. of leaves	5.3	5.4	6.2	6.0
No. of tillers	0.1	-	-	-

b)

Variety	date of sowing	date of transplanting	date of heading	date of harvesting	total crop duration
A. TN-1	March 18	April 21	June 23	July 25	129
B. Padma	March 17	April 21	June 17	July 24	129
C. T-65	March 17	April 21	June 25	August 14	139
D. T-3	March 17	April 21	June 19	August 15	140

c) Growth process

No. of observation	date of observation	variety	height of hills (cm)				No. of tillers			
			I	II	III	IV	I	II	III	IV
1.	May 15	TN-1	44.4	48.7	50.7	45.1	13.4	17.0	13.4	16.4
		Padma	49.3	50.5	49.7	50.3	15.1	17.0	14.6	18.6
		T-65	48.7	46.5	47.7	46.6	14.6	14.5	9.8	13.8
		T-3	55.7	50.2	54.2	52.3	13.1	10.2	9.7	10.0
2.	May 26	TN-1	52.2	55.2	59.1	51.5	14.6	18.7	14.8	17.7
		Padma	56.3	55.4	56.5	55.7	17.1	18.0	16.4	19.0
		T-65	64.3	60.9	63.9	61.9	15.3	16.7	13.1	14.7
		T-3	71.0	64.4	68.9	68.4	14.5	12.7	12.8	12.4
3.	June 2	TN-1	59.2	60.2	66.5	58.2	14.3	18.7	15.0	17.4
		Padma	58.4	57.5	60.3	60.0	17.3	18.6	16.7	18.8
		T-65	70.2	67.4	71.9	68.6	15.9	16.4	14.0	14.7
		T-3	77.7	71.6	73.8	73.7	15.1	13.3	12.5	12.6
4.	June 25	TN-1	97.4	101.7	103.1	94.3	11.4	14.7	12.1	13.4
		Padma	89.0	90.0	93.7	86.9	15.2	16.8	12.1	14.1
		T-65	103.3	98.7	100.6	96.7	11.3	11.8	7.6	10.2
		T-3	121.6	111.0	111.7	109.6	10.0	8.7	8.7	9.1

(c) Result

variety	name of group	culm length	panicle length	No. of tillers per hill	No. of hills per sq.m.	No. of effective tillers per sq.m.	No. of grains per sq.m.	No. of matured grains per sq.m.	percentage of matured grains	weight of 1,000 grains	theoretical yield per sq.m.	theoretical yield per acre
		cm	cm	No.	No.	No.	100 No.	100 No.	% grm	grm	grm	Kgs.
A. TN-1	I.	62.6	20.6	10.5	41.5	436	349	244	70.0	23.8	580	2347
	II.	62.6	21.1	12.6	38.5	485	403	262	65.1	23.3	611	2473
	III.	64.5	20.8	10.6	39.5	419	322	214	66.2	26.5	565	2286
	IV.	60.1	20.2	12.6	35.9	452	381	256	67.1	22.5	574	2323
B. Padma	I.	57.9	19.4	10.9	38.5	420	445	327	73.6	20.1	659	2667
	II.	57.3	19.2	11.5	40.5	466	489	331	67.6	20.0	661	2675
	III.	59.3	19.7	9.4	38.5	362	402	261	65.8	19.7	521	2108
	IV.	58.8	18.9	13.0	40.0	520	541	364	67.3	18.8	686	2776
C. T-65	I.	84.0	18.0	7.7	39.0	300	231	171	74.0	23.3	399	1615
	II.	78.8	17.2	5.3	38.5	204	253	170	67.5	22.0	374	1513
	III.	83.3	17.2	6.0	39.0	234	216	188	87.0	24.2	455	1841
	IV.	78.3	16.9	5.8	42.0	244	212	173	81.5	23.5	406	1643
D. T-3	I.	91.2	19.9	9.9	38.3	379	296	243	82.1	25.5	618	2501
	II.	80.6	18.8	8.1	42.5	344	255	200	86.5	29.1	640	2590
	III.	88.6	19.1	8.1	39.0	315	253	212	83.8	28.2	597	2416
	IV.	88.5	18.9	8.4	37.6	316	256	212	82.7	26.3	556	2450

yield (by whole harvest)

variety	name of group	acreage of plot m^2	fresh weight of grains Kg.	final weight of grains Kg.	yield per sq.m. grm	yield per acre Kg.
A. TN-1	I	56.43	42.0	35.5	629	2545
	II	54.45	38.1	32.2	591	2392
	III	54.45	37.8	32.0	588	2372
	IV	55.95	40.0	33.8	604	2442
B. Padma	I	54.45	43.0	35.8	657	2659
	II	54.45	42.0	34.7	637	2578
	III	54.95	44.0	36.3	661	2675
	IV	55.44	41.0	33.9	611	2473
C. T-65	I	54.45	32.4	22.1	406	1643
	II	55.94	29.5	17.6	315	1275
	III	56.43	37.5	27.4	486	1967
	IV	54.45	31.5	23.3	428	1732
D. T-3	I	54.95	36.5	30.1	548	2218
	II	55.44	43.5	31.0	559	2262
	III	54.45	27.6	22.7	417	1687
	IV	54.45	29.7	24.1	443	1793

analysis of variance

source of variation	degree of freedom	sum of square	value of variance	F			Pr.
total	15	168481	-	-	>	3.86	0.05
between varieties	3	135079	45026	37.52	>	6.99	0.01
between groups	3	3601	1200	2.76	<	3.86	0.05
errors	9	29801	3311	-	<	6.99	0.01

$n_1 \cdot n_2 \longrightarrow \quad Pr_9^3 \{ F > F_O \} (0.05) = 3.86$

$Pr_9^3 \{ F > F_O \} (0.01) = 6.99$

From the above, it appears that there is a clear and significant difference among varieties, but no significant difference among the groups.

In this connection, T-test treatment of the average yield is not necessary for comparing varieties with one another. The following order was noticed by a means.

B (641.5g) - A (603.0) - D (491.8) - C (408.8 gr.)

Coefficient variation = 0.1073

(d) Few comments

a) It was found that there was a clear and significant difference among varieties, but no significant difference among the groups.

The new variety, Padma, had the highest yield followed by TN-1, T-3, and T-65. It can be, therefore, said that Padma is most suitable.

b) Growth characteristics of all the varieties were found similar, except T-65 and T-3 in which case the crop duration was found ten days longer.

c) So far as the yield component factors are concerned, the number of matured grains was found less in case of T-65 and T-3. The number of effective tillers was found more in case of Padma and TN-1 than in case of other two varieties.

As for theoretical yield, T-3 was found similar to TN-1. The weight of 1,000 grains of T-3 was slightly higher than TN-1.

3) Kharif 1970

(a) Trial method

Varieties	A... Tachiminori B... Nakate-shin-Senbon C... IR-52 D... IR-5
Date of sowing	June 17
Date of transplanting	July 13
No. of nursery plants per hill	3
planting distance	15 x 15 cm (6" x 6")
plot	4 replications (Randomised Block Method) One plot: - 5 x 8 m = 40 m^2 Total acreage: 40 m^2 x 16 = 640 m^2

Fertilizer application (per acre)

	N	P205	K20
Nursery bed	20 Kgs	10 Kgs	10 Kgs
Main field	40 Kgs	25 Kgs	20 Kgs

Note: 50% of nitrogenous fertilizers were applied as base and the rest as top dressing.

plot design

III Group				IV Group			
C	D	A	B	D	A	B	C
A	B	C	D	B	C	D	A
II Group				I Group			

(b) Observation of paddy growth

a) Nursery plant

	A	B	C	D
Height (cm)	31.3	21.3	38.9	28.6
No. of leaves	4.1	4.4	4.5	4.7
No. of tillers	-	-	-	-

b) Process of growth

No. of observation	date of observation	variety	height of plant (cm)				No. of tillers			
			I	II	III	IV	I	II	III	IV
1	August 2	A	47.7	31.2	50.7	38.6	6.2	3.6	8.5	4.5
		B	36.0	35.6	38.7	34.9	6.6	5.7	6.9	6.2
		C	48.2	48.2	47.2	43.4	9.0	5.6	7.7	4.7
		D	41.4	39.3	40.3	49.2	8.5	9.7	10.7	11.8
2	August 25	A	83.8	63.5	86.2	70.8	7.0	6.9	7.6	6.1
		B	63.7	68.4	68.4	66.4	6.8	8.6	6.2	5.7
		C	97.1	88.1	84.1	82.1	8.6	7.7	8.7	6.4
		D	57.1	63.6	64.1	62.9	9.6	12.5	12.9	11.7
3	September 11	A	88.6	70.8	95.4	81.0	6.4	7.5	7.5	6.0
		B	72.3	73.2	72.6	73.0	6.5	11.2	6.2	7.2
		C	113.1	110.0	107.6	109.4	7.7	7.0	7.7	6.4
		D	67.4	77.4	76.2	76.8	8.1	10.2	8.7	9.0

c) Crop duration

variety	date of sowing	date of transplanting	date of heading (40-50%)	date of maturing (harvesting)	duration			
					nursery	transplanting to heading	heading to maturing	total duration
A	June 17	July 13	August 23	September 23	26	41	31	98
B	June 17	July 13	August 15	September 24	26	43	30	99
C	June 17	July 13	September 11	October 21	26	60	40	126
D	June 17	July 13	October 13	November 17	26	92	35	153

(c) Result

Analysis of factors of yield

variety	group	culm length	panicle length	per panicle: No. of effective tillers	per panicle: total No. of grains	No. of matured grains	No. of hills per sq.m.	No. of effective tillers per sq.m.	total No. of grains per sq.m.	No. of matured grains per sq.m.	percentage of matured grains	theoretical yield: weight of 1000 grains	theoretical yield: per sq.m.	theoretical yield: per acre
		cm	cm	No.	No.	No.	No.	No.	100 No.	100 No.	%	grm	grm	kgs
A. Tachiminori	I.	63.9	17.5	6.2	65.1	49.7	33.4	207	135	103	76.3	24.9	257	1040
	II.	50.7	16.4	6.4	45.7	27.4	31.4	201	92	55	59.9	24.3	135	546
	III.	67.1	17.8	6.5	69.5	50.8	32.9	214	149	109	73.1	27.0	392	1186
	IV.	55.1	17.2	6.0	55.4	39.2	31.4	188	104	74	70.9	25.4	188	761
	Av.	59.2	17.2	6.3	59.0	41.8	32.3	204	120	85	70.9	25.6	218	882
B. Nakate-Shin Senbon	I.	45.9	15.1	6.0	51.4	42.0	32.4	194	100	82	81.7	26.9	220	890
	II.	44.0	14.7	12.2	41.1	25.5	33.1	404	166	103	62.0	24.2	250	1012
	III.	48.9	14.5	4.5	45.6	38.7	36.1	163	74	63	84.0	25.7	163	660
	IV.	43.3	14.0	9.1	45.0	35.2	35.8	254	114	89	78.2	26.0	234	947
	Av.	45.5	14.6	7.5	44.8	33.1	34.4	258	116	85	73.9	25.6	219	886
C. IR-52	I.	89.0	24.3	6.1	89.9	65.6	31.6	193	174	126	73.0	27.3	345	1396
	II.	84.7	24.2	5.7	117.1	86.0	28.9	165	193	142	73.5	25.1	356	1441
	III.	84.9	23.4	6.3	96.2	71.4	34.8	219	211	157	74.2	25.0	390	1578
	IV.	86.5	23.8	5.8	112.3	77.9	32.1	186	209	145	69.3	27.7	402	1627
	Av.	86.3	23.9	6.0	103.5	75.0	31.9	191	198	144	72.5	26.2	377	1526
D. IR-5	I.	79.0	22.7	5.9	89.8	77.8	31.6	186	167	145	86.6	33.0	364	1473
	II.	87.9	24.3	6.8	96.1	87.6	29.4	200	192	175	91.2	26.1	458	1853
	III.	83.9	23.5	7.8	98.5	85.8	32.1	250	246	215	87.9	25.1	541	2189
	IV.	81.9	22.8	6.5	80.8	72.1	31.9	207	167	150	89.2	25.2	378	1530
	Av.	83.2	23.3	6.8	91.5	81.2	31.3	213	195	173	88.8	25.4	438	1772

yield (by whole harvest)

varieties	group	plot acreage	fresh weight of grains per plot	final weight of grains per plot	grain yield per sq.m.	grain yield per acre
		sq.m.	Kg.	Kg.	gram	Kg.
A. Tachimi-nori	I.	42.1	20.0	15.2	361.0	1461
	II.	41.0	13.6	9.6	234.1	947
	III.	42.6	17.0	13.3	312.2	1263
	IV.	42.1	11.6	8.7	216.7	837
	Av.	42.0	15.6	11.7	278.6	1127
B. Nakate-Shin-Senbon	I.	42.1	15.0	12.5	296.9	1202
	II.	42.1	18.2	13.5	320.7	1298
	III.	41.3	18.4	14.5	351.1	1421
	IV.	40.5	13.1	10.9	269.1	1089
	Av.	41.5	16.2	12.9	310.8	1258
C. IR-52	I.	41.3	18.2	16.1	389.8	1577
	II.	42.6	18.5	14.6	342.7	1387
	III.	40.5	21.5	18.4	454.3	1838
	IV.	40.5	16.2	13.4	330.9	1339
	Av.	41.2	18.6	15.6	378.6	1532
D. IR-5	I.	41.3	28.4	22.7	549.6	2224
	II.	42.1	27.5	21.8	517.8	2095
	III.	42.6	26.5	19.9	467.1	1890
	IV.	42.1	26.0	20.4	484.6	1961
	Av.	42.0	25.9	21.2	505.8	2047

Analysis of variance

Source of variation	degree of freedom	sum of square	variance	F		
total	15	153390				
among varieties	3	121335	40445	**	> 3.86	Pr 0.05
				12.70	> 6.99	0.01
among groups	3	9554	3185	1.27	< 3.86	0.05
					< 6.99	0.01
error	9	22501	2500	-		

$n_1 n_2 \rightarrow Pr_9^3 \{ F > F_o \} \; 0.05 = 3.86$

$Pr_9^3 \{ F > F_o \} \; 0.01 = 6.99$

It was found that there was a significant difference among varieties. Therefore, it was tested by using T-test and the following order was concluded.

D (IR-5) -- C (IR - 52) -- B (Natake-Shinsenbon)
- A (Tachiminori)

However, coefficient variation value was found large, namely

C.V. = 13.6%

(d) Few comments

a) The crop duration of varieties was found 30 - 50 days shorter in case of Tachiminori and Nakate Shinsenbon, but their grain yields were less than IR-52 and IR-5. The crop duration of IR-5 was over 150 days, but its yield was higher than any others.

b) As a result of analysis of variance, there was significance of two stars, but the coefficient variation value was large i.e. 13.6%.

c) The trial should be continued and one or two new varieties should be added up.

d) Tachiminori, a Japanese variety, was found suitable for up land since it can thrive well in less water condition.

e) In general, it was found that all these varieties have advantages and disadvantages concurrently.

(5) Direct sowing of paddy

1) Trial method

varieties

Summer 1969	TN-1
Summer 1970	TN-1 and Padma

Method of direct sowing

a) In the year of 1969, 15 days before wheat harvest (between the two rows of wheat)

b) In the year of 1970, 10 and 15 days before wheat harvest (between two rows of wheat)

c) Sown after harvest of wheat (1970)

2) Results

a) Direct sowing was found economical, the per acre yield being more than 1,000 Kgs. However, the fields were overrun with weeds particularly in the year of 1970.

(b) In the year of 1969, paddy was grown satisfactorily between two rows of wheat, but there were certain difficulties like weeds, irregular sowing etc.

(c) Application of weedicides are essential in future.

(6) District level trial (Kharif 1970)

This trial was conducted at the request of AICRIP, Hyderabad.

1) Trial method

(a) Varieties — Jaya, IR-20 and BR-34

(b) Treatment — Non replicated

(c) Date of sowing — July 9, 1970

Date of transplanting — August 5, 1970

Area sown — 400 sq.m. (for each variety)

Planting distance — 4" x 9" for Jaya and IR-20
6" x 10" for BR-34

(d) Application of fertilizers

Jaya and IR-20 — Same as recommended for HYV

BR-34 — Same as recommended for improved varieties

2) Result

Observation of growth

	1st observation					2nd observation	
variety	weight cm	No. of leaves No.	No. of tillers No.	height of hills cm	No. of tiller No.	height of hill cm	No. of tiller No.
Jaya	30.5	5.3	1.3	52.3	16.8	80.3	14.3
IR-20	17.0	4.4	-	41.0	22.2	77.3	23.1
BR-34	46.7	5.0	-	52.0	14.7	83.7	14.7

Remarks: - 1st observation ... August 26, 1970
2nd observation... September 15, 1970

Crop duration and grain yield (by whole harvest)

variety	date of flowering (50%)	date of maturing (harvesting)	grain yield per acre (Kg.)	duration	
				to 50% of heading (days)	to maturing (days)
Jaya	10/10	18/11	2029	93	132
IR-20	12/10	18/11	1823	95	132
BR-34	19/10	24/11	1282	102	138

Component factors of yield (analysis of 10 uprooted samples)

variety	culm length cm	panicle length cm	No. of panicles per hill No.	No. of hills per sq.m. No.	No. of panicle per sq.m. No.	total No. of grains per sq.m. 100 No.	No. of matured grains per sq.m. 100 No.	Percentage of matured grains %	weight of 1000 grains grm.	theoretical yield	
										per sq.m. gms.	per acre Kgs.
Jaya	81.1	21.1	10.7	21.7	232	256	219	85.5	27.6	604.4	2446
IR-20	76.3	25.2	14.4	25.5	324	315	271	74.2	18.9	512.2	2073
BR-34	126.3	24.9	9.5	22.7	216	231	184	79.7	21.8	401.1	1623

3) Few comments

(a) As regards the grain yield, Jaya had the highest yield, 2446 Kgs/Acre, IR-20 following with 2073 Kgs/acre. BR-34 had the lowest yield, 1623 Kgs/acre.

(b) Since IR-20 is a variety of fine grains, finer than Jaya, it seems that the cultivators have had many varieties to choose. Both Jaya and IR-20 have a potentiality of substantial yield and about one week shorter in crop duration than the present variety of BR-34.

2. ACTIVITIES ON SOIL AND FERTILIZER AND RESULTS

As a Japanese Expert on soil and fertilizer was assigned to the Centre in 1969, one year later than three other Experts assignments, main activities on soil and fertilizer have been conducted since Kharif 1969, the schedule being as follows:

The first year (1969) : finding out the limiting elements of fertilizers for rice production in the area and a means of settling

The second year (1970) : establishing the rational fertilizing practices on important elements of fertilizers on the basis of the first year's finding.

In order to establish the rational fertilizing practices, it is essential to grasp the weather conditions in the area. For the purpose, atmospheric, irrigation water and soil temperature, and humidity have been observed every day at 8 and 13, and also every hour on a whole day and night in a month.

(1) Soil condition of trial plots in the Centre.

The field and soil in the Centre are used for field trials and pot testing. Paddy field soil in the area, lying in the middle of the Ganges, consists of aluminum, which are of clay loam and rich in silt clay. The Centre belongs to the area of alluvium soil. Such a soil contains very little N and P_2O_5, but much Ca and Mg. Therefore it should be noticed to apply proper amount of nitrogenous fertilizers for rice cultivation. On the other hand, since the soil is clayey, water is liable to stagnate in the field, resulting in root damage, so called NEGUSARE. In other words, such a soil has many negative factors adversely affecting rice growth and yield.

(2) Summary of trials conducted in Kharif 1969

1) Trial on three elements of fertilizer
(trial method)

trial field	field in the Centre	
varieties used	IR-8 and T-141	
planting distance	IR-8	15 x 15 cm
	T-141	25 x 15
area of trial field	72 m^2 (8 x 9 m)	

trial plots and amount of supplied fertilizers (Kg/acre)

variety	plot	N basal	N additional	P_2O_5	K_2O
IR-8	no-fertilizer	0	0	0	0
	no-N	0	0	25	20
	no-P_2O_5	24	16	0	20
	no-K_2O	24	16	25	0
	three elements	24	16	25	20
T-141	no-fertilizer	0	0	0	0
	no-N	0	0	20	15
	no-P_2O_5	8	12	0	15
	no-K_2O	8	12	20	0
	three elements	8	12	20	15

(result)

(a) The stage of growth and availability of natural nutrients

IR-8 and T-141 were transplanted on July 29, and harvested and threshed on November 20 in case of IR-8 and December 1 in case of T-141. Plant height, number of tillers, tillering, number of leaves of trunks, percentage of dead leaves and elongation rate of plant height per day were observed seven times during vegetation period, on August 9, 17 and 26, September 5 and 17, and October 3 and 17. After transplantation, vegetation development was satisfactory and on August 1 rooting was seen in all plots. Difference in vegetation were recognized around August 5, and decolouration in the plots of no-fertilizer and no-N was clearly recognized around August 10, plant body becoming light green. These plots showed symptoms of N shortage.

In August and September, there was much rainfall with many rainy days and high humidity, although it was usual in the area. These weather conditions adver-

sely affected the vegetation development of rice. That is, Bacterial Leaf Blight and virus diseases occurred around August 8 when heavy rain started along with high humidity. At first only IR-8 was attacked, but T-141, Indica type, was also affected later in the middle and/or later in August.

The stage of vegetation growth ended in the middle of September in case of IR-8 and in the middle of October in case of T-141, heading being on September 28 and October 23 respectively.

Looking at the availability of natural nutrients during vegetative growth, vegetation development of no-N plots was poorest throughout the vegetative growth period, almost the same result as that of no-fertilizer plots, followed by no-K_2O and no-P_2O_5 plots in this order.

The effect of P_2O_5 and K_2O was not recognized in the no-N plots, showing the same result as the no-fertilizer plots, that is, P_2O_5 and K_2O are effective only with N fertilizers in case of alluvial soil. This result is quite different from that of alluvial soil in Japan.

As seen from the above, P_2O_5 is richest in natural nutients, followed by K_2O. In other words, natural supply of N is least among natural nutrients.

(b) yield

The heading time of IR-8 was on October 11-13 and that of T-141 was on October 27, being harvested and threshed on November 20 and December 1, respectively. Straw and grains obtained from 3 plots, 3.3 m^2 each, were weighed and also seed setting rate was observed on 50 panicles selected as moderate ones among 50 hills from one plot. Taking an yield of three element plots, that is 2.19 Kg/3.3 m^2, as 100, a yield of no-fertilizer plots is 47, that of no-N plots 46, no-P_2O_5 plots 94, no K_2O plots 85. These results concur with those of observation on the stage of growth mentioned above.

Low yields of no-fertilizer plots and no-N plots are mainly caused by poorness in the percentage of effective tillers, ratio of grains to straws, 1,000 grain weight and seed setting rate. As noted in the above, it is concluded that natural supply of P_2O_5 is most plenty among nutrients, that of K_2O coming next, and that of N being least. Therefore establishment of fertilizing practices of nitrogenous fertilizers is essential to increase rice production in the area.

2) Trial on fertilizing practices of nitrogenous fertilizers

(trial method)

trial field	field in the Centre	
varieties used	IR-8 (HYV) and T-141 (low yielding variety)	
planting distance	IR-8	15 x 15 cm
	T-141	25 x 15
area of trial field	72 m^2 (8 x 9 m)	

trial plots and amount of supplied fertilizers (Kg/acre)

variety	plot	N basal	N additional	P_2O_5	K_2O
	no-fertilizer	0	0	0	0
	no-N	0	0	25	20
	standard	24	16	25	20
IR-8	N basal	28	12	25	20
	N additional A	12	28	25	20
	N additional B	0	40	25	20
	no-fertilizer	0	0	0	0
	no-N	0	0	20	15
	standard	8	12	20	15
T-141	N basal	14	6	20	15
	N additional A	6	14	20	15
	N additional B	0	20	20	15

(result)

(a) The stage of growth

Both varieties were transplanted on July 29, and harvested and threshed on November 20 in case of IR-8 and December 1 in case of T-141. The stage of growth was observed seven times during vegetation period on August 9, 17 and 26, September 5 and 17, and October 3 and 17.

In case of IR-8, the first stage of growth was best in the N basal plots where 70% of N fertilizers was applied as base, showing longest plant height during August. However, after applying additional N fertilizers on September 3, the growth of N additional A and B plots was better than that of other plots including N basal plots, showing longer plant elongation rate per day that was almost double of that of standard plots, but final results of N additional B plots were inferior to standard plots because of poorness in the first stage of growth without basal fertilizers. This indicates necessity of applying basal fertilizer.

The growth of T-141 was almost the same as in case of IR-8. Plant height and plant elongation per day were much higher in case of T-141 than IR-8.

In conclusion, N additional A plots showed the best result, that is, the best practice of applying N fertilizers is to apply 30% as base and 70% as addition.

In case of IR-8, tillering of N-basal plots was getting better than that of standard plots from the middle of August, reaching the maximum on August 26, but after that it was getting inferior to standard plots regardless of additional N fertilizers on September 3. On the other hand tillering of N additional A and B plots was inferior to that of standard plots in the first stage of growth, but after applying additional N fertilizer, their tillering was getting vigorous, reaching the maximum on September 17.

In case of T-141, tillering was slightly different from in case of IR-8. That is, tillering of N basal plots was always inferior to standard plots. On the other hand, although tillering of N additional A and B plots was getting vigorous after applying additional N fertilizer, it was not so much as in case of IR-8.

In conclusion, tillering can be said to depend on additional fertilizers, especially in case of IR-8. Leaf colour of IR-8 in the no-fertilizer and no-N plots was fading from August 10, to more yellow than light green. Leaf colour in the N basal plots was dark green from the beginning of growth, but changed into light green from August 25, which remained unchanged regardless of additional application of N fertilizer on September 3. Leaf colour of N additional B plots, which was changing into light green from the middle of August, and that of N additional A, which was fading from the end of August, became green again around the end of September due to additional application of N fertilizer on September 3. It was faster in case of N additional A plots than in B plots to become green again, but more dark in B plots than in A plots.

These changes of leaf colour concur with those of plant height and tillering.

After transplantation on July 29 in case of IR-8 plant diseases like BLB occurred as early as August 8, especially in the N basal plots where the first stage of growth was vigorous. In case of T-141, they occurred later towards the end of August. It is obvious that these diseases occur concentrically in August and September when there is heavy rainfall.

Occurance of these diseases in the N additional B plots where no basal N fertilizer was put, was too late and not serious as compared with the N basal and three element plots. With additional N fertilizer (100%) to N additional B plots in such a condition of diseases, plant grew vast changing dark green, and symptoms almost disappeared. It could be concluded that for protecting varieties like IR-8 which are susceptible to BLB and virus from these diseases, number of hills and tillers should be increased and basal N fertilizer should not be applied much, applying much additional B fertilizers aiming at the improvement of the latter stage of growth and recovery of damaged plants.

(b) yield

IR-8 and T-141 were harvested on November 20 and December 1 respectively and observed on yield. Yield of IR-8 was 597 kg/10a in paddy in the standard plots. On the other hand, it was 281 Kg in no-fertilizer plots, 53% less, 272 Kg in the B basal plots, 55% less, 651 Kg in the N additional A plots, 9% more and 417 Kg in the N additional B plots, 12% less respectively then in the standard plots.

Yield of T-141 was 266 Kg/10 a in paddy in the standard plots. On the other hand, it was 27% less in the no-fertilizer plots, 30% less in the no-N plots, 44% less in the N basal plots, 13% more in the N additional A, and 38% less in the N additional B plots respectively than in the standard plots.

It can be said that the additional application of N fertilizers is more effective than applying them mainly as base especially in case of T-141. The N additional plots were mainly of high percentage in effective tillers and high seed setting rate resulting in increase of production.

3) trial on amount of supplied superphosphate of lime

(trial method)

trial field	field in the Centre
variety used	IR-8
Planting distance	15 x 15 cm

area of trial field 72 m^2 (8 x 9 m)

trial plots and amount of supplied superphosphate of lime (Kg/acre)

plot	N		P_2O_5	K_2O
	basal	additional		
no-fertilizer	0	0	0	0
no-P_2O_5	24	16	0	20
P_2O_5 10 Kg.	24	16	10	20
- do - 25	24	16	25	20
- do - 40	24	16	40	20
- do - 60	24	16	60	20
- do - 80	24	16	80	20

(result)

It was transplanted on July 29 and harvested on November 20. During this period. the stage of growth and yield were observed seven times. Plant height, number of tillers and plant elongation per day was in direct proportion to the increase of the amount of superphosphate of lime upto its 25 kg, reaching their maximum in 25 kg plots. On the contrary, application of more than 25 kg superphosphate of lime resulted in deterioration of growth.

Yield was in the same tendency as growth mentioned above, that is, 25 Kg plots brought the highest yield, 597 kg/10a in paddy, and application of more than 25 kg, on the contrary, resulted in decrease of yield.

In conclusion, it is enough to apply 25 kg/acre of P_2O_5 as recommended by the State Government as well as Japanese technicians stationed at Arrah at the time of Demonstration Farm.

4) Survey on low water

The soil in the centre contains much clay which adversely affect rooting of paddy resulting in low yield. Out of trial plots on application of N fertilizers, low water was observed in the three elements, no-N and N basal plots. Although there was difference in depth of low water among plots and dates of survey, the low water was very little, less than 10mm per day. The soil can be said to keep water long but, on the other hand, to be deleterious for the crop causing addled roots (NEGUSARE) due to bad drainage.

5) Meteorological observation

In order to find out the relationship between weather conditions and cropping, meteorological observation has been conducted in the Centre since Kharif 1969 on temperature, soil and water temperature, humidity, rainfall, amount of cloudiness.

So far it has been found from the observation that the weather conditions in the Kharif season gives the optimum for plant diseases, especially BLB, mainly because of high moisture. Therefore, one of the important techniques in the area is to establish the suitable cultivation and fertilizing practices from the point of view of protecting crops from plant diseases like BLB.

6) Trial on application of N fertilizers (Kharif 1970)

It has been found from the trial on the same in Kharif 1969 that natural supply of N is scanty, and also application of P_2O_5 and K_2O has no effect without N.

Therefore application of N fertilizers is very important in the area.

(trial method)

trial field field in the Centre

varieties used Nagina, IR-8, T-1, T-65, Padma, BC-5

trial plot 1/20,000

trial plots and amount of supplied fertilizers

N 0.75 g per (pot)

P_2O_5 0.47

K_2O 0.38

For all varieties, three elements, no-N, no-fertilizer plots were arranged.

transplanting April 20

number of plants 3

(result)

As found from the trial in Kharif 1969 it was confirmed that application of N fertilizers are essential to get the desired yield in case of any varieties.

3. ACTIVITIES ON AGRICULTURAL MACHINERY AND RESULTS

Activities on agricultural machinery at the Centre have been aimed at extending the use of modern agricultural machinery by using those provided by the Government of Japan to Indian staff and farmers, and finding out the future works on extension of agricultural machinery taking into account the local conditions.

In promoting the mechanized farming in India, light and small type of machinery like Japanese machinery are expected to contribute much especially to mechanization of rice cultivation. Apart from Indian Government policy on import of machinery, whether Japanese machinery root in Indian farming depends on the following factors.

(a) Japanese machinery should show effectiveness and efficiency in local conditions in India

(b) Indian people including farmers could operate them well.

(c) Indian farmers could make both ends meet on introduction of such machinery.

Activities on agricultural machinery have been done being kept the above in mind.

(1) Activities and results at the Sub-Centres

1) Use of power tiller (Kharif 1969)

Block	Power tiller	operating hours (hours)	cultivating areas (acres)	operating hours per acre	fuel consumption (l)	fuel consumption per acre (l)	cost of fuel per acre	soil
Dehri	No. 1	171	21.79	7'40"	258	11.8	10.40	sandy loam
- do -	No. 2	153	20.00	7'40"	235	11.7	10.30	sandy loam
Bikramganj	No. 3	219	23.01	9'30"	216	9.4	8.27	clayey loam
Charpokhari	No. 4	129	19.77	6'36"	196	9.9	8.72	clayey loam
Udwantnagar	No. 5	134	16.45	8'09"	176	10.7	9.42	clayey loam
Koilwar	No. 6	257	32.00	8'03"	310	9.7	8.53	loam
total		1,063	133.02		1,391			
average		177	22.17	7'54"	232	10.5	9.24	

Remarks: 1. Cultivation was done twice by rotary ploughing.

2. Cost of fuel was calculated at 88 NP/l.

The cultivating areas was 22 acres on average, ranging from 15.50 to 32.00 acres, which is much more than in Japan, and operating hours per acre was 8 hours, which is almost the same as in Japan. Some weak points of Japanese power tiller are found in claw and belt which are recommended to be improved so as to suit Indian conditions.

2) Use of thresher

block	operating days (days)	operating hours	operating hours per day	amount of threshed paddy (Kg)	amount of threshed paddy per hour (Kg)	fuel consumption (l)
Bikramganj	22	76'15"	2'30"	18,975	247.5	112
Piro	18	98'15"	5'20"	13,800	148.1	71
Udwantnagar	3	12'00"	4'00"	2,700	225.0	7
Koilwar	4	12'00"	3'00"	1,325	191.3	27
total	47	198'50"	14'50"	37,800	811.9	217
average	11	49'12"	3'50"	9,450	202.9	542

Amount of threshed paddy per hour was 292.9 Kg. In other words, it took about 5 hours to thresh paddy produced in an acre since yield per acre was about 1,000 Kg. This amount is almost the same as in Japan.

3) Comparison of performances between four wheel tractor and power tiller

In Kharif 1969 and Rabi 1969-70, comparison of performances between

four wheel tractor and power tiller was observed as shown below.

	cultivating area (acre) (Kharif 1969)	operating hours	operating hours per acre	fuel consumption per acre (1)
four wheel tractor	36.65 (100)	172'28" (100)	4'42" (100)	20.0 (100)
power tiller	22.17 (61)	177'00" (102)	7'45" (109)	10.5 (52)
	(Rabi 1969 - 70)			
four wheel tractor	38.46 (100)	150'45" (100)	3'55" (100)	14.4 (100)
power tiller	9.70 (25)	231'22" (153)	11'51" (302)	17.6 (123)

In Kharif 1969, there was much difference between the two. Operating hours per acre was much less in four wheel tractor, but fuel consumption of power tiller was half of that of four wheel tractor. In Rabi 1970, there was wide difference than in Kharif 1969, four wheel tractor being much better in performances than power tiller.

Needless to say, the above results show that high power tractors suit to plough hard soil more than to do soft soil. On the other hand, small power tillers suit more to plough soft soil like paddy field in Kharif.

4) Machinery let out to Sub-Centre on hire

Performances of letting out of agricultural machinery to the Sub-Centres on hire are as follows.

	1969		1970		
	Kharif	Rabi	Summer	Kharif	Rabi
power tiller	6	10	7	10	5
tractor	1	1		1	7
(cultivating area in acre)	(266)	(271)	(110)	(413)	(580)
thresher with engine	9	6	6	6	6
plant protection equipment	6	6	6	6	6
cutter	6	6	6	6	6
pump	1			1	1

(2) Training of operator

It was made clear from the results mentioned above that Japanese modern agricultural machinery are useful in Indian farming. Then, next point is whether Indian operator could manage them well. For the purpose, training was imparted to 13 persons as operators for a month from February 21 to March 20, 1970. The subjects were on inspection and adjustment of power tiller, diesel engine and air cooling engine, and practical knowledge of engine.

It was found through the written and oral examination that because of poorness in literacy, practical training through oral explanation and by showing the things was essential in conducting the training programme for undergraduates.

(3) Trials in the Centre

1) Trial on fresh paddy threshing (Summer 1970)

(trial method)

machinery used	Kubota auto thresher 540 the number of rotations 550/RPM
variety used	Padma
harvesting	July 23

(result)

As shown below, performance of auto thresher was almost the same regardless of number of dates after harvesting. Therefore Japanese auto thresher can be used for threshing summer paddy in the area. It can be said that since double performance was found in threshing paddy kept in the shed for 6 days, construction of such a shed be recommended for summer paddy which are usually harvested in the beginning of the Monsoon.

number of dates after harvesting (days)	amount of threshing paddy per hour (Kg.)	loss	threshing damage	moisture
1	76.3	nil	nil	23
2	64.4	nil	nil	23
4	91.1	nil	nil	22
6 (kept in the shed for 6 days)	180.0	nil	nil	20
local practice	50.0	nil	nil	

2) Observation on influence of the use of modern machinery to the labour wage

It is already found that Japanese machinery are useful in Indian farming. However, the use of them should be profitable. From this angle, this observation was conducted, and results are as follows.

	A	B	C	D
paddy produced (Kg)	350.80	304.50	290.00	302.00
total hours of labour	109'04"	74'36"	85'41"	41'56"
hours of labour required for producing 100 Kg paddy	32'	24'	28'	14'
labour wage required for processing 100 Kg paddy (Rs.)	9.92 (100)	7.44 (75)	8.68 (88)	4.34 (44)

Remarks: 1. plots

	ploughing	harvesting	threshing
A	bullock	man	bullock
B	power tiller	man	thresher
C	power tiller	harvestor	man
D	power tiller	harvestor	thresher

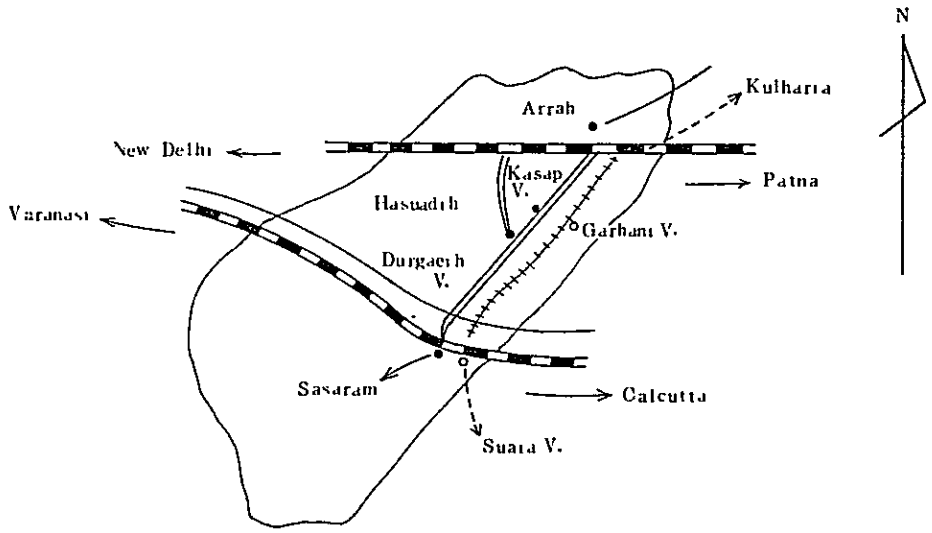
2. labour wage 2.5 Rs per 8 hours

4. ACTIVITIES AT SUB-CENTERS AND RESULTS

(1) Name of Sub-Centres and their locations

Six Sub-Centres are situated at Shahabad district as shown below in Map I-3.

Map I - 3. Locations of Sub-Centers



Distance from Arrah (main Centre) to , and source of irrigation and soil conditions at each Sub-Centre are as follows:

Name of Block and Village	Distance from Arrah (Mileage)	Source of Irrigation	Soil Condition
1. Dehri (Suara)	74	Tube well	Sandy Loam
2. Bikramganj (Durgadih)	45	Canal	Clayey Loam
3. Piro (Hasuadih)	32	Tube well	Sandy Loam
4. Charpokhari (Garhani)	20	Tube well	Clayey Loam
5. Udwantnagar (Kasap)	6	Tube well	Clayey Loam
* 6. Koilwar (Kulharia)	10	Tube well	Sandy Loam

* Non-package block

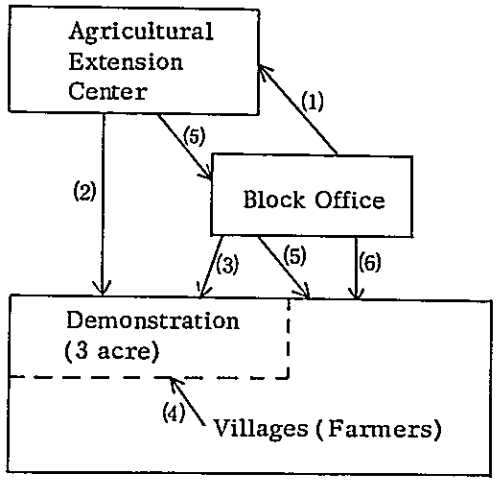
(2) Intensive Agricultural Extension Area and Number of Participants in the Sub-Centres

	1969-70		1970-71	
	Targeted Acreage	Participant	Acreage	Participant
1.	50.86	14	266.00	57
2.	50.70	16	50.70	16
3.	50.06	7	50.06	7
4.	53.30	33	53.30	33
5.	50.69	63	52.24	23
6.	49.80	63	49.80	63
Total	304.41	196	522.10	199

In the beginning of 1969, 18 villages had been selected in the action plan of Agricultural Extension Works in the Villages by the Block Officers. Consequently, in March 1969, final decision was taken for the selection of Six Villages out of 18 villages after Japanese experts and the district authorities consulted with one another by observing the sites and taking into consideration the following factors:-

1) Population, 2) No. of farm households, 3) No. of communities, 4) Farming situation i.e. the size of holdings, acreage under paddy cropping pattern, maximum, minimum and average yield, agricultural machinery, irrigation facilities, electricity and other facilities like agricultural co-operatives etc.

(3) Plan of activities at Sub-Centres



1) Monthly meeting with Agricultural Officers and periodical training of S.M.S., A.E.S. and V.L.W. in charge of Sub-Centres on rice cultivation

2) Supply of required materials for demonstration and training of farmers

3) Arrangement of demonstrations and training of farmers.

4) Attendance of farmers at training

5) Hiring of agricultural machinery, and technical advices

6) Technical instructions and advices

The cultivators in the area are not only engaged in the cultivation of paddy but also most of them are engaged in the cultivation of other crops like wheat, sugar-cane, potato etc. Agricultural extension activities in the Villages, therefore, must be done by taking into consideration many factors like location, no. of farming families, land holdings of farmers, etc. But activities of the Centre have been so far confined to paddy and wheat cultivation only because of limited resources and technical know-how, although suitable extension approach

depending on the characteristics of each village have been taken.

(4) Recommended cropping pattern

Kharif (Paddy)	June - Nov.
Rabi (Wheat)	Nov. - April
Summer (Paddy)	March - July

(5) Training of Indian Officers

Block officers play a very important role in carrying out the Sub-Centres, Most of the programmes of Sub-Centres are conducted through the block offices. At the same time, most of the farmers approach the Agricultural Extension Centre at Arrah through block officers. Therefore, the training of Indian officers (block officers) is not like institutional one, but it covers most of the practical aspects based on the local field conditions. Orientation and evaluation of schemes are main subjects of such a type of training.

The training programmes so far conducted are given below:-

(From June '69 to Dec. 1970) (Undeline)

Sl. No.	Date	Duration (days)	No. of participants			Subject
			A.O.	S.M.S. A.E.S.	V.L.W.	
1.	1969. 6	2		5	7	Orientation of the scheme, practice of variety selection and nursery preparation.
2.	1969. 7	3		6	6	Evaluation of the last month's activities, practice of paddy transplanting.
3.	1969. 8	2		6	6	Evaluation, plant protection, water management, top dressing.
4.	1969.11	1		6	6	Evaluation, method of yield test.
5.	1970. 2	3		4	3	Evaluation of Kharif and orientation of Rabi.
6.	1970. 3	1	5	1		Summer paddy orientation and evaluation of Rabi.
7.	1970. 4	1	6	2		Practice of test harvest, evaluation and orientation of Summer paddy.
8.	1970. 5	1	5	3		Annual evaluation, orientation of Kharif.
9.	1970. 6	3		4	2	- do -
10.	1970. 6	1	5	3		- do -
11.	1970. 7	2		9	6	- do - and land preparation, transplanting etc.
12.	1970. 7	1	6	3		- do -
13.	1970. 8	1	6	3		Evaluation of Summer, orientation of Kharif.

Sl. No.	Date	Duration (days)	No. of participants			Subject
			A.O.	S.M.S. A.E.S.	V.L.W.	
14.	1970. 9	1	6	3		Evaluation of Summer, orientation of Kharif.
15.	1970.10	1	6	3		- do -
16.	1970.11	1	6	3		Orientation of Rabi.
17.	1970.11	1		4	5	- do -
18.	1970.12	1	6	3		- do - and evaluation of Kharif.

Total number of persons so far trained is as follows.

1) Agricultural Officer (A.O.) 57
2) Subject Matter Specialist (S.M.S.) 71
3) Village Level Worker (V.L.W.) 41

(6) Demonstration-cum-training field

Recommended cropping pattern has already been mentioned earlier as Kharif-paddy, Rabi-wheat and Summer-paddy. For popularising such a type of cropping pattern amongst farmers in the Sub-Centres, the Agricultural Extension Centre used 54.0 acres belonging to 42 cultivators in total in the year of 1969-70, as demonstration-cum-training field. The Agricultural Extension Centre supplied free fertilizers, free agricultural chemicals, the rest of requirements being met by cultivators (Seeds were supplied by the A.E.C. on cash payment). Similarly in the year of 1970-71, 24 acres of the field belonging to 16 cultivators was being used for the purpose of conducting demonstration plot.

(7) Training of farmers

Training of farmers at the Centre can be divided into two categories:

(1) Training at Sub-Centres:

Farmers training are conducted at the site of demonstration-cum-training plots. This type of training is organized by taking into consideration the local farming conditions. Total number of participants in the 6 Sub-Centres have come to 1,005-1,690 since Kharif 1969, the total gathering being 19,550 - 23,000. The training programmes in the Sub-Centres are standardised as below:

(a) Management of demonstration plots by farmers and the block officers (day time)
(b) Discussion on important aspects of field management.
(c) Distribution of pamphlets (evening time)
(d) Group discussions (evening time)
(e) Interview (evening time)
(f) Film show (one technical and one or two cultural)

(2) The other training is imparted in the farmer's training programmes organized by the Kisan Vidyapith, which is an institutional training centre. About 1,000 farmers in 30 programmes have been trained by the Centre since 1969.

(8) Hiring of agricultural machinery in the Sub-Centres

As it is well known any development or progress in agriculture is not possible only by simple technical guidance. Therefore, the following agricultural machinery are being supplied for assisting farmers in the Sub-Centres on hire basis:-

1) 4-Wheel tractor
2) Power tiller
3) Pumping set
4) Power thresher
5) Chemical control equipment
6) Ensilage cutter

The detailed function of such agricultural machinery is mentioned earlier in the item 3 (on agricultural machinery). Ploughing machinery such as power tiller, 4-wheel tractor have been found very useful for farmers, in view of a very short time available for field preparations due to busy cropping pattern.

(9) Results of activities of Sub-Centres at a glance

1) Comparison of yields

(a) Yield of demonstration plots (in quintal per acre)

Name of Sub-Centre	1969 - 70			1970 - 71	
	Kharif	Rabi	Summer	Kharif	
				H.Y.V.	Imp. V.
1. Dehri (Suara)	17.70	11.30	20.72	15.38	15.10
2. Bikramganj (Durgadih)	32.00	9.30		16.84	14.70
3. Piro (Hasuadih)	12.00	6.50	10.85	19.16	19.47
4. Charpokhari (Garhani)	11.30	11.20	16.30	19.33	14.98
5. Udwantnagar (Piania/ Kasap)	19.40	11.40	-	18.80	16.69
6. Koilwar (Kulharia)	9.60	10.10	11.86	14.11	13.38
Average	17.00	9.97	14.93	17.27	15.65

(b) Average yield of farmers plots in the Sub-Centres

1. Dehri (Suara)	11.40	5.70	18.55	16.61	13.30
2. Bikramganj (Durgadih)	7.20	11.00		18.80	15.12
3. Piro (Hasuadih)	3.00	6.60	13.04	-	-
4. Charpokhari (Garhani)	7.70	7.80	11.80	12.00	9.70
5. *Udwantnagar (Piania/ Kasap)	8.10			16.80	14.28
6. Koilwar (Kulharia)	10.20	5.60	10.56	16.54	10.74
Average	7.93	7.34	13.49	15.99	12.63

(c) Average yield of farmers' plots outside the Sub-Centres

1. Dehri	8.30	-	-	-	-
2. Bikramganj	4.20	-	-	-	-
3. Piro	3.00	5.00	-	-	-

Name of Sub-Centre	1969 - 70 Kharif	Rabi	Summer	1970 - 71 Kharif H.Y.V.	Imp. V.
4. Charpokhari	7.70	4.20	-	-	-
5. Udwantnagar	3.80	-	-	-	-
6. Koilwar	3.60	4.30	-	-	-
Average	5.10	4.50	-	-	-

(d) District average: (From District Office, Annual Report, 1969-70)

1967 - 68	6.75	5.16
1968 - 69	7.92	5.49
1969 - 70	7.94	6.17

Remarks: Variety used in demonstration plots

1969 - 70 Kharif	Rabi	Summer	1970 - 71 Kharif H.Y.V.	Kharif Imp.V.
IR-8	S-227	TN - 1	IR-8	Malinja

2) Areal achievement in Sub-Centers

1969-70

Name of Sub-Centres	Target Area	Kharif H.Y.V.	Kharif Line planting	Rabi H.Y.V.	Rabi Total acreage	Summer H.Y.V.	Summer Total acreage
1. Dehri (Suara)	50.86	43	8.04	41	-	24.00	25.00
2. Bikramganj (Durgadih)	50.70	22	5.00	43	-	-	-
3. Piro (Hasuadih)	50.06	25	1.00	45	-	9.85	19.85
4. Charpokhari (Garhani)	53.30	18	2.20	25	-	7.00	10.00
5. *Udwantnagar (Piania)	50.69	20	1.00	25	-	-	-
6. Koilwar (Kulharia)	49.80	21	2.00	35	-	3.48	3.48
Total	304.41	149	19.24	214	-	44.33	58.33

1970-71

1. Dehri (Suara)	266.00	165.50	-	214	241.00
2. Bikramganj (Durgadih)	50.70	5.00		41	41.00
3. Piro (Hasuadih)	50.06	32.00	-	-	-
4. Charpokhari (Garhani)	53.30	6.00	-	30	35.00
5. *Udwantnagar (Piania/Kasap)	52.24	42.00	-	48	48.00
6. Koilwar (Kulharia)	49.80	25.00	-	40	50.00
Total	522.10	275.50	-	373.00	415.00

Remarks:

* The Piania Sub-Centr- in Udwantnagar block was changed to Kasap from Kharif 1970-71.

x1 not available.

x2 There was no significant difference in yield between line planting and others. Therefore, it was not studied in Kharif 1970.

(10) Some studies on farmers' behaviours in Sub-Centre-

1) Yield of farmers' expectation (by hearing)

Name of block (Village)	Bumper harvest		Not Bumper	
	percentage of farmers	Average expected yield	Percentage of farmers	Average expected yield
1. Dehri (Suara)	43%	1462.5 kg/ac.	57	825.0 kg/ac
2. Bikramganj (Durgadih)	50	1031.3	50	412.5
3. Piro (Hasuadih)	-		100	300.0
4. Charpokhari (Garhani)	-		100	768.8
5. Udwantnagar (Piani)	25	1237.5	75	375.0
6. Koilwar (Kulharia)	18	1687.5	82	363.8

(a) Dehri (Suara) and Charpokhari (Garhani) were observed as high standard Villages.

(b) Most of farmers are not satisfied by a yield of 700 - 800 kg per acre.

(c) The farmers who replied "bumper harvest" are getting more than 1,000 kg/acre of yield.

(d) Therefore, yield of demonstration plots like Piro, Charpokhari and Koilwar must be reconsidered and improved. In other words demonstration plots should show more than 1,000 - 1,200 kg/acre.

2) Relation between land holdings and adoption of IR-8 (1969-70)

class (acre)	No. of farmers (%)	No. of farmers who adopted IR-8 (%)	No. of farmers who did not adopt IR-8 (%)	Total acreage under IR-8 (%)	Percentage of IR-8 to cultivated area
0-- 5	24 (31.2)	5 (6.5)	19 (24.7)	4.80 acre (3.2)	32.0
5--10	29 (37.6)	11 (14.4)	18 (23.4)	23.05 (15.6)	37.7
10--20	12 (15.6)	7 (9.1)	5 (6.4)	12.63 (8.5)	14.4
20--30	7 (9.1)	7 (9.1)	0 (0)	45.37 (30.8)	29.3
30--	5 (6.5)	5 (6.4)	0 (0)	62.00 (41.9)	27.5
Average 77 (100)		35 (45.5)	42 (54.5)	147.85 acre(100)	23.5

(a) 85% of farmers belong to class of land holdings less than 20 acres and 1/3 of these small farmers adopted IR-8.

(b) The acreage of IR-8 adopted by small farmers is 30% of this total cultivated area.

(c) Farmers holding more than 20 acres is 15% in number, but 100% of them adopted IR-8 occupying 70% of total acreage of IR-8.

(d) Therefore, it is clear that the effect of extension works can be seen mostly among big farmers. Majority of farmers holding less than 20 acres are not so enthusiastic in adopting IR-8.

(e) These differences were not due to lack of information.

(f) It was observed that none of farmers introduced IR-8 all in their land.

(g) Most of farmers of all classes introduced IR-8 upto 20 - 30% of their land holdings.

3) Possibility of acceptance of new varieties

This was particularly studied on the variety of Padma in 1969-70 when introduced for the first time.

Possibility of acceptance of new varieties and position of High Yielding Varieties according to Land holdings (Kharif 1969-70 and 1970-71) can be seen from the following.

Land holding (acre)	1969 - 70				1970 - 71			
	Padma		H.Y.V.		Padma		H.Y.V.	
	Acreage	%	Acreage	%	Acreage	%	Acreage	%
0 -- 5	.5	50.0	.5	50.0	0	0	0	0
5 -- 10	.6	8.7	1.5	20.7	0	0	0.5	7.5
10 -- 20	1.1	6.7	2.1	13.1	0.4	2.3	1.8	11.1
20 -- 30	.7	2.8	4.1	16.2	0	0	1.7	6.7
30 --	2.3	5.0	5.8	12.8	0	0	1.0	2.2

(a) The acreage and percentage show a possibility of acceptance of new variety for all types of cultivators.

(b) In the year 1970-71 most of farmers did not adopt the same variety. The small farmers were much more notable than the big farmers in changing their varieties.

4) Distribution of yield of demonstration plots (Padma, Kharif 1969)

It is well known that High Yielding Varieties have high potentiality in yield, but there is much fluctuation in yield, because of its susceptibility to diseases as the table given below shows. In spite of a great care taken by the agriculture department authority, such a fluctuation in yield can not be understood by the small farmers.

Yield (Fresh weight in kg/acre)	Number of farmers	Percentage	Remarks
0	8	13	4-farmers from general
- 200	10	16.9	1 - do -
- 400	2	3.4	
- 600	15	25.4	1 - do -
- 800	7	11.8	1 - do -
-1000	8	13.6	
-1200	3	5.1	
1200-	6	10.2	highest yield 1912 Kgs/acre.

5) Disposal of IR-8 grains

How IR-8 grains is disposed of can be found from the table given below:

Class (acre)	No. of farmers		Completely for selling
	For self consumption	Mostly for selling	
0 -- 5	4	1	0
5 -- 10	7	0	3
10 -- 20	2	2	3
20 -- 30	1	2	5
30 --	0	1	4
Total	14	6	15

As regards the mode of consumption of IR-8, the following observations have been made: -

(a) No. of farmers for self consumption and completely for selling are evenly distributed.

(b) Farmers holding less than 10 acres adopted IR-8 almost for self consumption.

(c) Farmers holding 10 to 20 acres and more adopted IR-8 completely for selling purpose.

6) Number and type of varieties adopted (Kharif 1969 - 70 and 1970 - 71)

How many different varieties farmers are using at present can be found from the table given below: -

Land holding (acres)	Farmer	No. of varieties adopted in 69 - 70		No. of varieties adopted in 70 - 71		No. of varieties adopted in both years	
		H.Y.V.	Others	H.Y.V.	Others	H.Y.V.	Others
0 -- 5	A	1	3	0	4	-	2
	B	2	2	0	3	-	2
5 -- 10	C	1	4	0	3	-	2
	D	2	2	1	3	1	2
	E	1	2	1	4	1	1
	F	2	2	1	3	1	2
	G	2	3	0	4	-	3
	H	2	3	2	3	1	3
	I	1	3	0	3	-	3
	J	2	2	1	3	1	2
10 -- 20	K	2	4	2	3	1*	3
	L	1	2	0	3	-	2
	M	2	3	3	4	1	3
	N	1	4	0	3	-	3
20 -- 30	O	3	5	1	5	-	5
	P	2	4	2	5	1	4
	Q	2	3	0	3	-	2
30 --	R	1	3	0	4	-	2
	S	2	5	1	5	1	4
Average		1.7	3.1	0.8	3.6	0.4	2.6

(a) Due to occurrence of diseases, a set back was seen in the High Yielding Variety Programme. On the other hand Local or Improved Varieties increased.

(b) Most of cultivators grow 4 - 7 varieties every year.

(c) 100% of cultivators keep their own varieties for seeds every year.

7) Popular paddy varieties (Kharif) among farmers

The following table shows the popular varieties amongst farmers at present depending on their land holdings.

Popular Paddy Varieties

Land Holdings (Ac.)	Kalamidan	Katika	Basmati	Br-34	Co29	Dehradoon	T-141	Nagina
0 - 5	1	1	-	-	-	-	-	-
5 - 10	5	5	4	4	1	-	2	-
10 - 20	4	2	3	1	1	-	-	-
20 - 30	2	2	2	2	-	2	-	1
30 --	1	-	2	1	1	1	-	1
Total No. of farmers	13	10	11	8	3	3	2	2

8) Farmers' practices on the application of chemical fertilizers

As per recommendation of the Agriculture Extension Centre as well as the State Department of Agriculture, farmers must apply fertilizers worth Rs. 170-225 per acre for paddy. However, the value of fertilizers which farmers are now practicing are much less than that as found in the table given below:- (Case study of farmers belonging to the Sub-Centres)

1968 - 69						1969 - 70		
Name of Sub-Centres	No.	Varieties	Total paddy acreage	Amount spent on fertilizers in Rs.	Rupees spent per acre	Total paddy acreage	Amount spent on fertilizers in Rs.	Rupees spent per acre
Dehri (Suara)	A	H.Y.V. General	16 3	3,000	157.8	10 10	3,000	150.00
	B	H.Y.V. General	4 2	600	100.0	4.5 2.0	650	100.00
	C	H.Y.V. General	8 0	400	50.0	6.0 2.0	400	50.00
Bikramgan (Durgadih)	D	H.Y.V. General	0 12.5	500	40.0	1.0 11.5	500	40.00
	E	H.Y.V. General	9 6	600	60.0	4.0 7.0	800	72.07
Piro (Hasuadih)	F	H.Y.V. General	50.0 10.0	6,000	100.0	13.0 47.0	6,000	100.00
- do -	G	H.Y.V. General	4 36	800	20.0	- 40.0	800	20.00
	H	H.Y.V. General	17 33	4,000	80.0	5.0 45.0	1,500	30.00
Charpokhari (Garhani)	I	H.Y.V. General	1 3	80	20.0	1.0 2.0	50	17.00
	J	H.Y.V. General	1 4	250	50.0	0.0 5.1	100	40.00
	K	H.Y.V. General	3 4	400	57.0	0.0 7.0	100	14.00
Udwantngar (Kasap)	L	H.Y.V. General	52 11	1,200	20.0	37.0 26.5	1,200	20.00
	M	H.Y.V. General	3 1.5	0	0	0.0 4.5	0	00.00
Koilwar (Kulharia)	N	H.Y.V. General	1 13	700	50.0	1.0 13.0	500	36.00
	O	H.Y.V. General	2 13	600	40.0	0.0 15.0	600	40.00
	P	H.Y.V. General	1.3 11.7	700	53.0	0.0 13.0	800	62.00
	Q	H.Y.V. General	1.0 12.0	500	38.0	0.0 12.0	400	33.00

From the table given in the above the following inference can be drawn:

(a) The majority of farmers are practicing the application of chemical fertilizers.

(b) Farmers in the Tube Well irrigating area are spending more on fertilizers than other farmers, as observed in case of Suara and Hasuadih.

(c) Large farmers are applying more fertilizers than small ones.

(d) There has been no co-relation between the acreage under H.Y.V. and the quantity of fertilizers used per acre.

(e) There has been no farmer who have used fertilizers as per the recommendation.

(f) Most of farmers are spending Rs. 20 - 80 per acre which can be found from the table given below depending on land holdings:

Land holding	Amount spent on fertilizer in Rupees/acre					Remarks
	0	40	80	120	120	
0 -- 5	1	1	1	-	-	Figure shown is the number of cultivators
5 -- 10	-	-	3	-	-	
10 -- 20	-	2	4	-	1	
*20 -- 30	-	-	-	-	-	
30 --	-	2	1	1	-	
Total:	1	5	8	2	1	

* In the case study, farmers holding 20 - 30 acres have not been studied.

Prise of Chemical Fertilizers	
A/S (100 Kgs)	Rs. 55.54
Urea (50 Kgs)	49.54
S.S.P. (100 Kgs)	58.81
M.P. (100 Kgs)	60.59

9) Classification of farmers on the basis of their land holdings

As a result of agricultural extension activities and observations of farmers' behaviours, it was recognized that there were two different categories of farmers:-

(a) Farmers who are able to follow any technical guidances and to improve their farming conditions.

(b) Farmers who are not able to follow any technical guidances due to small holdings and lack of resources.

Farmers belonging to the first category can be said to be objective farmers from the extension point of view, whereas farmers belonging to the second category should be backed up by public sector or others other than technical guidances for their development in the

farming conditions.

The way of extension approach can be made clear by finding out the farmers' conditions in detail, especially as to whether they are those belonging to the category (a) or (b). The following items will be helpful in finding out the farmers' conditions.

(a) Farming resources:
- a) No. of bullocks
- b) No. of ploughs
- c) No. of pumping sets
- d) Tractors and equipment

(b) Willingness for production:
- a) Cash credit requirement
- b) Kind credit requirement

(c) Other financial background:
- a) Excess production for sale
- b) Subsidiary business
- c) No. of families
- d) Educational background

These observations in detail are still in progress.

(11) Distribution of quality seeds

1) Introduction of new varieties of paddy

During the year of 1965, two new varieties of Paddy i.e. Mashuri and Malinja were introduced and multiplied at the main Centre. These two varieties were evolved by crossing Indica and Japanica types of Paddy at Bukit Merah Paddy Experiment Station in Malaya where Japanese Experts had been associating.

2) Parentage

Mashuri: (Taichung 65 x Nayang 80) x Mayang Evis 80

Malinja: Sima 29 x Parifun

These varieties have been kept and examined at the Centre for the last five years. It is found that Mazhuri and Malinja maintain the constant high yielding ability having resistance to pests and diseases. Now at the instance of the State Government the seeds of these varieties are being dispatched to other districts of the State in standard cloth bags 15 kgs, truthfully labelled with package of practice and other desired information.

3) An economical analysis on production of IR-8 and Malinja

Particulars	IR-8	Malinja
Yield per acre (in Paddy)	1,727 Kg	1,565 Kg.
Gross income (per acre)		
From paddy	Rs. 1,120.00	Rs. 1,114.00
From straw	Rs. 103.40	Rs. 187.80
Total:	Rs. 1,223.40	Rs. 1,301.80

Particulars	IR-8	Malinja
Expenditure (per acre)		
For seeds	Rs. 9.00	Rs. 11.30
For fertilizers	Rs. 279.50	Rs. 210.70
For labour and cultivation practices	Rs. 396.70	Rs. 396.70
Total:	Rs. 685.20	Rs. 618.70
Profit:	Rs. 538.20 (100%)	Rs. 683.10 (126.9%)

Remarks: These figures were obtained from the results of demonstrations at the Sub-Centres in Kharif 1970.

IV. VIEWS AND PROPOSITION

Activities of the Centre have been consentrated upon the extension works of improved agricultural techniques for increasing the per acre yield by taking into consideration the local conditions.

This report was prepared based on the results so far obtained aiming at further improvement of the cultivation techniques in the area. For improving the paddy cultivation techniques, trial on planting distance has been given the first priority.

1. PLANTING DISTANCE

(1) Significance of dense planting in paddy cultivation

As already mentioned earlier in the beginning of Article III, paddy transplanting was found very rough in the area. As recommended, the number of hills per square meter should be 44 in case of High Yielding Varieties and 33 in case of improved varieties. No doubt, as the number of hills increases the number of panicles per hill decreases. In case of High Yielding Varieties, because of their short culm or hardness of lodging, dense planting is more effective. However, the present recommended distance of 6" x 6"(15 cm x 15 cm) in case of HYV has been found to be a little inconvenient to carrying out interculture, and so it has been modified to 9" x 4"(23 cm x 10 cm) since Summer 1971 without changing the plant population in the unit area.

(2) Problems of dense planting

1) Dense planting provides congenial atmosphere for the quick transmission of Bacterial Leaf Blight.

2) Dense planting requires more quantity of fertilizers.

3) For dense planting, line planting has been found more convenient. But farmers do not like line planting, because the labour requirement for the purpose is nearly three times in comparison to traditional method of random planting. Moreover, cultivators has not been adequately trained of line planting.

(3) Improvements

Naturally, the problems mentioned above are to be overcome. Some way-outs are given below:

1) There is an urgent need of introducing varieties resistant to Bacterial Leaf Blight disease. There should be a legal restriction on release of varieties. Varieties, before being released to farmers, should be thoroughly tested on resistance to B.L.B. by conducting district level and field level trials.

2) Adequate preventive measures should be taken to reduce the chances of occurrence of B.L.B. For this hot water treatment of seeds (51°C - 1 minutes -- 56°C - 10 minutes -- cold water -- 10-15 minutes) is desirable. Moreover, treatment of TF 130 with irrigation water has also been found effective in the nursery stage. But, the problem is the availability of the chemical. As such, import of TF 130 from Japan may be considered. This treatment can be repeated in the main field also. Treatment at nursery stage is of course easier because of small acreage, as observed by Dr. Wakimoto at the second International Symposium on Plant Pathology and from results of experiment conducted at AICRIP, Hyderabad.

3) Co-relation between planting distance and amount of supplied fertilizers

Next point to be deeply considered is on co-relation between planting distance and amount of supplied fertilizers.

In this regard, a trial has been conducted at the Centre on three elements, response of plant to different elements and different fertilizers. The soil is mainly of clayey loam, the natural supply of nitrogen being very scanty. As such, response of N has been found much more in comparison to P and K. For this purpose trial was conducted on different amount of N i.e. 20, 40, 60, 80 and 120 Kgs. per acre with 25 Kgs. of P_2O_5 and 20 Kgs of K_2O. It was observed that there was a high response to N upto the amount of 60 Kgs per acre but it was slowed down as the amount of N increases more than 60 Kgs. Therefore 60 Kgs. of N per acre has been found most suitable. As regards application of Nitrogenous fertilizers as division, it is recommended that 30% should be applied as base and the rest 70% should be used as top dressing. However, in case of improved varieties, because of long culm, they are likely to lodge after heading, and so the amount of fertilizers should be reconsidered in this case. As plant population increases in the unit area, it is suggested, the more nitrogenous fertilizers should be applied.

At present farmers are being trained on dense planting in the Sub-Centres, may it be in line or random planting, through the demonstration plots.

Although the requirement of transplanting labour is more in line planting, they may be compensated by the greater use of farm machinery in other operations.

As a result of trial conducted at the Centre, it has been made clear that the ploughing capacity of one power tiller is equivalent to 8 bullock powers. Similarly, threshing capacity of automatic thresher is equivalent to 20 bullock powers.

Now the Government of India is also giving a deep consideration for farm mechanisation for betterment of farming conditions. But the small farmers are not in a position to have the farm machinery because of their limited resources. As such, it is suggested that the agricultural machinery should be subsidised and also the custom service organisation should be further strengthened. They are very much useful and helpful for the small farmers in particular.

2. SUGGESTIONS FOR AGRICULTURAL EXTENSION WORKS

As mentioned earlier, the Sub-Centre system was introduced particularly with a view to carrying out the extension works. But some of problems coming in the way are given below.

(1) Demonstrations are being conducted in the Sub-Centers, with a view to having an ideal site for practical training of farmers. As such, the standard of our demonstration plots is supposed to be very high or, in a sense, sophisticated so that they easily attracts the attention of farmers. In case the targeted yield is not obtained in the demonstration plots, the very idea of conducting demonstration plots does not held good. As such, great care is to be taken in the selection of demonstration plots. In this connection, the following factors are to be fully considered.

1) Location of the demonstration plots should be conveniently accessable.
2) Demonstration (participating) farmers should be progressive and enthusiastic ones.
3) There should be adequate irrigation and drainage facilities.

4) Soil should be well suited to the crops.

(2) Practical training has been imparted to farmers at the site of demonstration plots. In fact such training is possible only in day time. But it has been experienced that farmers do not gather at the site of demonstration plots in day time, since they are busy in their own fields. It is necessary to have film show in the night to have farmers gather. Thus training is possible through films, group discussions, and distribution of technical instruction and pamphlets.

(3) Studies carried out in the Sub-Centres reveal that there are two categories of farmers. One category comprise those who are able to receive any technical guidances and to improve their farming conditions whereas another category of farmers are not able to do so because of their small holdings and limited resources. The first category of farmers may be termed as objective farmers from the extension point of view. On the other hand the second category require Government assistance and others before they are able to receive any technical guidances. The second category may adopt guided techniques step by step if they get economic assistance in any form.

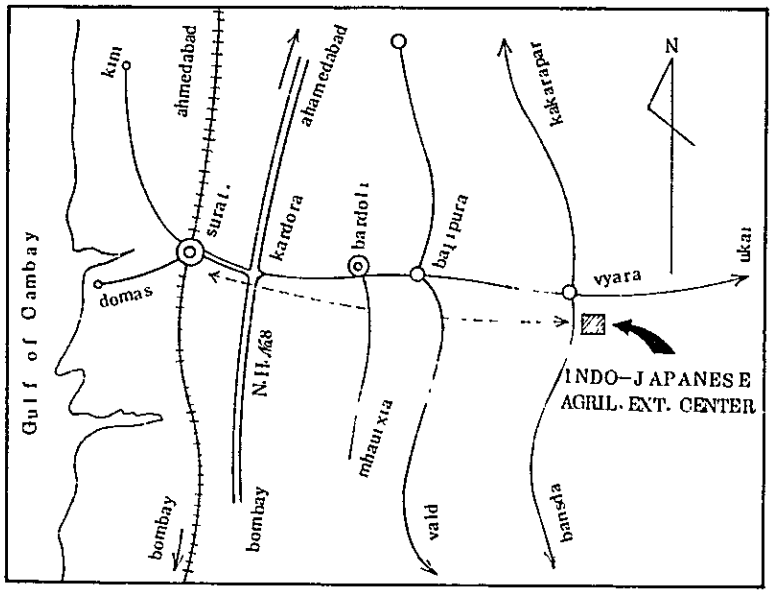
PART II INDO-JAPANESE AGRICULTURAL EXTENSION CENTER AT VYARA IN GUJARAT (JULY 1968 - MARCH 1971)

I. SURROUNDINGS

1. LOCATION

The Indo-Japanese Agricultural Center, called "the Vyara Center", is located at Vyara town, Vyara Taluka, Surat District, Gujarat, which map is shown below in map II-1.

Map II-1 Rough sketch around Vyara



The Center, in the suburbs of Surat City, is in latitude 20°10'N and longitude 72°20'E, 83.7 meters above the sea and lies about 80 kilometers east of the coast of Gulf of Cambay as the crow flies and 61 kilometers east of Surat City. Trains and buses are served between Surat and Vyara. It is about 1.5 kilometers far from the railway station of Vyara.

2. WEATHER CONDITIONS

There are two distinct seasons, rainy season from June to September and dry season from October to May. Annual average rainfall is about 1,500 millimeters, almost all of which are of two month's rainfall in July and August. Taking Surat district as a whole rainfall is ranging from 750 to 1650 millimeters, and it is generally less and less as going up north. Surat district is the southern extremity of Gujarat and the most rainy area in the State. Accordingly Surat is the typical rice producing district in the State.

The temperature is highest in summer season from March to May, especially April and May when it rises more than 45°C several days. In Kharif season from June to September, there

are many rainy days which result in little sunshine, low temperature which is going down to 30°C at the highest and the narrowest range of difference between the maximum and minimum temperature. It is in Rabi season from December to January when the temperature is lowest, going down to 3-5°C but no frost falls.

Rice is grown normally once a year, preparing seed-bed and sowing just after the first rainfall in June and transplanting in July. These earing and flowering are toward the end of the rainy season and harvesting is done in the dry season. Such a rice cultivation is accorded with natural phenomena.

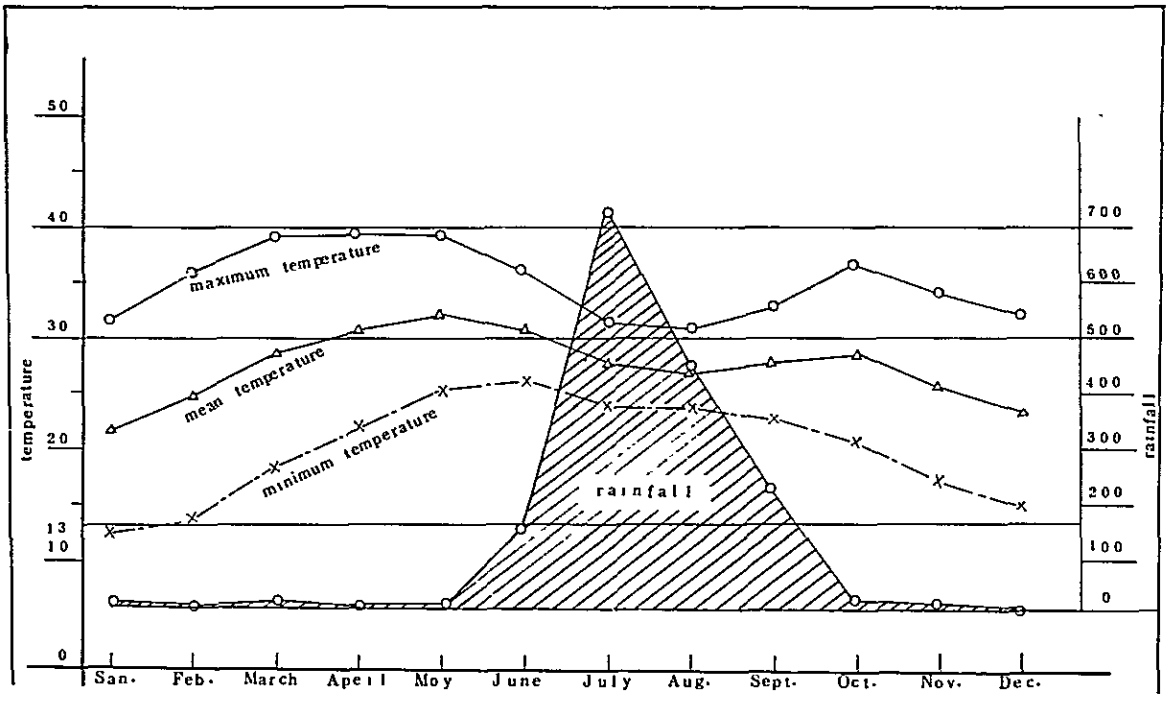
In rainfed areas, damages by drought is seen once in a few years. Damages by rainfall as being washed away due to flood can be hardly seen, but damages by damp to unland crops are not so few. Damages by temperature can be hardly seen in the case of Kharif paddy, but in the case of twice and three time rice culture, some of Rabi paddy which are earing and flowering during the period from the middle of December to the beginning of January are suffering from sterility due to low temperature. Some of summer paddy which are earing and flowering in April and May are also sterilized due to high temperature with hot winds. These are bottle-necks in extending twice and three time rice culture in future. In other words, introduction of multi-time rice culture to the area depends on how to remove such bottle-necks.

Figures on weather conditions are shown below in table II-1 and Chart II-1.

Table II-1 Figures on weather conditions (five years average from 1964 to 1968)

Month	Mean Temp.	Max. Temp.	Min. Temp.	Rainfall millimeters	Rainy day
Jan.	21.5°C	31.1°C	11.8°C	1.6	0.5 days
Feb.	24.3	35.2	13.4	0.	0
March	28.1	38.4	17.8	4.3	0.7
April	30.4	39.6	21.2	0	0
May	32.0	39.4	24.6	2.5	0.5
June	30.7	35.8	25.5	149.4	10.1
July	27.4	31.3	23.5	719.3	24.4
Aug.	26.8	30.6	23.1	433.3	26.6
Sept.	27.5	32.6	22.4	220.9	12.2
Oct.	28.6	36.7	20.5	19.7	0.8
Nov.	25.4	33.8	17.0	10.3	1.2
Dec.	23.3	31.7	14.8	5.3	0.6

Chart II-1 Diagram on Table II-1



3. AGRICULTURAL SITUATION

In Surat district including Bulsar, which district was separated from Surat in 1965, farming population are about 1.9 millions which percentage to the total population (about 2.5 millions) is 75 percent as shown in Table II-2.

As regards land holding, as shown in Table II-3, about 65 percent in number are small farmers ranging from 0 to 5 acres who own only 20 percent in acreage. Medium farmers holding from 6 to 15 acres are 25 percent in number and also in acreage. Large farmers owning more than 20 acres are only 12 percent in number but more than 50 percent in acreage. Looking at the land holding from the point of view of land ownership, as seen in Table II-4, land owners account for 55 percent, tenant is 20 percent, landless labourers 23 percent and non-resident land owners 1.5 percent.

In Gujarat, as found from Table II-5, paddy crop is given only 7 percent of weight to all crops due to unfavourable weather conditions for paddy, but taking Surat district as a whole, weight of paddy goes up to 25 percent, which is almost the same weight as that of all Indian average. As the Ukai dam is developed, paddy will be more and more important crop in Surat in near future.

The State of Gujarat belonged to the State of Bombay which was divided into two states, Gujarat and Maharashtra, in 1960. As the main rice producing areas in the State of Bombay were in southern part of the State which is now all in Maharashtra, rice research institutes in Gujarat have been operating only for ten years, and so it can be said that rice cultivation in

Gujarat has been behind in other states. In the circumstances, paddy yield per unit is rather low. However there is much potentiality for increase of the yield as the integrated extension works are taken up in future. In the area, it is sure to bring the entire agricultural development by making more efforts to increase paddy production.

Table II-2 Population of Surat district (1961)

Population	2,451,624
Rural Population	1,909,429
Urban Population	542,195

Table II-3 Land holdings in Surat district (1961)

Size of Holding	No. of Holders	% to Total	Holding Area	% to Total
0 -- 5 ac.	144,986	64.4	315,518	19.3
6 -- 15	52,470	23.3	410,785	25.0
16 -- 25	16,308	7.3	297,538	18.1
26 -- 100	10,318	4.6	416,892	25.5
101 -- 500	870	0.4	179,118	10.9
501 --	26	0.01	20,269	1.2

Table II-4 Livelihood pattern in Surat District

	Population
1. Agricultural Sources	1,215,360
1) Cultivators of land wholly or mainly owned and their dependents.	673,711
2) Cultivators of land wholly or mainly unowned and their dependents	238,840
3) Cultivating labourers and their dependents	284,687
4) Non-cultivating owners of land, agri. rent receivers and their dependents	18,122
2. Non Agricultural Sources	739,265

Table II-5 Area under cultivation

Crops	Gujarat State		Surat District	
	Cultivation Area	%	Cultivation Area	%
Rice	1,280,000	6.9	329,362	25.0
Jowar	3,320,000	17.9	255,081	19.8
Bajiri	750,000	5.1	3,926	0.2
Maize	550,000	2.9	579	-
Ragi	160,000	0.8	64,874	4.9
Wheat	1,030,000	5.5	28,310	2.1
Gram	250,000	1.3	11,280	0.8
Tur	210,000	1.1	50,881	3.8
Sugar Cane	50,000	0.2	9,170	0.6
Chillies	50,000	0.2	6,071	0.4
Potato (Sweet)	10,000	-	64	-
Groundnut	4,560,000	24.6	85,413	6.4
Sesamun	250,000	1.3	1,440	0.1
Castor	160,000	0.8	8,731	0.6
Rape, Mustared	80,000	0.4	132	-
Cotton	4,170,000	22.5	396,629	30.1
Tabacco	190,000	1.0	249	-
Other Crops	1,220,000	6.5	64,040	4.8
Total	18,490,000	100	1,316,212	100

4. LOCAL RICE CULTIVATION TECHNIQUES

At present almost all of farmers in the area are using paddy seeds domestically produced produced on their own farms only by doing wind selection, and brine assortment can be hardly seen in the area. They are preparing "nursery bed" in "roderwald" which can be called "semi-irrigated nursery bed". That is to say, they are selecting plots pre-arranged for nursery bed out of paddy fields, and putting straws, fallen leaves and twigs on the fields and then setting fire to them. After all things are reduced to ashes, they are ploughing and preparing soil, and then sowing. They are applying a little ammonium sulphate twice in two weeks after sowing. Phosphate and Potassic fertilizers are not applied, although ashes include a little Phosphatic and Potassic element. Assured water has been changing that into "irrigated nursery bed".

Quantity of seeds to nursery bed is generally more than enough. This thick sowing and also ill-balanced application of fertilizers bring up poor infant rice plants, as a result of which about ten nursery plants per hill are required for transplantation. A long duration in nursery bed and deep planting are causes of low yield, being poor in tillering.

Transplanting is usually done at random. Even though the regular row planting is adopted, weeding machinery are not used. Only when much weed is seen, weed control is done with manual labour or with wasted tin boxes in few cases. Paddy fields are ploughed with two bullocks just after harvesting, considering heavy soil. In rainfed areas bunds are reinforced in the dry season for keeping water by piling up the soil on the bunds. In the beginning of monsoon all farmers are completing the preparation of works like fertilizer application and puddling so as to do them just after the first rainfall. The fertilizer application is generally done only with organic manure like compost and only sulphate ammonium and little Phosphatic fertilizers even in the case of using chemical fertilizers. In any cases Potassic fertilizers are not applied. Water management is poor. The threshing are done by hammering paddy with the wooden board

and selecting by wind. These are local techniques used for rice cultivation. These techniques are much behind the improved practices.

Recently High Yielding Varieties (HYV) are being introduced, local varieties which accounted for 80 percent a few years ago being replaced, decreasing to about 40 percent. The average yield per acre is about 1.5 tons in the irrigated area and 0.5 tons in the rain fed acreas. These can be increased in future by adopting improved cultivation practices. Yield per acre of major crops are shown below in Table II-6 and II-7.

Table II-6 Yield per acre of major crops in Gujarat

Crops	1949 - 50	1954 - 55	1959 - 60	1963 - 64	1965 - 66
Rice	249	297	336	378	198
Jowar	87	100	83	123	102
Bajiri	111	122	78	220	189
Wheat	230	414	225	357	432

Table II-7 Yield per acre of major crops in Surat District (1963 - 64)

Rice	538	Gram	208
Wheat	270	Tur	258
Jowar	325	Lab-Lab	224

II. FUNCTION AND OPERATION

1. AIM OF ACTIVITIES

In a word the aim for operating the Centre is to contribute to the increase in rice production of the area under the Indo-Japanese technical cooperation.

For this purpose practical trials relating to cultivation, soil and fertilizer and agricultural machinery, which are main factors for increasing the production, are conducted in the Center, and their results are extended to farmers. Simultaneously training of Indian technicians and farmers are also conducted.

2. ORGANIZATION

(1) Staff

1) Japanese Experts

Mr. K. Morita	Chief Adviser-cum-Agronomist
Mr. M. Chiba	Soil and Fertilizer Expert
Mr. Y. Okano	Agricultural Machinery Expert

All arrived at the Centre on July 2, 1968.

2) Indian Staff

Mr. N.K. Vanjaria	Assist. Plant Breeder
Mr. T.B. Patel	Administrative Officer
Mr. S.O. Patel	Agricultural Superviser
Mr. J.A. Surkhi	Agricultural Assistant
Mr. D.M. Desai	Agricultural Assistant
Mr. F.C. Patel	Mechanic
Mr. U.A. Bhawsar	Senior Clerk cum Store Keeper
Mr. S.A. Vanker	Junior Clerk cum typist
Mr. C.B. Naiker	Driver
Mr. R.S. Dwodia	Peon
Mr. T.N. Camit	Counter-Mukadam

(2) Materials

(Placement of these materials is shown in Map II-2.)

1) Buildings

(a)	office	83.0 m^2
(b)	garage	108.0
(c)	machinery sheds	535.0
(d)	repairing shop	25.9
(e)	shed for fuel	9.0
(f)	fertilizer shed	28.8
(g)	misc. shed	28.8
(h)	outhouse	43.2
(i)	bungalow	480.0
(j)	hostel for trainees	138.7
	Total	1,480.4

2) Site 2.87 ha

3) Total fields 5.92

Paddy fields 5.12

4) Machinery and equipment

	Name of Machinery and equipment (for cultivation)	1962 to 1968	1969 to 1971	Total
1.	KMB 200 power tiller	6	15	21
2.	Garden tractor	2	-	2
3.	4 wheel tractor	2	-	2
4.	Gasoline engine	2	-	2
5.	Kerosin engine	2	-	2
6.	Power sprayer	4	6	10
7.	Mist duster	6	29	35
8.	Sprayer manual	11	3	14
9.	Breat hand duster	6	2	8
10.	Motor scootar & Motor Bicycle	3	-	3
11.	Bicycle	4	2	6
12.	Rear car & Push car	5	6	11
13.	Power thresher Automatic	4	8	12
14.	Power thresher semi auto	3	15	18
15.	Rice huller	1	-	1
16.	Rice polishing machine combine	1	1	2
17.	Winnover	2	16	18
18.	Rope making machine	1	2	3
19.	Straw softening machine	1	-	1
20.	Ensilige cutter	1	0	10
21.	Straw cutter	-	1	1
22.	Cutter manual	1	-	1
23.	Vertical pump	2	2	4
24.	Centrifugal pump	7	2	9
25.	Yanmar diesel engine	3	-	3
26.	Mitsubishi motor	1	-	1
27.	Draft animal plough	16	-	16
28.	Draft animal leveler	5	-	5
29.	Draft animal harrow	6	-	6
30.	Draft animal rake	5	-	5
31.	Draft animal hoe	3	-	3
32.	Draft animal cultivator	4	-	4
33.	Sprinkler	1	-	1
34.	Sickle	324	200	524
35.	Hoe	22	29	51
36.	Shovel	20	5	25
37.	Fork	11	10	21
38.	Garden rake	10	10	20
39.	Garden hoe	10	-	10
40.	Toyota jeep	1	1	2
41.	Toyota car	1	-	1
42.	Toyota truck	-	1	1
43.	Foot t hresher	1	-	1
44.	Weeder	34	230	264

45.	Hand sprayer	1	-	1
46.	Small engine petrol	1	-	1
47.	Diesel engine	1	6	7
48.	Double range harrow	1	-	1
49.	Reaper H.K.	1	-	1
50.	Air circulating grain dryer	1	-	1
51.	Straw mat making machine	1	-	1
52.	Noodle making machine	1	-	1
53.	Reaper	1	-	1
54.	Paddy field seeder manual	1	-	1
55.	Rat poison sprayer pump	5	-	5
56.	Auto scattering machine	5	-	5
57.	Pick axes	10	-	10
58.	Hand granual pump	-	10	10
59.	Harvester machine	-	1	1
60.	Power rice transplanter	-	2	2
61.	Huller & polishing machine	2	1	3
62.	Thresher	1	10	11

Remarks: These are all provided by the Government of Japan.

List of experimental and audio visual equipment

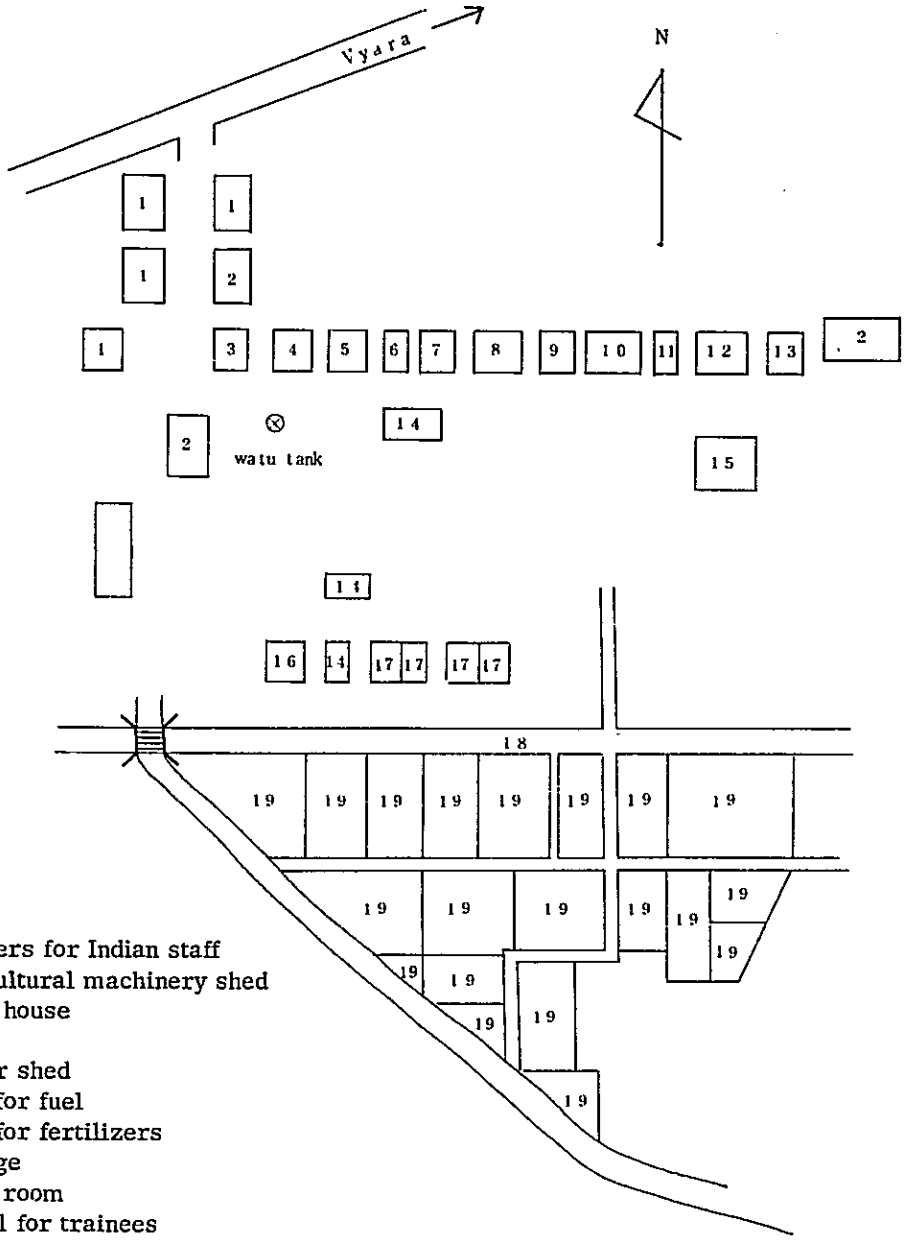
	(for experiment and audio visual aids)	1962-68	1969-71	Total
1.	Tape measure	1	2	3
2.	Stop watch	1	2	3
3.	Soil tester	2	2	4
4.	Soil testing stick	2	2	4
5.	Standard book on soil colour	2	2	4
6.	Counting machine	1	-	1
7.	Crop nutrient tester	1	1	2
8.	Hygrometer	1	10	11
9.	Thermometer	1	-	1
10.	Pluviometer	1	1	2
11.	Numbering machine	1	-	1
12.	Slide rule	1	-	1
13.	Compass with tripod	1	-	1
14.	Hand level	1	-	1
15.	Mess cylinder			
	1 mℓ	2	1	3
	500	2	2	4
	100	2	4	6
16.	Pippets			
	25	2	10	12
	10	2	10	12
	5	2	5	7
17.	Screen for meteorological observation	1	1	2
18.	Air conditioner	1	-	1
19.	Refrigerator	1	-	1
20.	Book shelf	1	-	1
21.	Hand loud speaker	1	1	2
22.	Camera with tripod	1	1	2

23.	Tape recorder	1	-	1
24.	Projector (slide)	1	1	2
25.	Calculator	1	1	2
26.	Typewriter	1	1	2
27.	Mimeograph set	1	1	2
28.	DPE set	1	-	1
29.	Screen	1	1	2
30.	Movie camera 8mm	1	-	1
31.	Projector for 8 mm	1	-	1
32.	Projector for 16 mm	1	1	2
33.	Recopier set	-	1	1
34.	Soroban (abacus)	2	-	2
35.	Watch for dark room	-	1	1
36.	Numbering machine	-	1	1
37.	Scale for ear	2	2	4
38.	Scale for hill	2	2	4
39.	Balance	2	2	4
40.	Bamboo measure	-	5	5
41.	Max. and min. thermometer	-	2	2
42.	Subterraneous thermometer	-	40	40
43.	Hand ph meter	-	1	1
44.	Hand EH meter	-	1	1
45.	Hand FE2 meter	-	1	1
46.	P.H. meter	-	1	1
47.	Concussion equipment	-	1	1
48.	Vacuum pump	-	1	1
49.	Iron	-	1	1
50.	Distiller	-	1	1
51.	Balance for chemicals	-	1	1
52.	Ammonium fixer	-	1	1
53.	All nitrogen fixer	-	1	1
54.	Titration equipment	-	1	1
55.	Water permeability equipment	-	1	1
56.	Root tester	-	1	1
57.	Test tube	-	50	50
58.	Test tube stand	-	2	2
59.	Reagent bottle			
	250	-	25	25
	500	-	10	10
	1000	-	5	5
	2000	-	5	5
60.	Polyethylene washer	-	2	2
61.	Polyethylen reagent bottle	-	2	2
62.	Beakers	-	80	80
63.	Pippet analysis equipment	-	1	1
64.	Rice and wheat moisture tester	-	1	1
65.	Mess flask 50	-	10	10
	100	-	10	10
	250	-	20	20
	500	-	10	10
66.	Triangular flask	-	25	25
67.	Desiccator	-	4	4
68.	Wagner pot (magnetic)	-	25	25
69.	Microscope	-	1	1
70.	Auto anemometer	-	1	1

71.	Auto thermometer	-	1	1
72.	Auto hygrometer	-	1	1
73.	Auto heliograph sunshine recorder	-	1	1
74.	Auto actionmeter	-	1	1
75.	First aid kit	-	1	1
76.	Watch type micrometer	-	1	1
77.	Torsion balance	-	1	1
78.	Wagner pot	-	25	25
79.	Electric drier	-	1	1
80.	Gauntlet for rock hammer test	-	1	1
81.	Pans	-	1	1
82.	Soil collector tube	-	1	1
83.	Tin plate bat for drying grains	--	100	100
84.	Tension meter	-	8	8

Remarks: The above are all provided by the Government of Japan.

Map II-2 Placement of materials in the Center

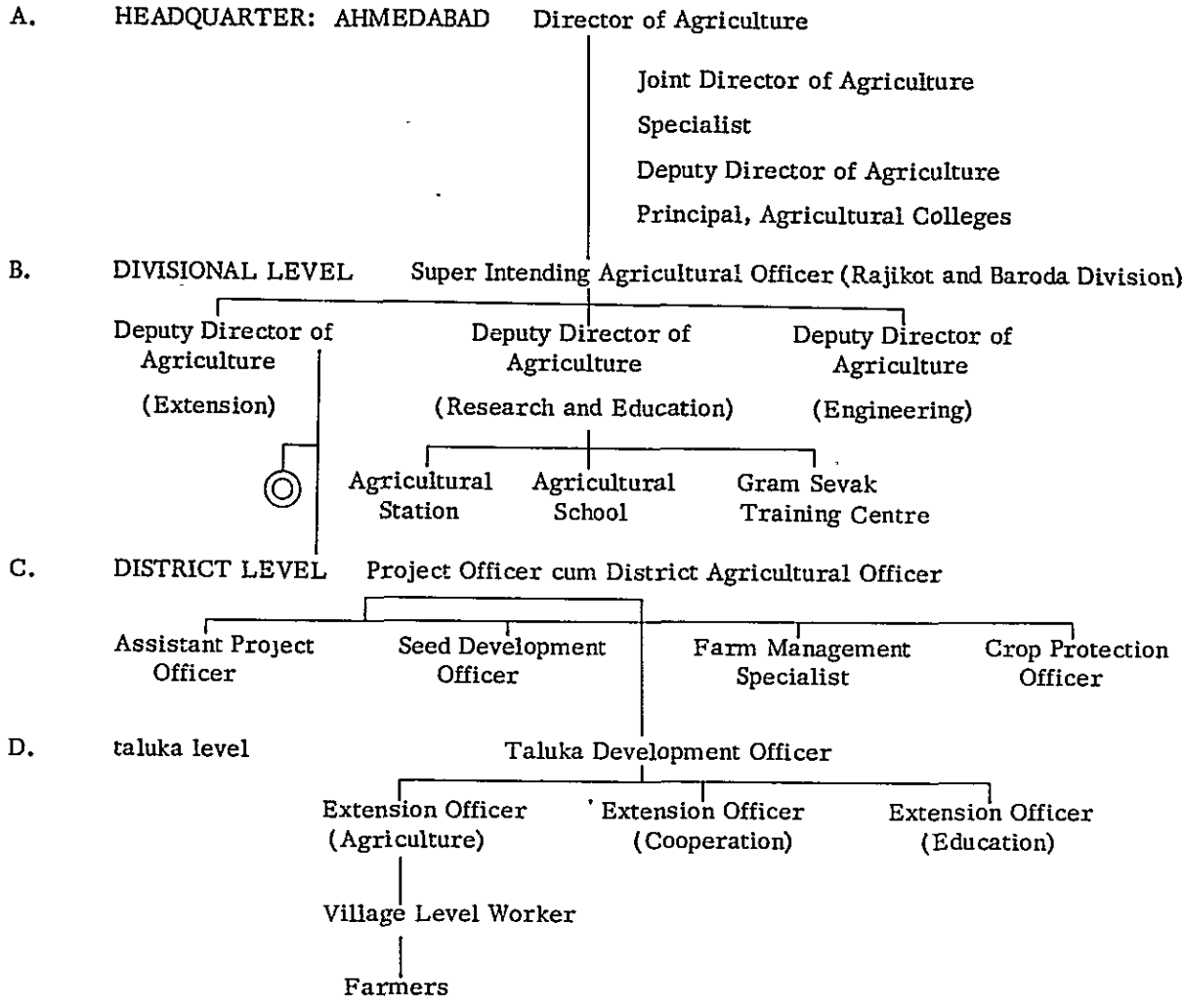


1. quarters for Indian staff
2. agricultural machinery shed
3. store house
4. office
5. repair shed
6. shed for fuel
7. shed for fertilizers
8. storage
9. batch room
10. hostel for trainees
11. cloakroom
12. drying room
13. poultry house
14. garage
15. quarters for employees
16. lecture hall
17. quarters for Japanese experts
18. main canal
19. field

(3) Position of the Centre in the State Government

The Centre belongs to the office of Director of Agriculture. Its position is shown below in Chart II-2.

Chart II-2. Position of the Centre



◎ Indo-Japanese Agricultural Extension Centre, Vyara

3. OPERATION

Firstly various trials on varieties, cultivation methods, soil and fertilizer, agricultural machinery are conducted in the Centre, and simultaneously training of extension officers and farmers are imparted.

Secondly, the results obtained in the Centre are experimented at area-wise demonstration trial plots, 8 plots in the irrigated area, 3 plots in the rainfed areas and 1 plot in the saline area, especially on varieties and three elements of fertilizer, which are also functioning as demonstration plots on varieties and cultivation methods to technicians and farmers, and also as base of extension works on Agricultural machinery. These demonstration trial plots are operated by the village level workers (VLW) who have been already trained in the Centre for the period of four months during summer season. These VLW are expected to get more knowledge and data on the techniques through their own experiences at the demonstration trial plots.

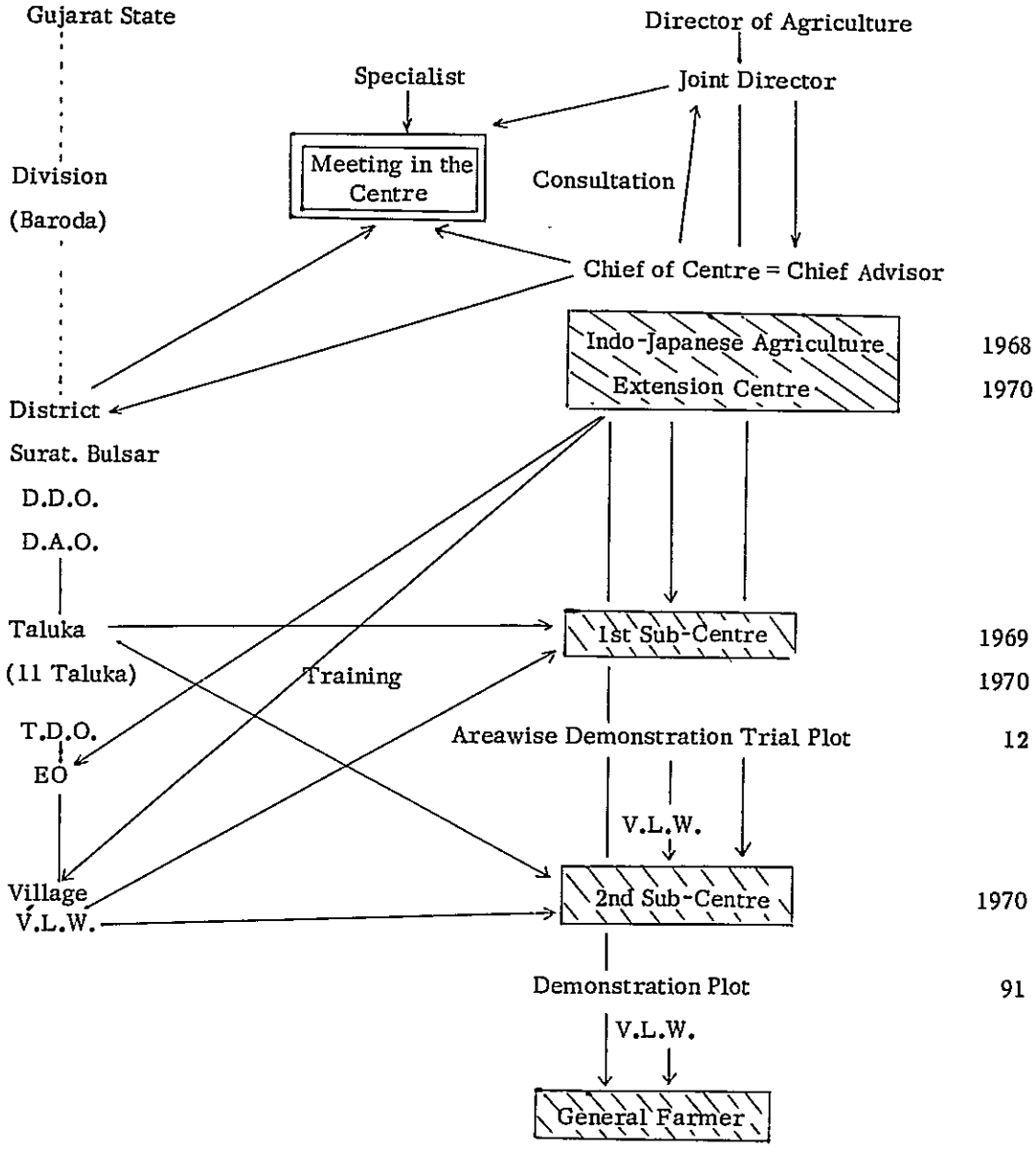
Thirdly, based on the results obtained through the above, the improved cultivation practices are demonstrated by setting up demonstration plots in 90 towns and villages. These demonstration plots are also mainly operated by VLW who have been already trained at the Center and in a few cases by VLWs who have not been trained in the Centres but trained in the demonstration trial plots. By collecting all data through the trials in the Centre, demonstration trial plots, demonstration plots, area-wise cultivation standard is to be established for useful guidance of extension works by VLW. This will be completed in 1972.

The great emphasis is also given to the training programmes of VLW at the Centre. It is, needless to say, because VLW themselves are getting in touch directly with farmers through their extension works on improved cultivation practices.

Annual operational plan on extension works are drawn up after Japanese and Indian authorities concerned are consulting with one another. This consultation is usually held two to three months before kharif season.

The chart on operation of the Centre is shown below in Chart II-3.

Chart II-3 Operation of the Centre



III. ACTIVITIES AND RESULTS

1. TRIALS IN THE CENTRE AND THEIR RESULTS

(1) KHARIF 1969

1) Preliminary trial on varietal yielding ability.

(trial method)

sowing to nursery bed	:	June 19
transplanting	:	July 15
number of varieties used including IRRI-29	:	17
planting distance	:	30 x 15 cm
number of nursery plants per hill	:	3
fertilizer application	:	N 100 Kg/ha P_2O_5 60 K_2O 60
one plot	:	18 m^2

(two plots were used for the same variety)

(result)

After analysing the results of the trial, B-47-15 were found best to be included in trial on varietal yielding ability.

2) Trial on varietal yielding ability.

(trial method)

Number of varieties used including Formosa-3	:	11
fertilizer application		
light application plot	:	N 50 kg/ha P_2O_5 30 K_2O 30
medium application plot	:	N 100 P_2O_5 60 K_2O 60
heavy application plot	:	N 150 P_2O_5 90 K_2O 90

The other conditions were the same as those mentioned in (1) above.

(result)

Yield of IRRI-8 was highest in all plots, followed by Mashuri. IRRI-52 was inferior in yield to IRRI-8. A local variety of Kada 176-12 was highest in yield in the light

application plots, but, in the medium and heavy application plots, it was lodged and its yield was less than those in light application plots. Z-31 showed the same result as Kada 176-12. These results were consistent with those obtained at the area-wise demonstration trial plots. In the circumstances local varieties are generally poor in fertilizer tolerability and disease resistance. As the amount of supplied fertilizers is increasing they will be replaced by HYV.

Jaya and Padma were also found good varieties which were included as a testing variety in the area-wise demonstration trial plots in 1970.

3) Trial on adaptability of Japanese varieties.

(trial method)

number of varieties used including Koshihikari : 8

The others were the same as those mentioned in (2) above.

(result)

Nakate-Shinsenbon, Honenwase and Tachiminori were found good. Although yields of these varieties were less than Formosa-3 and other HYV, growing duration was shorter, and fertilizer tolerability and disease resistance were better. Therefore, these might be good varieties in rainfed areas, especially in scarce rainfall areas.

4) Trial on relationship between quantity of seeds to nursery bed and number of nursery plants per hill, and amount of supplied fertilizers.

(trial method)

variety used	:	Formosa-3
planting distance	:	30 x 15 cm
quantity of seeds	:	0.18 ℓ per 3.3 m^2
number of nursery plants per hill	:	1
quantity of seeds	:	0.54 ℓ per 3.3 m^2
number of nursery plants per hill	:	1, 2, 3, & 5
quantity of seeds	:	1.62 ℓ per 3.3 m^2
number of nursery plants per hill	:	3, 5 and 7

These plots were combined with light, medium and heavy application of fertilizers.

(result)

Plot of 0.54 ℓ of seeds with 5 nursery plants per hill brought the highest yield in all the plots regardless of amount of supplied fertilizers, 6 percent more in yield than standard plot which planting distance was 30 x 15 cm and number of nursery plants per hill was 3.

5) Trial on relationship between number of hills per square meter in the fields and amount of supplied fertilizers.

(trial method)

varieties used	:	Formosa-3 and Mashuri
number of nursery plants per hill	:	3
planting distance	;	25 x 11 cm (36.4 hills/m^2) 25 x 13 cm (30.8) 30 x 10 cm (33.3) 30 x 12 cm (27.8) 30 x 15 cm (22.2) standard 25 x 15 cm (26.7) 25 x 20 cm (20.0) 25 x 22 cm (18.2) 30 x 20 cm (16.7) 25 x 25 cm (16.0) 27 x 27 cm (13.7) 30 x 30 cm (11.1)

These plots were also combined with light, medium and heavy application of fertilizers.

(result)

Formosa 3 showed that the more in number of hills per square meters, the higher in yield, and plots of 25 x 11 cm (36.4 hills/m^2) brought the highest yield regardless of amount of supplied fertilizers, 10 - 20 per cent more in yield than standard plots. On the other hand, Mushuri, which has long culm, was less in yield in plots of 25 x 11 cm than in standard plots in case of medium and heavy application of fertilizers although it is the same as Formosa-3 in case of light application of fertilizer that the more in number of hills, the higher in yield, 7 per cent more in yield than standard plot.

Yields of both varieties increased without exception in case of plots of a little wider planting distance than standard, that is 25 x 15 cm (26.7 hills/m^2). Considering such results, the present standard of planting distance adopted in the Center that is 30 x 15 cm has to be changed into 25 x 15 cm.

6) Trial on three time rice culture (the first crop)

(trial method)

variety used	:	Formosa-3
sowing to nursery bed	:	June 19
transplanting	:	July 14
planting distance	:	30 x 15 cm
number of nursery plants per hill	:	3

These were combined with compost application (10 tons per hectare) and no compost, and also with light, medium and heavy application of fertilizers. One plot is 36 square meters. The same combination were arranged in two plots.

(result)

In every plot of different amount of supplied fertilizers, plots with compost had better yield than plots without compost. The highest yield was 8.356 tons per ha in plots with compost and heavy application of fertilizers.

7) Trial on optimum amount of supplied fertilizers to nursery bed.

(trial method)

Variety used : Formosa-3

Other arrangements were as follows:

Plot	N base	N additional I	N additional II	P_2O_5	K_2O
	gram per sq. meters				
light application of fertilizers	4.8	1.6	1.6	10.0	10.0
medium application of fertilizers	9.0	3.0	3.0	15.0	15.0
heavy application of fertilizers	18.0	6.0	6.0	30.0	30.0
local practice	20.3	12.3	14.4	14.4	30.0

Remarks: The amount of supplied fertilizers in case of local practice was obtained by the Indo-Japanese Demonstration Farm at Vyara which had been for 5 years from 1962 to 1967.

Nursery plants grown in the above plots were transplanted to the paddy field plots, 15 sq. meters each, combined with light, medium and heavy application of fertilizers.

(result)

Nursery plants in the plots of medium application of fertilizers to nursery bed had the best yield, being followed by those in the plots of light application of fertilizers. It can be said, therefore, that optimum amount of supplied fertilizers to nursery bed on N, P_2O_5 and K_2O is about 15 grams each per square meters.

8) Trial on three elements of fertilizers

(trial method)

variety : Formosa-3

Other arrangements were as follows:

Plot	N			P_2O_5	K_2O
	base	additional			
		I	II		
nil	0	0	0	0	0
no-N	0	0	0	100	100
no-P_2O_5	50	25	25	0	100
no-K_2O	50	25	25	100	0
three-elements	50	25	25	100	100

One plot was 30 square meters. The same combinational arrangements were made in two plots.

(result)

The plots of three elements produced 5.888 tons of paddy per hectare. Taking this yield as 100, that of no-K_2O was 99, no-P_2O_5 97, no-N 41 and nil 40. It can be found that the amount of natural supply of K_2O_5 is plenty, but that of N is very scarce.

9) Trial on optimum amount of three elements of fertilizers

(trial method)

variety used : Formosa-3

amount of supplied fertilizers

N	P_2O_5	K_2O
60	20	20
90	40	40
120	60	60
150	90	90
180	120	120
210	150	150

Remarks: In finding optimum amount of one of three elements, the amount of other two elements was fixed at 100 kilograms per hectare. For example, in finding optimum amount of N fertilizers, the amount of P_2O_5 and K_2O were 100 kilograms per hectare respectively.

One plot was 30 square meters. The same combinational arrangements were made in two plots.

(result)

The highest yield was seen in the plots of 150 kilograms in case of N, 90 in case of P_2O_5 and 90 in case of K_2O. These are, in other words, the maximum amount of each of elements to be applied.

10) Trial on comparison of fertilizing effect among N fertilizers.

(trial method)

variety used : Formosa-3

fertilizers : ammonium sulphate, urea, diammonium phosphate, sulphate ammonium phosphate

amount of supplied fertilizers : base 50 kg/ha
additional I 25
additional II 25

(80 kg/ha of each of P_2O_5 and K_2O were also applied)

Remarks: Additional I of fertilizers were applied at tillering period (15 days after transplanting), and additional II were done at very young head forming period.

One plot was 30 square meters. The same combinational arrangements were made in two plots.

(result)

The yield was 5.037 tonns in plots of ammonium sulphate, 4.962 in plots of urea, 4.592 in plots of sulphate ammonium phosphate and 3.925 in plots of diammonium phosphate.

11) Trial on time of division application of ammonium sulphate

(trial method)

variety used : Formosa-3

Other arrangements were as follows:

Plot		base	N additional I	II	III
1. All as base		120 kg/ha	0	0	0
2. three time application	A	72	24	24	0
3. - do -	B	24	72	24	0
4. - do -	C	24	24	72	0
5. four time application	A	48	24	24	24
6. - do -	B	24	24	48	24

Remarks: 96 kg/ha of each of P_2O_5 and K_2O were also applied.

One plot was 30 square meters. The same combinational arrangements were made in two plots.

(result)

Yield of plots of all as base was lower than that of any other plots, among which plots of three time application (A) and four time application (A) had better results

in yield. It can be said more effective to apply half of N-fertilizers as base, applying the rest as two or three time division application.

12) Trial on effect of compost application

(trial method)

variety used : Formosa-3

plots of nil, 5, 10, 30 tons of compost were arranged.

One plot was 30 square meters. The same combinational arrangements were in two plots.

(result)

This trial did not bring about the clear results as to whether compost application is effective in increasing production. Therefore it was decided to find it later by trying again.

13) Trial on selection of varieties at the area-wise demonstration trial plots

(trial method)

The trial was conducted at 10 plots, 7 in irrigated areas, 2 in rainfed areas and 1 in saline area. Number of varieties used were 5 including IRRI-8 in irrigated areas, 9 including honenwase in rainfed areas and 10 including Bhura Rata in Saline area, being combined with light, medium and heavy application of fertilizers. One plot was 288 square meters with planting distance of 24 x 12 cm, and the same combinational arrangements were made in two plots.

(result)

IRRI-8 and Mashuri were found good varieties bringing high yields in irrigated areas, while Honenwase and Taichiminori in rainfed areas, and Bhura Rata and C-1032 in saline area were good in their respective area. Z-31 and Kada 176-12 were good in case of light application of fertilizers, but as the amount of supplied fertilizers increased, they lodged and their yields were lower than those in case of light application.

14) Trial on three elements of fertilizers at the areawise demonstration trial plots

(trial method)

Formosa-3 was used. Plots of no-fertilizer, no-N, no-P_2O_5, no-K_2O and three elements were arranged and, if applied, the amount of each of elements were 100 kg/ha. One plot was 60 square meters.

(result)

It was found that regions could be divided into two. One is regions where natural supply of N was least, followed by P_2O_5 and K_2O in this order, and another is where N was least, followed by K_2O and P_2O_5 in this order. The former are Mahuwa, Navsari, Candevi, Bulsar and Dhurampur, and the latter are Bardoli, Chikhli and Mangzol. More data are to be collected by continuing this trial.

(2) SUMMER 1970

1) Trial on adaptability of Japanese varieties

(trial method)

varieties used	:	7 including Honenwase
sowing to nursery bed	:	January 2
transplanting	:	February 8
planting distance	:	30 x 15 cm
number of nursery plants per hill	:	3
fertilizer application	:	heavy application

(result)

The growing duration of Honenwase was one week shorter than that of Formosa-3 (standard variety), and yield of Honenwase was 8.012 tons, 6 per cent higher than that of Formosa-3. Japanese varieties were found suitable to the areas as summer paddy.

2) Trial on relationship between quantity of seeds to nursery bed and number of nursery plants per hill, and amount of supplied fertilizers.

(trial method)

varieties used	:	Honenwase and Tachiminori
sowing to nursery bed	:	January 2
transplanting	:	February 7

Other arrangements were the same as in Kharif 1969.

(result)

0.54 ℓ per 3.3 m^2 of seeds and 2-3 nursery plants per hill brought good yield regardless of the amount of supplied fertilizers.

There was no difference in yield between Honenwase, heavy panicle type, and taichiminori, many tillering type.

3) Trial on relationship between number of hills per square meters and amount of supplied fertilizers

(trial method)

varieties used	:	Honenwase and Tachiminori
sowing to nursery bed	:	January 2
transplanting	:	February 8

Others were the same as in Kharif 1969.

(result)

In case of Honenwase, plots of 25 x 13 cm (30.8 hills/m^2) brought the highest yield, 25 per cent more than those of 30 x 15 cm (standard), and in case of Techiminori, dense planting was more effective and plots of 25 x 11 cm (36.4 hills/m^2) brought the highest yield, about 50 per cent more than standard regardless of the amount of supplied fertilizers.

The plots of 30 x 30 cm (11.1 hills/m^2) brought the least yield, 10 - 20 per cent less than standard, both in case of Honenwase and Tachiminori.

4) Trial on three time rice culture (the third crop)

(trial method)

varieties used	:	Formosa-3 and Padma
sowing	:	January 2
transplanting	:	February 7

Other arrangements were the same as in Kharif 1969.

(result)

In case of plots of heavy application of fertilizers, there was no difference in yield between Formosa-3 and Padma, producing 7.5 tons per hectares, but in case of plots of light and medium application, Padma was slightly better in yield than Formosa-3. Earing and maturing were about 10 days later in case of Padma than in Formosa-3. Although both varieties have different characteristics, both can be said to be suited as summer paddy of three time rice culture.

5) Trial on optimum amount of supplied fertilizers to nursery bed

(trial method)

variety used	:	Formosa-3
sowing	:	January 2
transplanting	:	February 9

Other arrangements were the same as in Kharif 1969.

(result)

Under the condition of light application of fertilizers in the fields, the amount of supplied fertilizers to nursery bed had little effect on yield, but under the condition of heavy application of fertilizers in the fields nursery plants from the plots of light and medium application of fertilizers brought the higher yields. The nursery plant from heavy application was worst in yield. Therefore it can be said that medium application, 15 grams per square meters of each of 3 elements, is found best in fertilizing to nursery bed.

6) Trial on three elements of fertilizers

(trial method)

variety used	:	Formosa-3

sowing : January 3

transplanting : February 9

Other arrangements were the same as in Kharif 1969.

(result)

Taking the yield of standard plots of three elements, 8.074 tons per hectare, as 100, yield of no-K_2O plot was 97 and that of no-P_2O_5 90, no-N 37 and nil 31.

7) Trial on the optimum amount of three elements

(trial method)

variety used : Formosa-3

sowing : January 2

transplanting : February 9

Other arrangements were the same as in Kharif 1969.

(result)

The highest yield were seen in case of 150 Kgs of N-Fertilizer, 90 Kgs of P_2O_5 and 90 Kgs of K_2O. This results were almost the same as in Kharif 1969 and it was found that the amount of each of P_2O_5 and K_2O could be applied at the rate of 60% of the amount of N-fertilizer.

8) Trial on rationalization of fertilizer application in the fields

(trial method)

variety used : Formosa-3

sowing : January 2

transplanting : February 9

Each plot was fertilized as follows:

Plot	base	N additional			P_2O_5	K_2O
		I	II			
		Kgs per ha.				
Nil	0	0	0		0	0
N 150 kg/ha.	80	35	35		90	90
N 200	120	40	40		120	120
N 250	150	50	50		150	150
N 300	180	60	60		180	180

(result)

The plots of N 200 kgs/ha brought the highest yield, 9.85 tons, 12% more than that of N 150. This shows that in case of good varieties in fertilizer tolerability

and disease resistance, N fertilizers can be applied to 200 kg/ha with P_2O_5 and K_2O at the rate of 60% of the amount of N fertilizer.

9) Trial on comparison of effect among N fertilizers

(trial method)

variety used	:	Formosa-3
sowing	:	January 2
transplanting	:	February 9
fertilizers	:	ammonium sulphate, Urea, ammonium phosphate and sulphate ammonium phosphate

The amount of each fertilizer was 80 kg/ha as base, 35 as additional I, 35 as additional II, and also 90 kg/ha each of P_2O_5 and K_2O and 10 tons of compost were applied.

(result)

The highest yield was brought by sulphate ammonium phosphate, followed by diammonium phosphate, ammonium sulphate and urea in this order.

10) Trial on the time of division application of ammonium sulphate

(trial method)

variety used	:	Formosa-3
sowing	:	January 2
transplanting	:	February 9

The amount of supplied fertilizers were as follows:

Plot	Base	N Additional		
		I	II	III
all as base	150	0	0	0
three time application				
A	90	30	30	0
- do - B	30	90	30	0
- do - C	30	30	90	0
four time application				
A	60	30	30	30
- do - B	30	30	60	30

90 kg/ha of each of P_2O_5 and K_2O were also applied.

Remarks: The additional I was applied at the tillering period just 15 days after transplanting, additional II at every young head forming period and additional III at earing period.

(result)

The plots of three time division application A brought the highest yield, followed by those of all as base. As elements of fertilizers seem to remain in the soil in summer season without being washed away by rainfall like in Kharif paddy, use of all fertilizers as base, or 60 per cent as base and 20 per cent each as division application at tillering period and very young head forming period may be recommendable.

(3) IMPROVEMENT OF LOCAL CULTIVATION PRACTICES ACCORDING TO RESULTS OBTAINED SO FAR THROUGH VARIOUS TRIALS

Local varieties like Z-31, Kada 176-12 etc. may have 4.5 tons per hectare in yield in case of light application of N fertilizers, that is 50 - 60 Kgs per hectare. However when more than 100 Kgs. of N fertilizers are applied, they will lodge and their yield will be, on the contrary, less than in case of light application.

These local varieties are all poor in tolerability to heavy application of fertilizers. Therefore the more fertilizer will not bring the higher yield. In order to get more production, HYV should be adopted. IRRI-8, Jaya etc. can produce 7 to 7.5 tons of paddy per hectare with 150 Kgs. of N fertilizers and 90 Kgs. of each of P_2O_5 and K_2O. However it should be borne in mind that these HYV have so soft culms that all insects and pests come to attack them. Therefore plant protection should accompany the introduction of HYV.

Brine assortment of seeds neither cost much nor need labor much. This assortment is the first technique to be taken up in the area. In local practices many seeds, more than enough, are sown to nursery bed, and many nursery plants, usually 10 nursery plants per hill which are all thin and tall, are transplanted, number of hills per square meter being few, about 18 hills. As these are transplanted at random there are much difference in number of hills per square meter among plots. According to the result obtained at the Center, quantity of seeds sown to nursery bed are to be 3,500 grains per square meter regardless of the size of grains. It is advisable that nursery bed be prepared in 5-6 per cent in acreage of paddy fields where transplanted, and also narrow raised nursery, 0.3 x 1.2 x 10-15 m be prepared. Taking into consideration the labour of transplanting, area of nursery bed, etc. planting distance is to be 25 x 15 cms (26.7 hills per square meter) with 3-5 nursery plants per hill. Regular row planting is the best way for adopting dense planting by using transplanting rope. Use of rotary weeder is very useful in increasing the production in case of heavy soil as seen in the area, and for this purpose regular row planting by transplanting rope is helpful.

In local practices amount of fertilizers to nursery bed is very little and only N fertilizers are applied. To get the healthy nursery plants 15 grams per square meter of each of N, P_2O_5 and K_2O are found necessary. In this case it is better to apply N fertilizers divisionally, 9 grams as base and 3 grams each about 10 days after germination and 4 - 5 days before transplanting. P_2O_5 and K_2O are applied all as base. The amount of supplied fertilizers to the field depends on characteristics of varieties. However it can be said that 150 Kgs per hectare of N fertilizers and 90 Kgs of each of P_2O_5 and K_2O are adequate to HYV. In this case P_2O_5 and K_2O are applied all as base, and 75 kgs of N fertilizers as base and 35 Kgs about 15 days after transplanting, 25 Kgs at very young head forming period and 15 Kgs at earing period.

All farmers in the area apply no K_2O and little P_2O_5. However in order to increase the production more than at present, these should be also applied at the rate of 50 - 60% of the amount of N fertilizers.

2. TRAINING

(1) Performance

Subject	Trainee	Number of trainee	Time	Duration
1. rice cultivation, soil and fertilizer (machinery) (lecture and practice)	VLW	10	summer paddy 1969	120 days (Feb. 1 - May 31)
2. - do -	EO	10	Rabi paddy 1969	14 days (Nov.24-29 and Dec.15-20)
3. - do -	VLW	12	Summer paddy 1970	75 days (Jan.16 - March 31)
4. - do -	VLW	12	- do -	75 days (April 1 - June 15)
5. - do - (mainly practice)	Farmers	3	- do -	28 days (a week in a month each from Feb. to May.

(2) Contents of training programme

Technical training plan for village level workers

Training term. Feb. 1 to 31st May 31, 1969. (4 months period)

Culture and Breeding

Month.	Lectures	Practices
Feb.	1. Yield of paddy. 2. Growing stages of paddy. 3. Tillering of paddy. 4. Conditions of good seedings.	1. Salt water selection. 2. Usplan disinfection of paddy seeds. 3. Water soaking of paddy seeds. 4. Germinating treatment of paddy seeds. 5. How to prepare nursery beds. 6. Sowing of paddy seeds 7. Transplanting in paddy fields. 8. Growth investigation of the seedlings. 9. Irrigation and drainage of water at nursery beds. 10. Disease and insect control.

March	1. Relation between paddy culture and temperatures. 2. Density of planting (Seedling number per hill and hill number/ 3/3 m^2). 3. Promising varieties in this area.	1. Disease and insect control. 2. Irrigation and drainage of water. 3. Growth investigation of trial plots. (Plant height, tillering and main stem leaves) 4. Investigation of the regional paddy varieties.
April	1. Irrigation and drainage of water in paddy culture. 2. Main diseases and insects and the control method. 3. Explanation on various trials that are to be done at summer paddy fields.	1. Investigation of maximum tillering stage. 2. Midsummer aeration in paddy fields. 3. Investigation of young panicle formation period. 4. Development investigation of young panicles. 5. Investigation on heading. 6. Investigation on flowering. 7. Irrigation stopping period in the paddy field. 8. Disease & insect control. 9. Removing of different types in Formosa-3 line culture field.
May	1. Rational multiplication method of paddy varieties. 2. Trial method on regional trial field and demonstration field.	1. Investigation on the growth of paddy plant. 2. Investigation of maturity stage. 3. Survey method of paddy field in trial. 4. Plots. 5. Survey of unpolished paddy percentage. 6. Quality investigation on polished paddy of various varieties.

Soil and Fertilizer

Month	Lectures	Practices.
Feb.	General property of soils. 1. Physical & chemical. 2. property of soils. 3. Action of organic matters in soils.	1. Survey of profile in paddy soils. 2. Observation of primary mineral in soils. 3. Fertilization of trial plots. 4. Transplanting of trial plots. 5. Growth survey of seedlings at nursery beds.

March	Property of paddy soils. 1. Property of soil morphology. 2. Effect by drying of soils. 3. Action of denitrification. 4. Action of nitrogen in paddy soils. 5. Action of phosphoric acid in paddy soils. 6. Micro nutrients. 7. Investigation on practical manuring of the regions.	1. Growth survey of trial plots in the field. 2. How to prepare the paddy straw compost. 3. Survey of profile in paddy soils.
April	1. Absorption of nutrients by paddy plant. 2. Natural nutrients supplied to paddy plant. 3. Action of paddy root in soils. 4. Top dressing and fertilizer for heading. 5. Utilization rate of fertilizers. 6. Fertilization plan.	1. How to prepare the paddy straw compost. 2. Observation on distribution of paddy roots in the soils.
May	1. Property of chemical fertilizers. 2. Property of self sufficing manures and how to make them. 3. Rational manuring technique from a point of view on soils.	

Agricultural Machinery

Month	Lectures	Practices.
Feb.	1. Classification of machinery which are used in various works. 2. Kind and function of motors.	1. Adjustment, trouble and maintenance of oil engines. 2. Operation of oil engines.
March	1. Structure and function of tractors, power cultivators (Power tillers) and trailors.	1. Method of use of rotary weeders. 2. Operation of the two cycles engine. 3. Operation of the tractor.
April	1. Structure and function of power threshers and paddy hulling machines.	1. Adjustment, trouble and treatment of tractor, power thresher and tailor. 2. Operation of power tiller (cultivator). 3. Operation of tailor. 4. Method of use of power sprayer & mist duster for control of diseases & insects on crops.

May	1. Kind and structure of pumps.	1. Method of use of paddle thresher. 2. Method of use of power thresher. 3. Method of use of winowing machine. 4. Method of use of paddy hulling machine. 5. Method of use of paddy polishing machine. 6. Method of use of vertical pump. 7. Method of use of centrifugal pump.

Technical training plan for Village Level Workers.

Training period: (1) Jan. 6 to March 31, 1970. (2.5 month) I-Batch.

(2) April 1 to June 15, 1970 (2.5 month) II-Batch.

Culture and Breeding

Month	Lectures	Practices.
Jan.	1. Yield of paddy. 2. Growing stages of paddy plant. 3. Tillering of paddy plant. 4. Conditions of good seedling.	1. Salt water selection. 2. Usplan disinfection of paddy seeds. 3. Water soaking of paddy seeds. 4. Treatment of paddy seeds for Germination. 5. How to prepare nursery beds. 6. Sowing of paddy seeds in nursery.
Feb.	1. Relation between paddy culture and temperatures. 2. Density of planting (Seedling number per hill and hill number/ m^2) 3. Characters of paddy varieties. 4. Promising varieties in this area.	1. Transplanting in paddy fields. 2. Growth survey on seedling of each variety. 3. Diseases and insects control. 4. Irrigation and drainage of water.
March	1. Main diseases and insects and the control method. 2. Explanation of various trial that are to be done at summer paddy fields. 3. Trial method on regional field and demonstration field.	1. Growth survey of various trial plots. 2. Diseases and insects control. 3. Survey on young panicle formation period. 4. Removing of different types in line culture field.

4. Rational multiplication method of paddy varieties.

Soil and Fertilizer

Month	Lectures	Practices.
Jan.	1. General property of soils. 2. Physico-chemical property of soils. 3. Action of organic matters in soil. 4. Fertilization method and C/N Ratio. 5. Action of soil micro-organism. 6. PH, EH and PF.	1. Survey of profile in paddy field soils.
Feb.	1. Morphological property of Indian soil. 2. Property of Indian paddy soil. 3. Effect by drying of soil. 4. Action of denitrification. 5. Action of phosphoric acid in soil. 6. Micro nutrients. 7. Investigation on practical manuring of the Regions.	1. Fertilization of trial plots. 2. Transplanting of trial plots. 3. Growth survey of the varieties in nursery bed and the field of trial plots.
March	1. Absorption of nutrients by paddy plant. 2. Natural nutrients supplied to paddy plant. 3. Action of paddy roots in soils. 4. Utilization Rate of fertilizers. 5. Fertilization plan. 6. Property of chemical fertilizers. 7. Rational manuring technique from a point of view on soil.	1. How to make paddy straw compost. 2. Observation on distribution of paddy roots in the soils. 3. Simple analysis of paddy soils.

Agricultural Machinery

Month	Lectures	Practices
Jan.	1. Function and use method of the farm machines and implements. 2. Kind and function of engines. 3. Working of motor oil.	1. Operation of engines. 2. Adjustment, trouble and treatment of engines.
Feb.	1. Structure and function of tractors and power tillers. 2. Structure and function of diseases and insects control machinery. 3. Structure and function of pumps.	1. Method of use of rotary weeder. 2. Operation of power tillers. 3. Adjustment, trouble and treatment of tractors and power tillers.
March	1. Structure and function of threshers and paddy hulling machines.	1. Method of use of diseases and insects control machines. 2. Method of use of threshers. 3. Method of use of winnowing machines. 4. Method of use of paddy hulling and polishing machines. 5. Method of use of various type of pumps.

Technical training plan for Extension Officers.

Training Period: Two weeks from Nov. 24 to Nov. 29, 1970 and Dec. 15 to Dec. 20, 1970.

Culture and Breeding

Duration	Lectures	Practices
First week	1. Yield of paddy. 2. Growing stage of paddy plant. 3. Tillering of paddy plant. 4. Conditions of good seedling.	1. Salt water selection. 2. Usplan disinfection of paddy seeds. 3. Water soaking of paddy seeds. 4. Treatment of paddy seeds for germination. 5. How to prepare nursery beds. 6. Sowing of paddy seeds in nursery.
Second week	1. Relation between paddy culture and temperature. 2. Density of planting (Seedling and hill number/m^2) 3. Characters of paddy varieties. 4. Rational multiplication methods of paddy varieties.	1. Investigation on young panicle formation period. 2. Investigation on paddy heading. 3. Diseases and insects control.

Soil and Fertilizer

Duration	Lectures	Practices.
First week	1. General property of soil. 2. Chemical property of soil. 3. Action of soil micro organism. 4. Property of paddy soils. (1) Property of soil morphology. (2) Effect by drying of paddy soil. (3) Action of denitrification. (4) Action of nitrogen in paddy soil. (5) C/N ratio and compost making from paddy straw. (6) Micro nutrients. (7) Investigation on practical manuring of the regions.	1. Survey of profile in paddy soils. 2. Fertilization of trial plots. 3. Compost making from paddy straw.
Second week	1. Absorption of nutrients by paddy plant. 2. Action of paddy root in soil. 3. Utilization rate of fertilizers. 4. Fertilization plan. 5. Property of chemical fertilizers. 6. Rational manuring technique from a point of view on soils.	1. Growth survey of seedling at nursery beds. 2. Growth survey of trial plots in the field. 3. Observation on distribution of paddy roots in the soil.

Agricultural Machinery

Duration	Lectures	Practices
First week	1. Classification of farm machines and implements which are used for various works. 2. Kinds and function of engines.	1. Method of use of rotary weeders. 2. Operation of engines.
Second week	1. Structure and function of power threshers and paddy hulling machines.	1. Operation of the power tiller. 2. Use method of use of the pedal thresher. 3. Use method of the winnowing machine.

Technical training plan for the farmers.

The first period (March 1 - 9, 1969)

Training items:
1. Winnowing machine selection.
2. Salt water selection.
3. Usplan disinfection of paddy seeds.
4. Soil preparation of nursery beds.
5. How to prepare the nursery beds.
6. Manuring of nursery beds.
7. Sowing in nursery beds.
8. Weeding by rotary weeders in paddy fields.
9. Threshing of paddy grains by paddle thresher.

The second period (April 1 - 9, 1969)

Training items:
1. Soil preparation of paddy fields.
2. Manuring of paddy fields (basal dose).
3. Transplanting.
4. Weeding by rotary weeders.
5. Treatment method of power cultivators (tillers).
6. How to prepare the paddy straw compost.

The third period (May 1 - 9, 1969)

Training items:
1. Spraying and dusting for disease and insect control.
2. Midsummer aeration of paddy fields.
3. Top dressing at the young panicle formation period.
4. Treatment method of disease and insect control machines.
5. Treatment method of power cultivators.
6. How to prepare the paddy straw compost.

(3) Activities of trainees after training

1) VLW trained for 4 months in summer paddy, 1969 are taking charge of area demonstration trial plots (ADTP). Out of them 2 VLW were transferred one year later.

2) 10 EO trained for 2 weeks in Rabi paddy, 1969 are in charge of planning and liaison of extension works in each taluka.

3) Out of 12 VLW trained for 2 weeks in summer paddy 1970, 2 are succeeding to VLW who were transferred as mentioned in 1) above. Others are conducting demonstration plots. Out of 12 VLWs trained for 2.5 months in summer 1970, 2 are conducting ADTP, others conducting demonstration plots.

3. AGRICULTURAL MACHINERY

1) Trials and results on deep ploughing by machinery

1) Kharif 1969

(trial method)

variety used	:	IRRI-52
sowing	:	June 19
transplanting	:	July 13
machinery used	:	rotary power tiller (Kubota KMB 200) (ploughing depth 5 and 12 cm)
		rotary power tiller (Kubota KMB 200 and plough (Kubota T18 tractor), and Kubota tiller KA 650 for puddling (ploughing depth 20 cm)

These plots were combined with plots of compost and no compost, and also with those of medium application of fertilizers (100 kgs/ha of N fertilizer, 80 Kgs/ha of each of P_2O_5 and K_2O) and 50 per cent more application of fertilizers (N-150 kgs/ha, P_2O_5 and K_2O-120 kg/ha each.

One plot was 135 square meters (15 x 9 m). The same combinational arrangements were made in two plots.

(result)

Plots of 12 cm of ploughing depth by rotary power tiller brought the highest yield regardless of application of compost and amount of supplied fertilizers.

2) Summer Paddy 1970

(trial method)

sowing	:	January 2
transplanting	:	February 6

Other arrangements were the same as in Kharif 1969.

(result)

The result was the same as in Kharif 1969, that is, plots of 12 cm of ploughing depth brought the highest yield. This shows, apart from the view of point of productivity, that local method of ploughing by bullocks brings the same result as ploughing by machinery from the view point of increase in production. This may be because of heavy soil in the area.

(2) Training

1) Performance

Subject	trainee	number of trainee	time	duration
1. agricultural machinery (rice cultivation, soil and fertilizer (lecture and practice)	VLW	10	Summer paddy 1969	120 days (Feb. 1 - May 31)
2. - do -	EO	10	Rabi paddy 1969	14 days (Nov. 24 - 29 and Dec. 15 - 20)
3. - do -	VLW	12	Summer paddy 1970	75 days (Jan. 6 - March 31)
4. - do -	VLW	12	- do -	75 days (April 1 - June 15)
5. repairs of agricultural machinery (mainly practice)	mechanics	3	- do -	60 days (March and April)
6. operation (mainly practice)	VLW	10	- do -	14 days (May)

Remarks: The subject 5, was on repairs of agricultural machinery (power tillers, threshers, winnowers and mist dusters) which are let out on hire to farmers through Taluka. The subject 6 was on operation of the machinery let out on hire to farmers through Taluka.

2) Contents of training programme

Contents of training programmes are described in 2. (2) above.

3) Activities of trainees after training

(a) Mechanic

As all mechanics belong to district they are not in a position to instruct Taluka. Therefore their activities are poorer than what is expected.

2. VLW (operator)

All of these VLW are teaching and also demonstrating on how to use machinery to farmers.

4) Scope for introduction of modern agricultural machinery to India.

All farmers have known of the superiority of Japanese agricultural

machinery. There are many voices of expressing their desires to import effective and modern agricultural machinery for increasing productivity, especially alleviating the painful burden at the peak of field works like transplanting and harvesting among medium and large farmers whose area comes to more than 75 percent in the area. Small farmers whose number is about 65 per cent but whose land holding is only 20 percent have no capacity to get their machinery individually. Only way is to collectively introduce agricultural machinery for small farmers. From the point of view of increase of production for small farmers, simple machinery like planting rope and rotary weeder may be introduced and they must be very useful in getting more production. Plant protection machinery like mist duster should be introduced cooperatively or collectively.

5) Use of machinery at the Centre

The Centre let out a set of threshers, winnowers, mist dusters and 3 weeders on hire to 11 talukes where areawise demonstration trial plots are conducted. These are managed and maintained by each Taluka under the supervision and guidance of VLW in charge of plots. Farmers around these plots are using such machinery. Hiring charge is free except fuel charge which is incurred by farmers.

6) Manual on rice cultivation

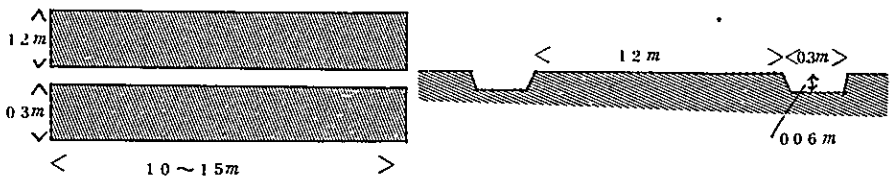
In connection with extension works, the following manual has been prepared in January, 1971 at the Centre.

Standard Cultivation Method of Kharif Paddy

Indo-Japanese Agricultural Extension Centre
Vyara, Dist. Surat (Gujarat State), Jan. 1971

A. Irrigated area

1. Salt water selection: Water 20 ℓ, Salt 5.4 Kgs (27%)
2. Water soaking: 1 - 2 days (please change to new water 2 times a day.)
3. Germination treatment: 1 day (state of seed bud, - about 1 cm long)
4. Nursery bed: Rectangular form: Width 1.2 m, Furrow 0.3 m and length 10 - 15 m.



5. Suitable space of nursery bed: 5% of the field area. 500 m^2 per ha. for planting distances of 25 x 15 cm and 3 plants per hill.
6. Suitable seeding volume: $(30m)^2$ - 3 grains. namely;

variety	1,000 grains weight	Seed weight per m^2	Seed rate per ha.
(1) IRRI-8 (2) Formosa-3	30 g	100 g	50 Kgs
(3) Jaya	25	83	41.5
(4) Padma	20	67	33.5
(5) Mashuri	16	53	26.5
(6) Z-31	13	43	21.5

7. Suitable time of seeding in nursery bed: about 15 - 25th June.
8. Suitable fertilizers in nursery bed (gs per m^2)

Kinds of fertilizers	Basal	1st	2nd
Ammonium sulfate	45	15	15
Super phosfate	90	-	-
Muriate potash	30	-	-

Top dressing: 1st, about 10 days after seeding
2nd, about 4 days before transplanting

9. Planting density: Distances: 25 x 15 cm
Seeding nos., 3 plants per hill
10. Suitable time of transplanting: Main stem leaf nos. - 6, about 5 - 15th, July.
11. Suitable fertilizers of each varieties in the field (kgs per ha.)

variety	N	P_2O_5	K_2O	about yield (kgs per ha.)
1. IRRI-8	150	90	90	7,000
2. Mashuri	130	78	78	6,500
3. Jaya	150	90	90	6,500
4. Padma	150	90	90	6,000
5. Z-31	60	36	36	4,500

Dose method of N (kgs per ha.)
Top dressing

variety	Basal	1st	2nd	3rd
1. IRRI-8	75	35	25	15
2. Mashuri	70	30	20	10
3. Jaya	75	35	25	15
4. Padma	75	35	25	15
5. Z-31	30	15	15	0

Top dressing: 1st, 15 days after transplanting, 2nd, young panicle formation period (about 3 weeks before heading), 3rd, Full heading period.

Note: Ammonium sulfate N, 20.5% = N x 5
Super phosfate P_2O_5, 16.0% = P_2O_5 x 6
Muriate potash K_2O, 50% = K_2O x 2

12. Weeding by rotary weeder: 1st, 10 days - 2 weeks after transplanting. 2nd, 10 days after 1st weeding.
13. Medical control for diseases and insects
1) Nursery stage (Nursery area for one acre = 0.4 ha.)
(1) Spray End in (20 E.C.) of 25 ml in 10 liters of water after one week from the date of germination.
(2) Dust 10% B.H.C. dust or 10% Sevin powder of 300 - 400 gs after 2 weeds from the date of germination.
Spraying and dusting of insecticides are required for control of insects, pests - Jassids, Catter pillar, Grass popper, etc.)
2) field stage (for one acre = 0.4 ha.)
(1) Spray, 400 - 500 ml. Endrin (20 E.C.) in 200 liters of water between 12 - 15 days from the date of transplanting.

(2) Dust 6 - 8 kgs. B.H.C. (10%) dust or 6 kg Sevin (10%) powder after 15 days from the date of 1st spraying.

(3) Spray 500 ml. Endrin (20 E.C.) or 400 ml. Thiodom (32 E.C.) in 200 liters of water after 20 days from the above dusting.

(4) Dust of 6 - 8 kgs Sevin (10%) powder or 6 - 8 kgs B.H.C. (10%) dust,or spray 500 ml. Sevin (50% wetable) or 500 ml thiodan (32 E.C.) in 250 - 300 liters of water after 20 days from the above spraying.

Spraying and dustings of insecticides are required as pre-control measures for controling the attack of Jassids, Leaf eating Catterpillars, Grass hoppers, Rice blue beatles, stem borer, swarmy or army catterpillars, etc.

B. Non irrigation area

1. Salt water selection: - do -
2. Water soaking: nothing, dried seeds
3. Germination treatment, nothing
4. Nursery bed: almost the same, but cover some fine soil on the seeds after seeing in bed.
5. Suitable space of nursery bed: 6% of the field, for distance of 25 x 15 cm and 3 - 5 plants per hill.
6. Suitable seeding volume: - do -, namely

variety	1,000 grain. weight	Seed weight per m^2	Seeds rate per ha.
(1) SK-20	20 g	67 g	40 Kgs
(2) CR. 42 - 38	25	83	50
(3) Kada 176-12	28	93	56
(4) Sathi 34 - 36	25	83	50
(5) Tachiminori	28	93	56

7. Suitable time of seeding: Different depending on 1st rain in the year.
8. Suitable fertilizers in nursery bed: - do -
9. Planting density: Distances, 25 x 15 cm, seedling nos. 3 - 5 plants per hill.
10. Suitable time of transplanting: Main stem leaf nos. - about 6.
11/ Suitable fertilizers of each variety in the field

variety	N	P_2O_5	K_2O	about yield per ha.
(1) SK-20	100	60	60	5,000 kgs
(2) CR. 42-38	100	60	60	4,500
(3) Kada 176-12	70	42	42	4,000
(4) Sathi 34 - 36	70	42	42	4,000
(5) Tachiminori	135	80	80	5,500

Dose method of N

variety	Basal	Top dressing	
		1st	2nd
(1) SK-20	50	25	25
(2) CR, 92-38	50	25	25
(3) Kada 176-12	40	15	15
(4) Sathin 39-36	40	15	15
(5) Tachiminori	75	35	25

12. Weeding by rotary weeder: - do -
13. Medical control for diseases and insects: almost the same.

IV. VIEWS AND PROPOSITION

1. VIEWS

It is our understanding that extension works are services of linking agricultural techniques so far evolved and newly developed at institutions like national research institutes, universities, etc., with farmers for increasing agricultural production quantitatively and economically. For this purpose local agricultural research institutes should conduct mainly practical trials and impart technical training to EO, VLW and others. There should be a wide pipe to convey farmers' problems to institutes on the one hand and convey their solution back to farmers on the other through extension officers, VLW and so on. However, at present, good varieties evolved at national institutes are disseminated to farmers through state Governments and districts without any local trials as to whether they are suited to the local conditions. According to our experiences, trials on suitability of varieties to specific areas should be conducted no matter how excellent varieties they are.

There are so many varieties in the area and it is felt that seed renewal is essential for improving rice production. Use of planting rope as well as adoption of dense planting, use of weeder, rationalisation of fertilizer application are recommended to be extended to farmers quickly.

As HYV are introduced more and more pests and insects are spread over wider and wider. Therefore mist dusters and sprayers are to be introduced for plant protection. Many farmers who want to introduce Japanese power tillers are also seen.

As Ukai dam is devloped, irrigated area is to increase and twice and even three time rice culture may be made possible. But even at present yield of Summer Paddy is 20 per cent more than that of Kharif paddy. The trials on Summer Paddy are, however, few. These trials should be conducted intensively from now on. There are many other practices to be improved, for example, alternate use of land as paddy fields and upland.

2. PROPOSITION

(1) Strengthening of local agricultural research institutes

By establishing and/or improving the present local institutes as one of integrated research institutes, the institutes should conduct the training programmes of high school graduates for 2 years for educating as extension technical staff and also the training programme of the present technical staff for retraining.

These institutes should have close relationship with district and establish area-wise trial plots and let VLW conduct them. VLW may get the useful experiences and also use= ful data for their extension works through various trials.

(2) Strengthening of seed renewal

At present seed farms in the area are conducting pedigree culture and distributing them at the request of farmers. However, well organized seed renewal works are not seen, for example, organization of fundamental seed farms, original seed farms and seed farms, is essential for seed renewal. All kinds of seeds should be renewed every two to three years based upon an all farmer seed renewal programme.

The present seed farms will conduct pedigree culture and also function as original seed farms. Seed farms should be operated by town or village cooperatives. As such pure varieties treated with brine assortment of seeds are to be distributed to farmers in the area, contributing much to improvement of quality and to increase of production.

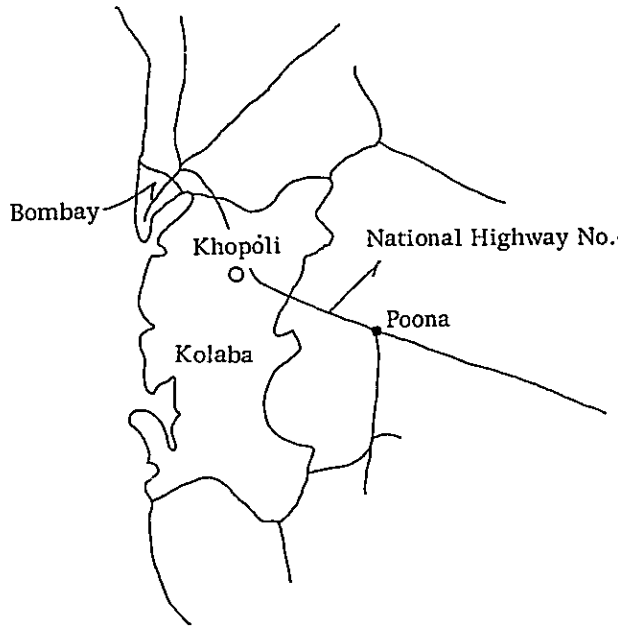
PART III. INDO-JAPANESE AGRICULTURAL EXTENSION CENTRE AT KHOPOLI IN MAHARASHTRA (January 1969 - March 1971)

I. SURROUNDINGS

1. LOCATION

This center is located at Khopoli in Konkan division, Kolaba district. The village of Khopoli is situated 100 km south-east of Bombay on the National Highway No.4 between Bombay and Poona, lying at a gate-way to the Deccan plateau, as shown below in Map III-1.

Map III-1. Rough sketch around Khopoli



2. WEATHER CONDITIONS

This area is one of rainy regions in Maharashtra. The annual rainfall is about 3,000 mm. It is concentrated in the monsoon season which sets in from June continuing up to October. In other seasons the rainfall is scanty. As to the temperature, the annual average of maximum is 34.3°C, and minimum is 19.8°C. The really hot weather lasts during April and May, when it is not unusual that the maximum temperature rises more than 40°C. Figures on weather conditions are shown below in Table III-1.

Table III-1. Weather Data (Six year average, 1964-1969)

Month	Air Temperature °C				Humidity (%)	Rainfall (mm)	Duration of sunshine (Hours)
	Maximum	Minimum	Daily Mean	Range of Temp.			
Jan.	32.1	12.6	22.9	20.5	79.7	-	272.7
Feb.	35.8	12.6	24.2	23.2	73.0	-	275.2
March	38.0	16.6	27.3	21.4	70.5	-	281.5
April	39.8	21.0	30.4	18.8	67.7	2.6	272.9
May	38.6	23.6	31.1	15.0	72.8	3.2	281.5
June	33.5	23.6	28.6	9.9	84.6	515.0	114.6
July	29.6	23.2	26.4	6.4	90.4	1370.0	41.6
Aug.	29.2	23.8	26.5	5.5	90.4	950.4	59.7
Sept.	30.6	23.1	26.9	7.5	92.5	322.5	124.2
Oct.	34.5	21.5	28.0	13.0	90.4	87.4	26.8
Nov.	35.6	20.5	28.1	15.1	81.1	8.3	249.9
Dec.	33.7	15.6	24.7	18.1	83.0	15.7	252.7
average	34.3	19.8	27.1	14.5	81.4	2976.0	2487.3

Years	1964	1965	1966	1967	1968	Av.of 5 Years	1970
Start of Monsoon	June 9	June 4	June 8	June 14	June 14	June 10	May 28
End of Monsoon	Oct. 16	Sept. 20	Sept. 30	Oct. 10	Oct. 12	Oct. 6	
Rainy days	129	108	114	118	120	118	

3. AGRICULTURAL SITUATION

As the following Table III-2 indicates the paddy field area in this district accounts for about 60 per cent of total cultivated area, nagli field about 8 percent, orchaed and vegetable about 1 percent, coconut about 0.3 percent and grassland 23 percent. Paddy is the main crop in this district, being one of granaries in the State. It is possible to raise two paddy-crops a year in Karjat, Khalapur and Roha talukas. The total of two-crop area accounts for 2 or 3 percent of the cultivated area.

Table III-2 Agricultural figures of Koloba district
(1961 Census)

(1)	Total area	7,024 km^2
(2)	Rural population	952,174
(3)	Urban population	106,681
(4)	Number of villages	1,772
(5)	Cultivated field	233,810 ha.
(6)	Paddy field (irrigated 2.3%)	135,000 ha.
(7)	Yield of paddy	234,500 ton
(8)	Nagli (a kind of millet)	18,533 ha.
(9)	Fruit and vegetable	2,386 ha.
(10)	Coconut	762 ha.
(11)	Grassland	53,518 ha.

4. LOCAL RICE CULTIVATION TECHNIQUES

As mentioned above, the paddy yield of 1,737 tons per hectare is quite poor. It may be observed that such a poor yield mainly depends on varieties of paddy. But even in the fields of high yielding varieties, the yield is about 2 tons per hectare.

Table III-3, which shows yield determining factors, may make the causes of poor yield clear.

Table III-3. Comparison of yield determining factors between improved and local methods [T(N)-1] (Obtained from the investigations from Kharif 1969 to Summer 1969-1970)

Type of Cultivation	Yield per acre	Number of Panicles/m^2	Number of grains/ panicle	Ripening ratio/ panicle	Weight of a grain
Improved method	2,081 kg.	232	119	81%	0.023 g
Local method	839 kg	137	113	67%	0.020 g

As the table above shows, it is clear that the main causes of poor yield obtained through the local method are (1) very small number of panicles per m^2, and (2) extremely poor ripening ratio per panicle. The yield may be also made poor depending on the number of grains per panicle as well as the weight of grain.

Analizing the above which have a great influence on the poor yield, the following practices can be said to result in these;

(1) Number of panicles per m^2

(a) Nursery beds

(a) extremely large number of seeds sown in nursery beds
(b) no fertilizer applied in nursery beds
(c) too long duration nursery plants left in nursery beds

b. Main field

(a) very little fertilizers (especially N) applied as a basal dose
(b) very rough planting distance adopted
(c) too deeply transplanted
(d) too large number of plants per hill planted

(2) Ripening ratio per panicle

very few or untimely additional fertilizers (especially N) applied.

II. FUNCTION AND OPERATION

1. FUNDAMENTAL POLICY

The fundamental policy in operating the Centre is to popularize the improved paddy cultivation techniques among farmers in this area, which were established by the Indo-Japanese Agricultural Demonstration Farm operated from 1965 to 1968. In order to realize this policy, the Centre has been positively engaged in the following activities; (1) finding out of the most suitable techniques to increase the yield in the surrounding paddy fields, (2) demonstration of the improved cultivation techniques, (3) training of agricultural officers of the State Government and leading farmers on improved cultivation techniques, (4) observation of the results of these techniques at farmers' paddy fields, and (5) demonstration (by farmers).

2. ORGANIZATION

(1) Staff

1) Japanese experts

Mr. S. Satoh (Chief adviser, Soil & fertilizer expert)	from Jan. 1969
Mr. S. Umeno (Agronomist)	from Jan. 1969
Mr. T. Harada (Agricultural machinery expert)	from Jan. 1969
Mr. T. Katoh (Agricultural extension expert)	from Apr. 1969
Mr. K. Ando (Land consolidation expert)	from Aug. 1970 to March 1971
Mr. K. Miyamoto (do.)	from Aug. 1970 to Feb. 1971
Mr. K. Chonan (Agricultural machinery expert)	from Feb. 1971
Mr. K. Koike (Agricultural extension expert)	from Feb. 1971
Mr. T. Ishikawa (do.)	from Feb. 1971

2) Indian staff

Mr. B.G. Bhalerao (Extension agronomist)
Mr. D.P. Talekar (Jr. agronomist)
Mr. V.M. Chavan (Agricultural engineer)
Mr. R.T. Handekar (Agricultural officer)
Mr. M.H. Jadhav (Foreman supervisor)
Other fifteen staff

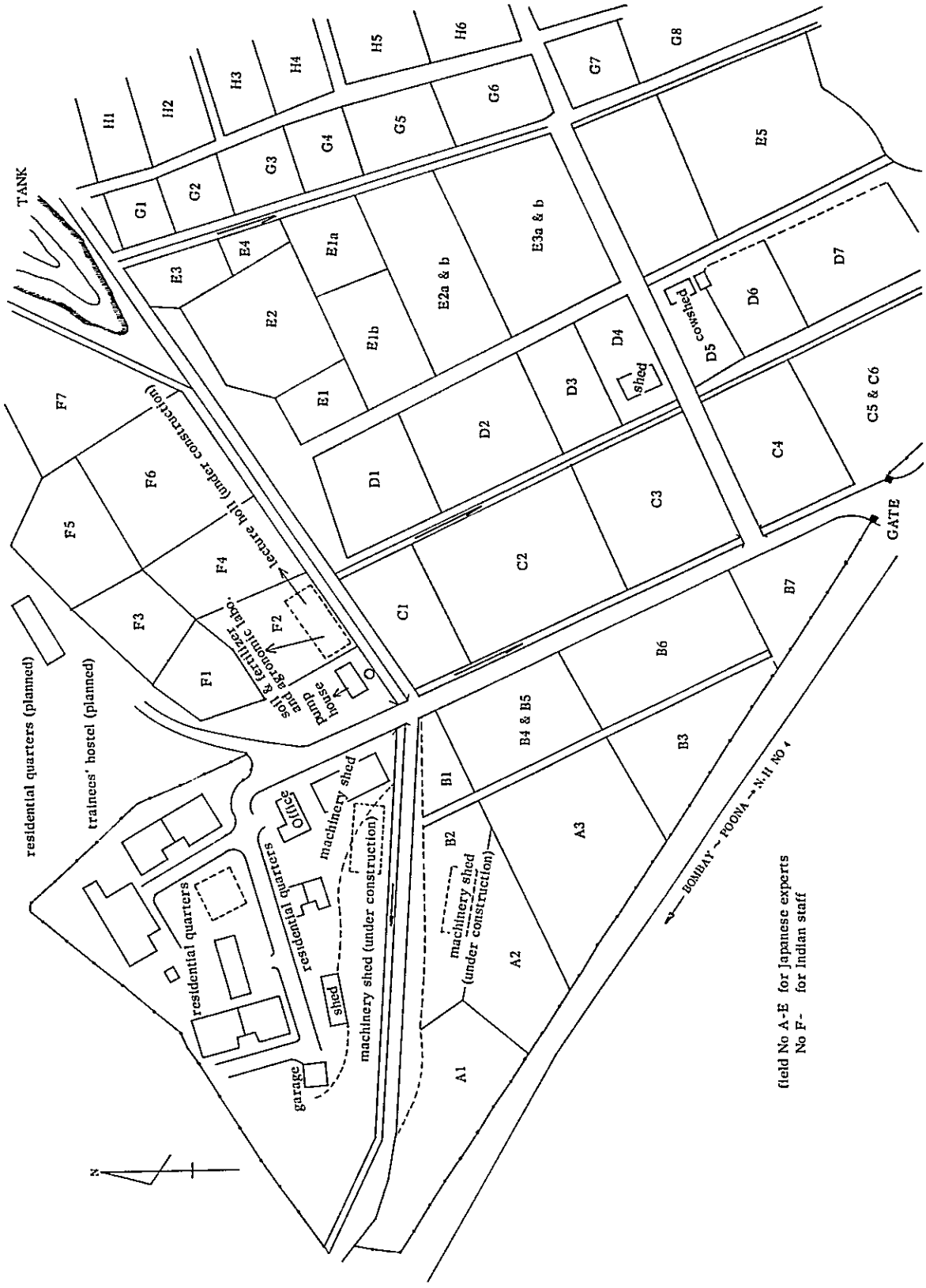
(2) Materials

1) Buildings and fields (see Map III-2)

The total area of the Centre is 50 acres, of which 23.5 acres are paddy fields. 10.0 acres and 13.5 acres of paddy fields are being used by Japanese and Indian teams respectively. Both teams are raising two crops a year.

Buildings for office, godown of machinery, residence, etc., are as shown in Map III-2. Soil and fertilizer laboratory, agronomic laboratory and implement shed (including workshop) are under construction.

Map III-2. A sketch of the Centre

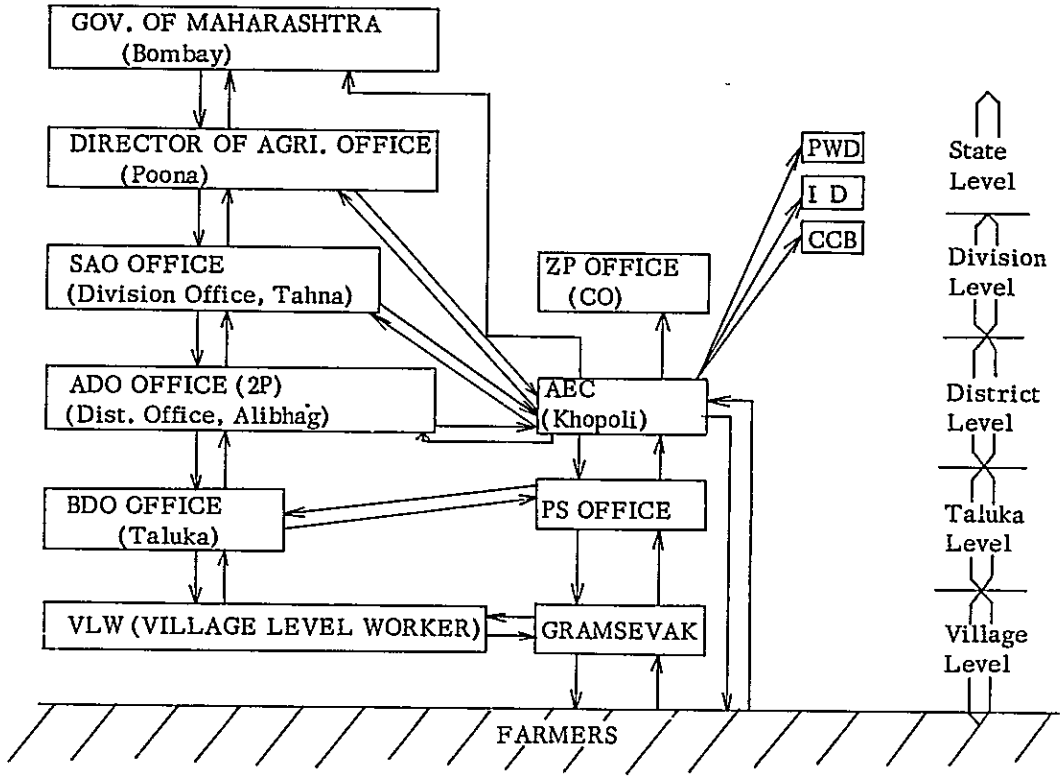


2) Agricultural machinery and equipment

SL. No.	Item	HP	Quantity
1.	Yammer Power Tiller	10 - 13	11
2.	Kubota Power Tiller	10 - 13	15
3.	Kubota four wheel tractor	27	4
4.	Kubota four wheel tractor	15	1
5.	Auto Thresher		9
6.	Semi Auto Thresher		19
7.	Combine Machine	9	1
8.	Kubota Harvester	4.5	2
9.	All types of Sprayers	3.5 - 4.5	26
10.	Power Knapsack Mist Duster	2	42
11.	Hand Duster and Granular Spreader		20
12.	Semi Auto Hand Sprayer		15
13.	Ensilage Cutter with gasoline Engine	4 - 5	16
14.	Kubota D. Engine	3	3
15.	Gasoline Engine	4 - 5	4
16.	Water Pump with Engine		2
17.	Vertical Pump		8
18.	Engine for Vertical Pump		6
19.	Station Wagon		1
20.	Land Crusher (Sedan Type)		2
21.	Truck		2
22.	Land Crusher (Jeep Type)		1
23.	Bulldozer	125	1

(3) Position of the Centre in the State Government

The position of the Centre occupying in the State Government can be seen from the following chart.



Remarks: SAO - Superintending Agricultural Officer
ADO - Agricultural Development Officer
BDO - Block Development Officer
VLW - Village level Worker
ZP - Zilla Parishad (Dist. Autonomy)
AEC - Agricultural Extension Centre
PS - Ponchyat Samiti (Taluka Autonomy)
Gramsevak - Unit organ of Panchyat
PWD - Public Work Department
IC - Irrigation Department
CCB - Dist. Central Coop. Bank
CO - Chief Executive Officer

3. IMPLEMENTATION

Before the time of sowing to nursery beds both in Kharif and Summer seasons (November and May),

(i) Messrs. Umeno and Harada draw up the programmes of trials and demonstrations on the improved rice cultivation techniques at the Centre, making a schedule of works;

(ii) Mr. Katoh draw up the programmes of demonstrations on the improved rice cultivation techniques at farmers' fields;

(iii) Indian staff make a plan of training of the government officers on paddy cultivation and agricultural machinery; and at the joint meeting consisting both of Japanese

and Indian staff, these concrete programmes of each season are finalized.

At the monthly meeting, which is held on every 25th of the month, occasional problems are solved by mutual consultations. As to the administrative matters, Chief Adviser, Mr. Satoh conducts its business after consulting with Indian Farm Manager.

III. ACTIVITIES AND RESULTS

Various trials and observations have been conducted in the Centre and also at farmers' fields, and their results so far obtained are described here as follows:

1. KHARIF (JUNE-OCTOBER) 1969

(1) Agronomy

1) Study on the growth phases of the main high yielding varieties

Object: - To study about the growth phases of the important high yielding varieties, early, medium and late crops, with a view to utilizing the same for the extension education of extension workers and farmers.

Results obtained: - Eight different varieties were grown and their growth phases were studied. The growth phases of these varieties are given in the following table.

SL. No.	Varieties	Growth Phases in days					Total crop duration in days.
		Nursery period	Period from transplanting to maximum tillering	Period from maximum tillering to earprimordia formation	Period from earprimordia to heading	Period from heading to ripening	
1.	T.K. 25	21	32	4	23	30	110
2.	E.K. 70	21	33	3	22	28	107
3.	Formoza	21	30	5	23	30	109
4.	T(N)-1	21	31	4	25	32	118
5.	Jaya	21	33	11	27	35	127
6.	I.R.-8	21	35	12	28	38	134
7.	Bhadas.1303	20	38	25	30	36	149
8.	I.R.-5	21	39	28	30	35	153

From the above it can be said that all the growth phases, except the growth phase from maximum tillering to earprimordia have almost the same period irrespective of varieties. In case of late varieties the maximum tillering phase and ripening phase is slightly longer than the other varieties. The growth phase from maximum tillering to earprimordia formation varies depending on varieties. In early varieties this period is shorter than medium and late varieties.

The study of growth phases is very important from the point of view of water management and top-dressing of nitrogenous fertilizers.

2) General survey of causes of low yield at farmers' fields

Object: - To find out the causes of low yield on farmers' fields and to use the same for extension education of extension workers and farmers.

Results obtained: - General survey to find out the causes of low yield on farmers' field was conducted in the Kharif seasons of 1968 and 1969. In Kharif 1968, thirty farmers were selected for the purpose and in Kharif 1969, twenty three fields were surveyed. In all these fields high yielding varieties were cultivated. The data collected are given in the following tables.

Results obtained in Kharif 1968

SL. No.	Yield constitution factors surveyed	Farmers' field	A.E.C. field	Remarks
1.	No. of hills per m^2	11	24	Variety used was T(N)-1
2.	Effective No. of panicles per m^2	144	242	
3.	No. of filled grains per panicle	52	98	
4.	Weight of 1,000 grains	20.2	23.8	
5.	Quantity of fertilizer applied in the form 'N' Kg/acre	5	50	
6.	Depth of planting	12.5 cm	3.5 cm	
7.	Yield in Kg/acre	615	2283	

Results obtained in Kharif 1969

SL. No.	Yield constitution factors surveyed	Farmers' fields where the improved method was not practised	Farmer's fields where the improved method was practised
1.	No.of hills per m^2	14.4	23.6
2.	Total No. of panicles/m^2	148	254
3.	Effective No. of panicles/m^2	137	232
4.	Effective No. of panicles/hill	9.5	9.8
5.	Weight per panicle in gm.	1.6	2.2
6.	Weight of grains per m^2 in gm.	218	508
7.	Fertilizer 'N' Kg/acre	8.5	39.0
8.	Yield in Kg/acre	872	2030

Note: The varieties used were I.R.-8 and T(N)-1.

Correlation between quantity of 'N' applied and yield obtained

SL. No.	Yield constitution factors	Nitrogen applied in Kg/acre			
		0	15	16-35	36-45
1.	No. of hills per m^2	15.7	17.2	13.9	22.7
2.	Total No. of panicles per m^2	166	177	191	240
3.	No. of effective panicles per m^2	163	166	167	233
4.	No. of effective panicles per hill	10.4	9.7	12.0	10.3
5.	Weight of grain/hill in gm.	1.5	1.7	2.3	2.1
6.	Weight of grain/m^2 in gm.	240	282	387	536
7.	Yield in kg/acre	972	1128	1548	2024

From the above it can be said that the main reasons for low yield on farmers' fields are as follows: -

a. Low number of hills per sq. meter.
b. Use of fertilizers: - Quantity of fertilizers particularly that of nigrogenous fertilizers used per acre is very low.
c. Depth of transplanting is too deep, hence poor tillering.

As such the aim of extension education of cultivators is to improve the above mentioned defects on the cultivators' fields with a view to increasing per acre yields.

3) Trial on spacing

Object: - To find out the optimum spacing

Variety used: - Jaya

Results obtained: - Five different spacing were tried. The fertilizers applied was 60 Kg. 'N', 30 kg. P_2O_5 and 30 kg. K_2O per acre.

The results obtained are given below: -

No.	Spacing, No. of hills per m^2	No. of effective panicles per m^2	Weight of 1,000 grains (filled) in gm.	No. of filled grains per panicle.	Weight of filled grains per m^2 in gm.	Yield in Kg/acre
I.	11(30x30cm)	158	28.2	87.1	388	1570
II.	20(25x20cm)	199	28.2	78.0	438	1772
III.	33(30x10cm)	205	28.9	83.9	497	2011
IV.	40(25x10cm)	248	29.5	75.8	555	2246
V.	50(20x10cm)	275	28.3	69.1	538	2177

From the above it is seen that with increasing the number of hills per sq. meter, the yield increases, and the plot of 40 hills per sq. meter has given the highest yield and shows 50% increase over the plot of 11 hills per sq. meter. The plot of 50 hills per sq. meter has shown slightly lower yield because of lodging.

4) Trial on I.R.-8 and local variety for high production

Object - To find out the possibility of getting the high yield by using high yielding varieties, developing the fertility of soil and using chemical fertilizers etc.

Details of Trial and Results obtained: - The main aim of this trial was to get yield of 3,000 kg per acre. The detail of trial arrangement are as follows:-

a. Variety: I.R.-8 and others
b. Date of sowing: June 14
c. Date of transplanting: July 4, 1969
d. Manures and Fertilizers:
   (a) Paddy straw: - 1,000 kgs/acre as basal.
   (b) Fused Magnesium Phosphate: 2,000 kg/acre as basal

(c) Calcium silicate: 1,000 kg/acre as basal.
(d) Chemical Fertilizer: -

	N	P	K
(i) Total:	60	30	30 kg/acre.
(ii) Basal	30	30	30 -do-
(iii) Tillering stage	12	-	- -do-
(iv) Primordium stage	12	-	- -do-
(v) Heading stage	12	-	- -do-

e. Spacing: 25 x 12.5 cm
f. Seeldings per hill: 3 - 4

The target and results obtained are summerized below: -

Variety	Full grains in gm/m^2	Effective panicles per m^2	No. of panicles per hill	Wt. of 1,000 grains in gm.	No. of grains per panicle	Yield in kg/acre.
Target	752	288	9.0	29.0	90.0	3,000
I.R.-8	587	259	8.1	28.2	80.4	2,348

From the above, it is seen that it was not possible to get the yield aimed at. It was difficult to attain the aim due to: -

a. Small number of tillers because of shortage of light and deep transplanting

b. Poor filling of grains on account of severe occurrance of Bacterial Leaf Blight at the heading stage

c. Poor weight of 1,000 grains

Other varieties adopted in this trial were severely affected by Bacterial Leaf Blight and also lodging. As a result the yields of these varieties were very low.

(2) Soil and Fertilizer

1) Factorial trial on different application of Nitrogen, Phosphorous and Potassium

Object: - To find out the optimum of N, P_2O_5 and K_2O per acre in Kharif and summer.

Variety: IR-8
Date of sowing June 20
Date of transplanting July 19

Other details and Results obtained: - Various combination of each element of N, P_2O_5 and K_2O as detailed below were tried with a view to finding out the optimum dose of N.P.K. for paddy. The results obtained are given below.

No.	Combination			Yield in kg/acre
	N	P	K	
I	0	0	0	972
II	0	60	60	991
III	30	60	60	1450
IV	60	60	60	1558
V	90	60	60	1443
VI	60	0	60	1335
VII	60	30	60	1481
VIII	60	90	60	1612
IX	30	30	30	1335
X	60	60	0	1558
XI	60	60	30	1558
XII	60	60	90	1473
XIII	90	90	90	1457
XIV	0	0	0	877

From the above, it can be said that the response to 'N' is observed upto 60 kg/acre while at the 90 kg/acre the yield has decreased or the contrary. Regarding the response to P_2O_5 it was observed upto 90 kg/acre when applied with high levels of 'N' and K_2O. There seems to be no response to K_2O at all.

From the above, it can be said that the optimum dose of N, P_2O_5 and K_2O could be 60, 60 and 30 kg/acre.

2) Trial on the time of application of nitrogen

Object: - To find out the optimum time of nitrogen top-dressing.

Variety: I.R.-8
Date of sowing: June 12
Date of transplanting July 4

Other details and Results obtained: - The time of top dressings were fixed at (i) the tillering stage, (ii) 25 days before heading (ear primordium formation stage), (iii) 15 days before heading and (iv) the heading stage.

The ratio of basal nitrogen and top dressing were fixed as follows. The treatment combinations and the results obtained are given in the following table. A total of 60 kg. 'N' in various spilts along with 30 kg. P_2O_5 and 30 kg. K_2O per acre, all as basal dose.

No.	Basal	Tillering stage	Treatments 'N' kg/acre 25 days before heading	15 days before heading	Heading stage	Yield in kg/acre.
I.	60	-	-	-	-	2411
II.	36	14	10	-	-	2278
III.	36	14	-	10	-	2140
IV.	36	-	14	-	10	2538
V.	36	-	-	14	10	2520
VI.	24	16	10	-	10	2428
VII.	24	16	-	10	10	2389

From the above it is seen that the treatment No. IV and V have given the best yields. Hence, from this it can be said that the optimum time of top-dressing of nitrogen could be at the stage of 25 days before heading (i.e. at the earprimordium formation stage) and at the heading stage.

3) Trial on the effect of application of bulky manures such as paddy straws

Object: - To find out the increase of soil productivity by using paddy straws and green manure.

Variety: Taichung (Native)-1
Date of sowing: June 7
Date of transplanting: July 30

Other details and results obtained: - The following quantities of paddy straws and green manures were tried. A common dose of 50:30:48 kg/acre of N.P.K. was applied as one at basal and the other at the primordium formation stage. The details of treatments and the results obtained are given in the following table.

No.	Quantities in kg/acre		Yield in kg/acre
	Paddy straw	Green manure	
I.	-	-	1558
II.	1000	-	1582
III.	2000	-	1494
IV.	-	3000	1420
V.	-	6000	1663
VI.	1000	3000	1548

From the results it is seen that there is no much difference in each treatment. Secondly there was severe occurrance of bacterial leaf blight. Hence it is rather difficult to assess the efficiency of each treatment.

4) Feeler trial to find out the effect of fritted minor elements fertilizers and slow releasing nitrogenous compound fertilizer

Variety: Taichung (N)-1
Date of sowing: June 7
Date of transplanting: June 30

Other details and results obtained: - The trial was conducted with five different treatments, as shown below. In treatment No.I and II i.e. control and fritted minor element fertilizer treatments, N P.K., at rate 50:30:48 kg/acre were applied in two doses with compound fertilizer and the fritted element was applied as basal. Regarding treatment No.III, IV and V, all quantity of fertilizers were applied as basal and no top dressing was done. The results obtained are given in the following table.

No.	Treatments	Yield in kg/acre
I.	Control (50:30:48 kg of N.P.K. per acre)	1332
II.	Fritted minor element fertilizer + 50:30:48 kg/N.P.K. per acre	1536
III.	Kumiai Gup (417 kg/acre)	1531
IV.	AM Compound (357 kg/acre)	1407
V.	DICYAN555 (335 kg/acre)	1437

From the results it is seen that there is a difference in yield between the treatments, and all the treatments are superior to the control. As regards the slow releasing nitrogenous compound fertilizer, these can be used with the yield advantage without carrying any top dressing. In this trial experiment there was also severe occurrance of BLB which must have affected the results.

5) Trial to find out the proper application method of Urea and Ammonium Sulphate

Variety: Jaya
Date of sowing: June 17
Date of transplanting: July 5

Other details and results obtained: - The trial was conducted with different types of application of urea and ammonium sulphate. The total quantity of N.P.K. applied was 60:30:30 kg/acre, all as basal. The treatment details and results obtained are given below:

No.	Treatments	Yield in kg/acre
I.	No nitrogen	1831
II.	Urea applied on surface only	1851
III.	Urea applied and worked into the soil	1953
IV.	Ammonium Sulphate applied on surface only	2003
V.	Ammonium Sulphate applied and worked into the soil	2286

From the results it is seen that there is a difference in yield between the treatments. Further it can be said that the nitrogenous fertilizers applied should be worked into the soil as soon as possible after its application by using some kind of agricultural implements.

(3) Trial demonstration on the improved agricultural techniques at the cultivators field:

Direct Crop Management Programme was started in this district in the Kharif 1969 on cultivators' fields. The main object of this programme is to help the farmers to reach the production target of 2 tons of paddy per acre by introducing new techniques in rice cultivation. In the Kharif season only 26 cultivators were selected from the 4 adjoining villages as shown in Table No. 1.

Table No. 1

Name of Taluka	Name of village	No. of cultivators	Area brought under the programme
1. Karjat	Jambivali	14	74.10
2. Khalapur	Mahad	6	9.20
	Chincholi	3	5.30
	Shedavali	3	6.30
Total		26	96.10

In a selected village generally 10 farmers were selected by themselves according to the following norms.

(1) Two farmers whose holding are above 10 acres.
(2) Three farmers whose holding are between 5 to 10 acres.
(3) Five farmers whose holding are below 5 acres.

The selection of farmers was done so as to have a cross section of farmers varying economic conditions. This was found important for analyzing their adaptability to use the optimum inputs and benefits accrued. It was also envisaged to increase the yield by directly managing rice cultivation of these farmers. Such farmers are expected to play an important role to extend the improved practices to other farmers in the selected village, who are not participating in the programme.

The recommendations to be followed by the participants under the programme are: -

(1) Use of high yielding varieties
(2) Use of chemical fertilizers as per recommendations.
(3) Line planting by block method
(4) Use of improved agricultural machinery

As per the above recommendations the results obtained are given in the following table No.2.

Table No.2: - Average yield of cultivators participated in 4 selected villages.

	Mahad	Shedavali	Jambivali	Chincholi	Average	Local method
No. of hills/m^2	18.6	14.7	17.0	19.0	17.3	13.5
No. of panicles per sq. meter	206	167	124	217	179	130
Panicles/hill	11.1	11.4	7.3	11.4	10.3	9.7
'N' kg/acre	27.3	22.7	10.0	22.5	20.6	0
Wt. of grains/ hill gms.	1.94	2.13	2.02	2.03	2.06	1.50
Wt. of grain/m^2	400	356	251	440	362	205
Yield in kg/acre	1660	1424	1004	1760	1447	820

From the above table it can be said that cultivators who participated in the programme could double their yield when compared to the local method. In the village Jambivali there was a heavy attach of stem borer, the yields being low. However all the cultivators could not attain the level of 2 tons per acre, the average being 1447 kg/acre. All the participants in the Direct Crop Management Programme were given Power Tiller on hire at a subsidised rate of Rs. 25/- per day. Most of the participants took advantage of this. In addition, other cultivators who were not participating in this programme, also took advantage of this opportunity. In all 58 farmers used Power Tiller on hire from the Centre, during the Kharif season.

The following table No.3 shows the No. of participants and area brought under various type of recommendations.

Table No. 3

Recommendations	Jambivali		Mahad		Chincholi		Shedavali		Total	
	No. of farmers participated.	Acreage	No. of farmers participated	Acreage	No. of farmers participated	Acreage	No. of farmers participated	Acreage	No. of farmers participated	Acreage
1) Use of implement machinery	6	8.50	-	-	-	-	-	-	6	8.50
2) Line planting by Block method	2	2.00	4	10.30	2	1.30	2	1.00	10	14.60
3) Use of fertilizers	14	74.50	6	9.50	3	6.70	3	5.30	26	96.00
4) Variety used	14	74.50	7	9.00	3	4.00	3	5.30	27	92.80

Note: - The cultivators of Mahad, Chincholi and Shedavali could not use the improved machinery since the machinery were not available with the farm.

Conclusion:

(1) According to the above tables it is seen that the farmers of the above villages are accepting the new improved recommendations on their farm.

(2) In the beginning the target was that each cultivator should at least adopt the improved practices on one acre. But from the above table it is seen that the cultivators are using the improved practices even in 4 acres at a time.

(3) Before introducing this programme the propaganda of use of high yielding varieties was undertaken by the Zilla Parishad in their usual schemes. Therefore use of these high yielding varieties was not a problem.

(4) Regarding use of agricultural machinery, it was so popular that the non-participant also wanted to use it in their fields.

In the villages like Mahad, Shedavali and Jambivali 4 cultivators were selected and were given personal guidance. They followed all the recommendations. By recommending the improved method of paddy cultivation to the cultivators it can be seen from the table No.4 that the cultivators are gradually taking up the improved method.

Table No. 4

Difference between the local and improved methods in Kharif 1969 (in case of four selected cultivators)

Yielding factors	Improved Method A	Local Method B	Ratio (A/B x 100)
1) No. of hills per sq.meter	236	144	164
2) Total no. of panicles per sq. meter	254	148	172
3) No. of good panicles per sq. meter	232	137	169
4) Average No. of effective panicles per hill	9.8	9.5	103
5) % of effective panicles	91.8	92.6	99
6) Yield per sq. meter	0.508	0.218	233
7) Weight per panicle in gm.	2.00	1.5	133
8) Yield per acre in kg.	2030	872	233

Conclusion:

It is observed from the above table that the improved method gives more than double the yield as compared to local method. By analyzing the results of yield it is seen that the improved method make the total number of hills per sq. meter increase.

2. SUMMER (DECEMBER-APRIL) 1969-70

(1) Agronomy

1) Study on the growth phases of some important high yielding varieties

Object: - To study about the growth phases of important high yielding varieties in early, medium and late crops with a view to utilize the same for the extension education of extension workers and farmers.

Results obtained:- Seven different varieties were grown in Summer 1970 and their growth phases were studied. The distinct phases of these varieties are given in the following table.

SL No.	Varieties	Date of sowing	Nursery period	Growth phases in days				Total crop duration in days
				Period from trans-planting to Max. tillering stage	Period from Max. tiller-ing to earpri-mordium forma-tion stage	Period from earpri-mordium to head-ing stage	Period from heading to ripening stage	
1.	Padma	Dec.24	35	31	2	26	31	125
2.	Hamsa	Dec.24	35	31	3	26	30	125
3.	T.K.25	Dec.24	35	31	8	26	30	130
4.	R.4	Dec.24	35	29	13	27	30	134
5.	T (N)1	Dec.24	35	31	12	26	33	137
6.	Jaya	Feb.27	35	30	24	25	33	147
7.	I.R.-8	Dec.24	35	31	26	26	34	152

From the above it is observed that all the growth phases, except the growth phase from the maximum tillering stage to the ear primordium stage, have almost the same period irrespective of varieties. In case of late varieties, the ripening phase is slightly longer than the other varieties. The growth phase from the maximum tillering statge to the ear primordium stage varies depending on the varieties. In the early varieties this period is shorter than medium and late varieties.

2) Trial on high yielding varieties under three different levels of fertilizers

Object: - To study about the yielding behaviour of various high yielding varieties under low, medium and high level of fertilizer doses.

Variety:	Seven	
Date of sowing:	Dec. 24	
Date of transplanting:	medium	Jan. 28
	low & high	Feb. 5
Spacing:	25 x 12.5 cm	

The fertilizer doses for different varieties were as follows:

SL. No.	Varieties	Kg/acre								
		Low			Medium			High		
		N	P	K	N	P	K	N	P	K
1.	T.K.25	20	10	10	40	20	20	60	30	30
2.	Hamsa									
3.	Padma									
4.	R.4									
5.	T(N) 1	25	13	13	50	25	25	75	35	35
6.	IR-8	30	15	15	60	30	30	90	45	45
7.	Jaya									

Results obtained

(A) Low fertilizer level:

SL No.	Varieties	No. of effective panicles per m^2	No. of ripened grains per panicle	Wt. of 1000 grns in gm.	Days until flowering	Yield in kg/acre	
						Straw	Grain
1.	T.K.25	360	96.9	14.2	103	1428	2015
2.	Hamsa	312	67.1	22.2	98	1793	1890
3.	Padma	345	79.5	19.9	96	2015	2355
4.	R. 4	362	61.8	14.2	107	1420	2104
5.	T(N)1	335	80.6	23.2	105	1861	2545
6.	IR-8	306	94.0	27.4	112	2056	2736
7.	Jaya	344	81.8	27.0	109	2299	2974

(B) Medium fertilizer level:

SL No.	Varieties	No. of effective panicles per m^2	No. of ripened grains per panicle	Wt. of 1000 grains in gms	Days until flowering	Yield in kg/acre	
						Straw	Grain
1.	T.K.25	430	109.4	14.9	100	2084	2853
2.	Hamsa	429	94.7	23.4	95	1990	3108
3.	Padma	395	96.0	19.9	94	2424	2663
4.	R.4	446	110.3	15.1	104	2023	3043
5.	T(N)1	354	83.3	23.9	104	2052	3047
6.	IR-8	372	83.4	28.0	118	3092	3537
7.	Jaya	432	99.2	27.6	117	2501	3414

(C) High fertilizer level:

SL No.	Varieties	No. of effective panicles per m^2	No. of ripened grains per panicle	Wt. of 1000 grains in gms.	Days until flowering	Yield in kg/acre	
						Straw	Grain
1.	T.K.25	431	101.9	14.7	103	2003	2562
2.	Hamsa	379	107.3	23.5	99	2590	3047
3.	Padma	445	70.7	20.2	99	2699	2942
4.	R.-4	469	100.4	14.4	108	1989	2772
5.	T(N) 1	468	77.6	23.8	106	2792	3496
6.	IR-8	388	84.5	38.4	115	3177	3852
7.	Jaya	435	75.9	28.4	111	3573	3792

(D) Comparison

SL No.	Varieties	Grain yield in kg/acre		
		Low	Medium	High
1.	T.K. 25	2015	2853	2562
2.	Hamsa	2355	2663	2942
3.	Padma	2355	2663	2942
4.	R.-4	2104	3043	2772
5.	T(N) 1	2545	3047	3496
6.	IR-8	2736	3537	3852
7.	Jaya	2974	3414	3792

According to the nitrogen response of various high yielding varieties the varieties tested were divided into three groups viz. low responsive, medium responsive and high responsive. From the results given in the above table it can be said that in the low responsive group the varieties of T.K. 25, Hamsa, R.-4 responded well upto the medium level of fertilizer (i.e. 40:20:20) whereas at high level of fertilizer there was no response with the yield decreasing. These varieties lodged with higher leavel of fertilizer and there was incidence of sheath rot. In the medium and high responsive groups the varieties T(N)-1,

IR-8 and Jaya showed linear response to the high doses of fertilizer applied.

3) Trial on spacing-cum-levels of fertilizers

Object: - To find out the optimum spacing and the fertilizer doses

Variety : Jaya

Date of sowing : Dec. 31

Date of transplanting: Feb. 7

Treatments : Main plot-Fertilizer levels.

	N	P	K	kg/acre
1.	0	0	0	
2.	30	15	15	
3.	60	30	30	
4.	90	45	45	

Sub-plot-spacing
1. 30 x 30 cm.
2. 25 x 20 cm.
3. 20 x 15 cm.
4. 25 x 10 cm.
5. 20 x 10 cm.

Results obtained: - Five different spacings were tried under four levels of fertilizers and the results obtained are given in the table below.

Spacing (cm.)	N level kg/acre	Grain yield kg/acre	No. of panicles per m^2	1000 grain Wt. in grams	Plant height in cms.	Panicle length in cms.	Straw yield kg/acre
30 x 30 (11)	0	2242	229	26.1	82	24.3	1671
	30	2938	299	27.7	88	24.3	2242
	60	3488	325	27.7	94	24.5	3460
	90	3650	310	27.4	94	25.2	3347
25 x 20 (20)	0	2096	310	25.8	81	22.5	2092
	30	3537	326	27.4	88	24.1	2877
	60	3852	382	28.0	94	24.5	3832
	90	4047	360	28.1	94	24.6	3946
20 x 15 (33)	0	2270	380	250	78	22.7	2256
	30	3525	403	28.2	87	22.8	3650
	60	4035	512	28.0	94	28.5	3832
	90	3941	475	27.3	93	23.7	4370
25 x 10 (40)	0	2266	384	25.0	76	22.0	1978
	30	3593	464	28.1	81	22.5	3375
	60	3820	540	28.3	88	22.5	4051
	90	3852	528	27.4	91	23.2	4310
20 x 10 (50)	0	2357	420	24.9	75	21.6	2011
	30	3379	470	27.9	81	22.4	3116
	60	3743	510	27.9	88	23.5	4225
	90	3925	585	27.8	90	23.0	4383

From the above it is seen that the yield increased as the levels of fertilizer increased in all the specings tried. Under no 'N'-level it was observed that there was no such difference in yield in all the spacings tried. Under 30 'N' level, the spacings of 25 x 20, 20 x 15 and 25 x 10 cms have almost given the same yield whereas the 30 x 30 cm and 20 x 10 cm have given lower yields. For 60 'N' level, the spacing 20 x 15 cm has given the highest yield of 4035 kg/acre whereas 30 x 30 is the lowest. Regarding the other three spacings, they are all on par. Under 90 'N' level, all the spacing are on par, except 30 x 30 cm which has yielded low. In general under 60 'N' the optimum spacing seems to be 20 x 15 cm (33 hills/m^2) and in case of 90 'N' the optimum spacing seems to be 25 x 20 cm (20 hills/m^2) which have the yield of 4 tons/acre.

(2) Soil and fertilizer

1) Factorial experiment of different levels of Nitrogen, Phosphorous and Potassium

Object: - To find out the optimum quantity of Nitrogen, P_2O_5 and K_2O per acre in Kharif and Summer.

Variety: IR-8

Date of sowing: Dec. 24

Date of transplanting: Feb. 2

Other details and results obtained: - Four levels viz. 0, 30, 60 and 90 kg/acre of N, P_2O_5 and K_2O in various combinations as detailed below were tried with a view to find out the optimum doses of N, P_2O_5 and K_2O for rice plant. The results obtained are given below:

No.	Treatment			Yield in kg/acre	
	N	P_2O5	K_2O	Straw	Grain
I.	0	0	0	1929	2729
II.	0	60	60	2280	3262
III.	30	60	60	2806	3589
IV.	60	60	60	3089	3882
V.	90	60	60	3946	4799
VI.	60	0	60	3187	4122
VII.	60	30	90	3254	4233
VIII.	60	90	60	3716	4742
IX.	30	30	30	2782	3737
X.	60	60	60	3487	4307
XI.	60	60	30	3565	4536
XII.	60	60	90	3072	3838
XIII.	90	90	90	4242	4698
XIV.	0	0	0	1909	2601

From the above it can be said that the response to 'N' is observed up to 90 kg/acre and response to 'P_2O_5' is also observed upto 90 kg/acre when applied with high level of 'N'. There is no response to "K_2O'. K_2O could be 60-90, 60 and 30 kg/acre respectively in summer season.

2) Trial on the time of application of Nitrogen

Object: - To find out the optimum time of Nitrogen as top dressing.

Variety: IR-8

Date of sowing: Dec. 24

Date of transplanting: Feb. 2

Other details and results obtained: - The time of top dressing were fixed at i) the tillering stage, ii) 25 days before heading (ear primordium formation stage), iii) 15 days before heading and iv) the heading stage.

Regarding the ratio of basal and top dressing of Nitrogen were fixed as under. The combinations and the results obtained are given in the following table. The total of 60 kg 'N' in various splits along with 30 kg of P_2O_5 and 30 kg of K_2O per acre as basal dose were applied.

No.	Basal	Treatment 'N' kg/acre			Heading	Yield in kg/acre	
		Tillering stage	25 days before heading	15 days before heading		Straw	Grain
I	60	-	-	-	-	3539	4196
II	36	14	10	-	-	3325	4177
III	36	14	-	10	-	3260	4049
IV	36	-	14	-	10	3352	4252
V	36	-	-	14	10	3368	4258
VI	24	16	10	-	10	3586	4303
VII	24	16	-	10	10	3262	4126

From the above it is seen that the treatment No. VI has given the best yield, but from this it can be said in general that the optimum time of top dressing of nitrogen is at the stage of 25 days before heading (i.e. at the stage of ear primordium) and heading.

3) Trial on the effect of application of bulky manure such as paddy straws and green manures

Object: To find out the effect of paddy straws and green manures to increase soil productivity.

Variety: T(N) - 1

Date of sowing: Dec. 24

Date of transplanting: Feb. 3

Other details and results obtained: - The following quantities of paddy straws and green manures were tried. A common dose of 50:30:48 kg/acre of 'N', P_2O_5 and K_2O by compound fertilizer was applied in two doses i.e. one at the basal and other at the ear primordium formation stage. The detail of treatments and the results obtained are given in the following table.

No.	Treatments untity in kg/acre		CDU	Yield in kg/acre	
	Paddy straw	Green manure		Straw	Grain
I	-	-	-	2628	3598
II	1000	-	-	2732	3898
III	2000	-	-	2846	3968
IV	-	3000	-	3274	4107
V	-	6000	-	2924	3857
VI	1000	3000	-	3042	4039

From the above it can be said that the response to application of paddy straws and green manures is observed. While in 6 tons of green manure treatment it has been slightly reduced. This is the second season of the trial. From these results it is seen that there is a residual effect of the bulky manures. Further it can be said that the optimum quantity of paddy straws and green manures to be applied is one ton and three tons per acre respectively.

4) Trial on the effect of slow acting fertilizer and residual effect of fritted minor elements.

Object: T(N)-1

Date of sowing: Dec. 24

Date of transplanting: Feb. 3

Other details and results obtained: - The trial was conducted in five different treatments as shown below. In treatment No. I and II i.e. control and fritted minor elements. fertilizer treatment N, P_2O_5 and K_2O at the rate of 50:30:48 kg/acre were applied in two doses by compound fertilizers and the fritted elements were not applied as basal to find out the residual effect. Regarding treatment No. III, IV and V all quantity of fertilizers were applied as basal and no top-dressing was done. The results obtained are in the following table.

No.	Treatments	Yield in kg/acre	
		Weight of straw	Weight of grain
I	Control	2723	3196
II	Fritted elements which applied last Kharif 1969	2962	3270
III	Kumiai Gup	4023	3563
IV	A.M. Compound	3465	3318
V	Dicyan 555	3408	3689

From the above it is seen that there is a difference in yield and No. III, IV and V treatments are superior to the control. From this, as regards the slow, releasing nitrogenous compound fertilizer, these can be used with the some yield advantage without applying any top-dressing. Regarding the second treatment the effect of minor elements is not observed. Therefore it can be said that the effect of minor elements can last for one crop season.

N.B. (a) Kumiai Gup (Phosphorous Guany/Uria): - this is a slow acting fertilizer.

(b) A.M. Compound (2-Amino-4-Chloro-6 Methyl primigrine) and and (c) Dicyan 555 (Diacyan Diamid): - These fertilizers contain some chemicals which control the activity of the bacteria.

5) Observation on response to N, P_2O_5 and K_2O in cultivators field.

Object: - To find out the response to N, P_2O_5 and K_2O in cultivators field.

Variety: T(N) - 1
Date of sowing & transplanting: Followed cultivator's

Other details and results obtained: - Five cultivators paddy fields, where fertilizer application has not ever been done, were selected. Total quantity of N is 60 kg/acre. 60% as basal and 25% and 15% as top-dressing at the time of ear primordium and heading respectively were applied and entire 30 kg of P_2O_5 and K_2O per acre as basal were applied. The details of treatments and results obtained are given in the following table.

No.	Treatment	Weight of grain in kg/acre				
		Humgaon	Posari	Hahad	Chincholi	Pui
I.	Control	2016	0907	1040	1164	1133
II.	P_2O_5 & K_2O	2103	0986	1076	1189	1229
III.	N & P_2O	3227	3599	2433	2171	1781
IV.	N & P_2O_5	3153	2941	2804	2515	2231
V.	N & P_2O_5 & K_2O	2864	2775	3116	2702	2504
VI.	N & P_2O_5 & 2 x K_2O	3033	3123	2926	2656	2034

From the above it can be said that the high response to N is observed in all the cases and the response to P_2O_5 and K_2O is also observed in Mahad and Chincholi villages in Khalapur, and Pui village in Roha. From this it can be said that the application of N is the most important factor and application of P_2O_5 and K_2O should also be done according to the soil conditions which would be found out by soil testing.

(3) Detailed targets and achievements in Extension works in the area

Direct Crop Management Programme

As stated above the Centre has selected 3 blocks for intensive works. From each block 3 villages having irrigation facilities for the second crop have been selected, and from each of the selected villages 10 cultivators of following 3 categories have been selected: -

5 Cultivators each holding less than 5 acres
3 Cultivators each holding 5 to 10 acres
2 Cultivators each holding above 10 acres

Close contacts are kept with these farmers and they are persuaded to take up the improved agricultural practices. Through various methods and techniques of agricultural extension works they are convinced of the economic utility of these practices. Their difficulties and problems as regards various in-puts like seed, fertilizer, plant protec-

tion material etc. are solved. Arrangements of finance either through co-operative bank loan or Govt. Tagai is made. Technical guidance with practical demonstrations is given to them in the fields and thus they re-motivated to transform their tradition-bound-forming to improved scientific farming. The following are some results: -

Table No. 1

Name of village	No. of selected farmers	Area of selected farmer	No. of farmers adopting improved practices with line planting	Area covered by improved practices with line planting	Area covered by improved practices but without line planting
1. Cove	10	57.00	1	2.00	19.50
2. Pui	9	40.00	2	1.00	17.50
3. Muthaoli	10	62.00	-	-	44.25
4. Mahad	10	56.00	2	8.00	26.00
5. Chincholi	5	49.00	1	1.00	18.65
6. Shedoli	5	16.00	--	-	10.20
7. Jambivali	10	84.00	10	15.00	-
8. Posari	12	72.00	10	17.00	-
9. Humgaon	10	64.00	6	7.00	2.50
Total	81	500.00	32	51.00	138.60

From the above it will be seen that, though 81 cultivators were selected, only 32, or 40% only came forward to adopt the improved agricultural practices including line planting, and, though 81 cultivators owned 500 acres, only 51 acres, or 10% was put under line planting. Out of the remaining only 138.60 acres were put under the improved agricultural practices but they did not take up line planting. Thus it will be seen that farmers are slow to take up line planting, though they increased number of hills per sq. meter even in case of random planting. Out of those 81 cultivators, 28 cultivators were selected for crop estimation by conducting crop cutting experiment under the guidance of Japanese experts, and the following are the village wise results.

Table No. 2

Name of Taluka & village	Improved methods (A)	Local (B)	$\%(\frac{A}{B} \times 100)$
Khalapur Taluka (Mean)	2440	1709	143
Chincholi/Shedoli	2053	1365	150
Mahad	2840	2053	138
Karjat Taluka (Mean)	2950	1600	184
Posari	3035	1323	228
Jambivali	3250	2020	161
Humgaon	2565	1459	176
Roha Taluka (Mean)	2402	1230	195
Pui	2504	1520	165
Mutholi	2304	970	238
Gove	2400	1200	200

It is observed that the yields of Summer crop both in local and improved methods are better than those of Kharif crop. From the above table which relates to per acre yields obtained in Summer crop it will be seen that even in local method the yield ranged from 9.70 to 20.5 quintal per acre. With the improved agricultural practices there was much increase in yield being 43% to 138% more the yield ranging from 20.5 to 32.5quitanls per acre. This clearly indicates that there are much possibility of boosting up the per acre yield of this tracts by persuading cultivators to adopt the improved agricultural practices through expansion of the works of Direct Crop Management Programme.

Fertilizer application in adequate doses and at the proper time has paramount importance in raising the agricultural production. The village wise record of the selected cultivators in the Direct Crop Management Programme was collected as follows in this connection.

Table No. 3

Name of village	10.6% N below 20 kg/acre. Yield in quintal per acre	46.6% N 21 to 40 kg/acre Yield in quintal per acre	42.8% N above 40 kg/acre Yield in quintal per acre
1. Mahad	-	20.53	-
2. Chincholi	18.10	-	-
3. Humgaon	15.62	21.24	19.89
4. Jambivali	-	30.50	34.20
5. Posari	-	21.47	31/56
Mean	16.86	23.42	28.55
Ratio	100%	138%	170%

From the above it will be seen that N level ranging from 0 to 20 Kg per acre gave comparatively low yield of 16.86 quintal per acre as against 23.42 quintal per acre in N level ranging from 20 to 40 kg per acre and 28.55 quintals per acre in N level above 40 kg per acre. Taking the average yield of N level ranging 0 to 20 kg per acre as 100 there was 38% increase in case of N level ranging 21 to 40 kg. per acre and 70% increase in case of N level above 40 kg. per acre. Thus it seems that persuading farmers to go in for higher doses of N is essential to bring better economic returns.

In rice cultivation, number of hills per acre directly determines the yield per acre. Normally if there are more than 20 hills per sq. meter and if all the other factors are favourable we can expect about three tons per acre. With a view that the selected farmers should get at least 3 tons per acre, they were persuaded to plant more than 20 hills per sq. meter. Their reaction to this was studied as follows: -

Table No. 4

Name of village	No. of farmers		Area brought	
	Hills below 20	Hills above 20	Hills below 20	Hills above 20
1. Mahad	25%	75%	15.00%	85.00%
2. Humgaon	80%	20%	80.00%	20.00%
3. Jambivali	22%	78%	21.43%	78.57%
4. Posari	-	100%	-	100.00%
5. Pui	50%	50%	50.00%	50.00%
6. Gove	40%	60%	40.00%	60.00%
Percentage:	40.5	59.5	30.6	69.4

From the above it will be seen that inspite of recommendations 40.5% of the farmers planted less than 20 hills per sq. meter whereas the remaining 59.5% of the farmers did more than 20 hills per sq. meter. A tendency to plant less number of hills is constantly noticed and so more dense planting is an important point in extension works.

Overall study of all the fields of the selected farmers taking up the improved agricultural practices was done as follows.

Table No. 5

(mean obtained in each village)

Item	Mahad	Chincholi	Humgaon	Jambivali	Poseri
1. No. of hills per sq. meter (Mean)	21	22	18	21	26
2. No. of panicles per sq. meter (Mean)	357	374	342	336	520
3. Panicles per hill (Mean)	17	17	19	21	20
4. Weight of grains per hill (gram) (Mean)	0.28	0.23	0.26	0.35	0.31
5. Weight of grain per sq. meter (Mean)	0.513	0.452	0.486	0.788	0.732
6. Yield in kg/acre (Mean)	2053	1810	1944	3142	2929

From the above it will be seen that most of the villages had more than 20 hills per sq. meter on an average. Out of 5 villages two villages, Jambivali and Posari produced about 3 tons per acre. In the rest villages the yield was about two tons per acre. Even though the number of hills was more than 20 in Mahad and Chincholi the yield could not exceed 20.5 quintals because the other factors like timely application of fertilizers incidence of pests and diseases, inproper water arrangement etc. were not properly followed.

It is clear from the above that in order to secure the yield of 3 tons per acre in Summer crop not only the number of hills but also the other factors should be taken into account equally.

(4) Impact of the extension works in the surrounding area

The intensive approach taken up under the Direct Crop Management Programme in 9 villages in 3 Panchayat Samities had a very good impact on the minds of farmers, and a favorable atmosphere has been created for the acceptance of the improved agricultural practices on a wider scale in the coming crop season. Though the adjoining villages have seen and heard of the economic utility of the improved agricultural practices there is not remarkable changes in their local practices so far. But it is felt that once the acreage under the improved agricultural practices in the selected villages is increased, the adjoining villages would also be motivated to follow suit.

It seems therefore necessary to strengthen the agricultural extension programme in the villages so that wider coverage under the improved agricultural practices is seen.

The programme of custom hire services is becoming very popular, and especially Yanmer Tiller and Thresher are in great demand. Farmers desire that adequate subsidy should be given in the hiring charges. These situations should be carefully reviewed by the concerned authority so as to modernize the farming with the improved agricultural machinery and equipment.

The special programme of control of Stem Borer was taken up in the selected villages with help of the Zilla Parishad. The application of Linden Granules proved to be very effective and thus the crop damaged was saved.

3. KHARIF 1970

(1) Agronomy

1) Study on the growth phases of some high yielding varieties

Object: - To study about the growth phases of some important high yielding varieties in early, medium and late crops.

Results: - Ten varieties were grown in Kharif 1970 and their growth phases were studied. The distinct growth phases of these varieties are given in the following table.

SL No.	Varieties	Date of sowing	Growth phases in days					
			Nursery period	Period from transplanting to max. tillering stage	Period from max. tillering to ear primordia	Period from ear primordia to heading	Period from heading to ripening	Total crop duration
1.	Padma	June 4	19	31	2	23	33	108
2.	Hamsa	"	19	34	4	23	33	113
3.	E.K. 70	"	19	33	3	24	34	113
4.	T.K.25	"	19	33	5	23	35	115
5.	R - 4	"	19	35	8	23	34	119
6.	T (N) 1	"	19	37	3	24	35	118
7.	Jaya	"	19	36	9	24	36	124
8.	IR - 8	"	19	37	16	23	36	131
9.	IR - 20	"	19	36	17	24	36	132
10.	IR - 22	"	19	37	19	24	35	134

From the above, it can be seen that all the growth phases, except the growth phase from the maximum tillering to the ear primordia stage, have almost the same period, irrespective varieties. The growth phases from the maximum tillering to the ear primordium stage varies depending on varieties. In early varieties, this period shorter and in medium and late varieties it is longer.

2) Trial on high yielding varieties

Object: - To study about the yielding behaviour of various high yielding varieties under high fortility conditions.

Varieties : 8 varieties

Date of sowing : June 4

Date of transplanting : June 23

Spacing : 25 x 12.5 cm

Fertilizer doses:

: Varieties	N	P	K	kg/acre
(i) IR-8, Jaya, IR-22, IR-20	60	30	30	
(ii) T(N)-1, Hamsa	50	25	25	
(iii) T.K. 25, R-4	40	20	20	

Results obtained

SL.No.	Varieties	No. of effective panicles per m^2	No. of ripened grains per panicle	1000 grain wt. in gms.	Days until flower-ing	Yield in kg/acre	
						Grain	Straw
1.	Hamsa	174	72	21.5	80	1089	1275
2.	T.K.25	241	82	14.3	80	1142	1275
3.	R-4	258	108	13.8	85	1558	1397
4.	T(N)-1	207	96	22.9	83	1853	1862
5.	Jaya	217	86	28.8	93	2177	2203
6.	IR-8	227	80	29.5	95	2040	1946
7.	IR-20	253	79	24.9	96	2016	1870
8.	IR-22	238	103	21.0	99	2088	2121

From the above it can be said that the varieties of Jaya, IR-8, IR-20 and IR-22 are almost the same in yield and have given more than 2 tons per acre. The grain quality of IR-20 and IR-22 is superior when compared to Jaya and IR-8. There was heavy infection of BLB on Hamsa, T.K.25, R-4 and T(N)-1. The intensity of BLB on IR-20 and IR-22 was less as compared to Jaya and IR-8.

3) Trial on spacing cum levels of fertilizers

Object: - To find out the optimum spacing and the fertilizer doses

Variety: Jaya

Date of sowing: June 5

Date of transplanting: July 9

Treatments: Main plot - Fertilizer levels

	N	P	K	Kg/acre
1.	0	0	0	
2.	30	15	15	
3.	60	30	30	
4.	90	45	45	
5.				

Sub-plot-spacing

1. 30 x 30 cm
2. 25 x 20 cm.
3. 20 x 15 cm
4. 25 x 10 cm
5. 20 x 10 cm

Results obtained: - Five different spacings were tried under four levels of fertilizers and the results obtained are given in the following table.

Spacing	'N' level kg/acre	No. of panicles per m^2	Ripened grains per panicles	1000 grain wt. in gms	Plant ht. in cms	Panicle length in cms.	Yield in kg/acre	
							grain	Straw
30 x 30	0	126	100	30.4	85.4	22.7	1550	992
(11 hills)	30	100	87	30.5	95.4	23.3	1716	1230
	60	163	92	29.5	97.4	23.5	1789	1712
	90	176	63	28.9	99.6	23.2	1303	1853
25 x 20	0	156	86	29.5	84.3	22.3	1611	1137
(20 hills)	30	197	88	37.1	92.2	22.7	2190	1752
	60	191	84	29.5	96.8	22.7	1927	1854
	90	199	64	29.0	99.7	22.5	1486	2015
20 x 15	0	198	69	30.4	83.8	21.8	1675	1202
(33 hills)	30	219	81	31.0	90.4	22.2	2239	1836
	60	234	68	30.0	95.3	22.3	1934	1894
	90	226	66	29.2	96.3	22.4	1757	2011
25 x 10	0	202	70	29.8	80.9	21.1	1716	1065
(40 hills)	30	228	73	31.4	89.9	22.0	2121	1660
	60	244	59	30.2	93.7	22.3	1773	1874
	90	244	62	29.2	96.1	22.1	1793	2072
20 x 10	0	220	63	30.1	79.7	21.4	1700	891
(50 hills)	30	257	68	31.3	87.7	22.0	2202	1769
	60	282	52	30.2	93.8	22.0	1781	2165
	90	288	48	28.8	94.9	22.0	1819	2214

From the data above, it can be said that the yields have increased only up to 30 kg. nitrogen level per acre whereas at 60 and 90 kg 'N' per acre the yields have discreased in all the spacings plots. At 30 kg. 'N' level the spacing 20 x 15 cms, or 33 hills/m^2 has given the highest yield of 2239 kg/acre and the other spacings of 25 x 20, 25 x 10 and 20 x 10 cm. are all on par. As regards the number of panicles in each fertilizer level, more planting has shown the tendency to increase the number of panicles per unit area. The causes of low yields under higher levels of fertilizer i.e. 60 and 90 kg 'N' are

acre can be said to be the followings.

a. Inspite of all the plant protection measures undertaken, severe occurrence of Bacterial Leaf Blight was observed during this season before and after the rooting stage.

In the treatments of heavy fertilizer doses i.e. 60 and 90 kg N/acre and more dense planting, the intensity of bacterial leaf blight was less.

b. In the treatments of 60 and 90 kg 'N'/acre and more dense spacing, only 50 to 60 filled grains per panicle were observed, because of the severe infection of bacterial leaf blight.

c. It is observed that under higher levels of nitrogen i.e. 60 and 90 kg/acre, the 1000 grain wt. is less than under low level of nitrogen in all the spacing plots, because of the heavy infection of bacterial leaf blight.

4) Trial on varieties cum levels of fertilizers

Object: - To study about the response of various high yielding varieties to the level of fertilizers

Date of sowing : June 4

Date of transplanting : June 24

Spacing : 25 x 12.5 cm

Treatments: : Main plot - Fertilizer levels

	N	P	K	kg/acre.
1.	0	0	0	= L-0
2.	20	15	15	=L-1
3.	60	30	30	= L-2
4.	90	45	45	= L-3

Sub-plot - Varieties

(1) T.K.25
(2) Hamsa
(3) R-4
(4) T(N)-1
(5) Jaya
(6) IR-8

Results obtained: - Six high yielding varieties were tried under four levels of fertilizers and the result obtained are given in the following tables.

a. Yield in kg/acre

S.No.	Level of Fertilizers / Varieties	L - 0	L - 1	L - 2	L - 3	Average
1.	T.K.25	1012	1299	720	805	959
2.	Hamsa	1117	1141	1012	648	980
3.	R-4	1445	1611	1599	1150	1451
4.	T(N) 1	1235	11486	1380	1409	1358
5.	Jaya	1575	1652	2263	2097	1897
6.	IR-8	1748	2335	2210	1842	2034

b. Number of panicles per m^2

1.	T.K.25	191	221	255	263	233
2.	Hamsa	173	205	227	238	211
3.	R-4	187	252	264	311	254
4.	T(N) 1	180	197	264	271	229
5.	Jaya	164	183	220	236	201
6.	IR-8	161	193	212	235	200

c. Number of filled grains/panicle.

1.	T.K. 25	92	1100	50	54	74
2.	Hamsa	70	61	49	31	53
3.	R-4	130	107	102	64	101
4.	T(N) 1	73	79	57	56	66
5.	Jaya	82	76	87	76	80
6.	IR-8	93	98	88	67	87

From the above it can be said the response to 'N' is seen only upto 30 kg/acre. On an average the varieties of IR-8 and Jaya have given 2034 and 1897 kg/acre respectively. The varieties of T.K.25, Hamsa, R-4 and T(N)-1 were heavily infected by BLB, as compared to Jaya and IR-8. Under high level of fertility, the infection was more.

(2) Soil and Fertilizer

1) Factorial experiment on different levels of Nitrogen, Phosphorous and Potassium

Object: - To find out the optimum quantity of Nitrogen, P_2O_5 and K_2O per acre in Kharif crop.

Variety: IR-8

Date of sowing: June 9

Date of transplanting: July 1

Spacing: 25 x 12.5 cm

Other details and results obtained: - Four levels of 0, 30, 60 and 90 kg/acre of 'N', P_2O_5 and K_2O in various combinations as detailed below were tried with a view to find out the optimum doses of N, P_2O_5 and K_2O for paddy. The results obtained are given below.

Treatment No.	Treatment details			
	N	P_2O_5	K_2O	Grain yield kg/acre
I	0	0	0	1691
II	0	60	60	1935
III	30	60	60	2304
IV	60	60	60	2446
V	90	60	60	2243
VI	60	0	60	2311
VII	60	30	60	2358
VIII	60	90	60	2420
IX	30	30	30	2241
X	60	60	0	2327
XI	60	60	30	2295
XII	60	60	90	2430
XIII	90	90	90	2367
XIV	0	0	0	1341

From the above it is observed that the response to 'N' is observed upto 30 kg/acre only. There is no response to 'N' in case of 60 and 90 kg/acre. Similarly no response to P_2O_5 as well as K_2O is observed during the Kharif season. During this season, there were more cloudy days as compared to the last season, and this may be one of the reasons why there was no response to 'N' beyond 30 kg/acre. Further the infection of BLB was seen where high doses of 'N' were applied.

2) Experiment on the time of application of Nitrogen and Potassium

Object: - To find out the optimum time of Nitrogen and Potassium as top-dressing

Variety	: IR-8
Date of sowing	: June 9
Date of transplanting	: July 1
Spacing	: 25 x 12.5 cm

Other details and results obtained: - The time of top-dressing was fixed at (i) the tillering stage, (ii) 25 days before heading (ear primordium formation stage) and (iii) the heading stage.

Regarding the ratio of basal dose and top-dressing of 'N' and "K_2O" was fixed as detailed below. The treatment combinations and the results obtained are given in the following table. A total dose of 60 kg. N and K_2O per acre in various spilts and 30 kg. P_2O_5 per acre as basal were applied.

Treatment No.	Treatment Details									
	Basal dose			Stage of top-dressing						
				Tillering		Ear Prim.		Heading		Grain yield
	N	P_2O_5	K_2O	N	K_2O	N	K_2O	N	K_2O	kg/acre
I.	60	30	30	-	-	-	-	-	-	2374
II.	48	30	30	-	-	12	-	-	-	2405
III.	36	30	30	-	-	12	-	12	-	2365
IV.	30	30	30	6	-	12	-	12	-	2379
V.	36	30	30	-	-	12	3-	-	-	2264
VI.	36	30	30	-	-	12	-	12	30	2401
VII.	36	30	30	-	-	12	15	12	15	2273

From the above it can be said that there is no difference in yield between any of the treatments tried i.e. application of 'N' & 'K' in full or in splits at various growth stages of the plant as top-dressing.

3) Trial on the effect of application of bulky manures such as paddy straws and green manures.

Object: - To find out the effect of paddy straws and green manures in increasing soil productivity.

Variety: Jaya

Date of sowing: June 10

Date of transplanting: July 6

Spacing: 25 x 12.5 cm

Other details and results obtained: - The following quantities of paddy straws and green manures in various combinations were tried. A common dose of 50:30:48 kg/acre of N, P_2O_5 and K_2O were applied in two doses i.e. one as basal and the other at the ear primordium formation stage. The details of treatments and the results obtained are given in the following table.

Treatment .No.	Quantity in kg/acre		Grain yield kg/acre
	Paddy straw	Green manure	
I	-	-	2559
II	1000	-	2620
III	2000	-	2815
IV	-	3,000	2420
V	-	6,000	2245
VI	1000	3,000	1815

From the above it can be said that the treatment No. III i.e. applying paddy straw at the rate of two tons per acre has given the highest yield of 2815 kg/acre as against 2559 kg/acre of control. No increase in yield is observed when compared to control by applying 3 and 6 tons of green manures per acre.

According to the results of these trials, the improvements of the following items are recommended to be concerned authorities;

(i) adoption of high yielding varieties (IR-8, T(N)-1, Jaya, IR-22, etc.)

(ii) improvement of nursery beds (Apart from the nursery style, there is much room for improvement of seed-quantity and fertilization)

(iii) application of fertilizer as basal dose (especially N-fertilizers necessary for proper tillering and adequate panicles)

(iv) dense and shallow transplanting (dense planting for adequate panicles and shallow planting for proper tillering)

(v) application of additional fertilizers (especially N-fertilizers to increase the number of grains per panicle, ripening ratio per panicle and weight of grains)

(vi) water control if possible

(vii) timely plant protection

4. TRAINING

The Centre conducts the in-service training programme for technical personnel working in the ride growing areas of the State. They are trained on the technical know-how of scientific and improved methods of rice cultivation. The unique feature of this training is that the maximum weightage is given to practical field training rather than theoretical lectures. The training is imparted at 4 stages of rice cultivation for 4 days each as follows:

1st stage - Nursery sowing
2nd stage - Transplanting
3rd stage - Post transplanting stage
4th stage - Harvesting stage

The batches of trainees trained so far are as follows:-

	Batch	Period (days)	No. of participants
Kharif 1969	I	10	14
	II	10	13
			Total 27
Summer 1969-70	I	12	14
	II	12	19
			Total 33
Kharif 1970	I	13	11
	II	13	9
			Total 20

The training programme is conducted according to the following items;

Salient Features of Rice Cultivation with special reference to high yielding varieties (Extension education training)

Subject: - Items of the extension education for Rice Cultivation

1. Make one understand the factors which determine the rice yield.

Y = Number of panicles per unit area x Numbers of grains per panicle x ripening ratio x (Weight of 1000 grains)

2. Make one understand the differences in yield-determing factors between the local and the improved method.

   i) Yield
   ii) Number of panicles per unit area.
   iii) Number of grains per panicle
   iv) Ripening ratio
   v) Weight of 1000 grains

3. Display differences in cultivation techniques between the local and the improved method.

   i) Quantity of seeds sown in the nursery
   ii) Quantity of fertilizers applied in the nursery
   iii) Seedling age or number of leaves before transplanting
   iv) Quantity of fertilizers applied as a basal dose
   v) Number of hills transplanted per unit area
   vi) Number of seedling transplanted per hill
   vii) Depth of transplanting
   viii) Quantity of fertilizers applied as a top-dressing
   ix) Weeding
   x) Water control
   xi) Plant protection

4. Extract and display the factors which are largely co-related to yield-determing factors.

   i) Proper age of seedlings
   ii) Increase of fertilizers to be applied as a basal dose
   iii) Increase of number of hills per unit area
   iv) Decrease of number of seedlings to be transplanted per hill
   v) Strict enforcement of shallow transplanting
   vi) Increase of quantity of fertilizers as top-dressing and its strict enforcement at proper stage
   vii) Strict enforcement of plant protection measures

5. Concrete explanation of each item mentioned in 4 above, trying to make one understand them.

   1) Proper age of seedlings
      a) Why the aged seedlings are being utilized
      b) Seedling age (Number of leaves) at the time of transplanting
      c) Renewal of seeds every five years
      d) Meaning of application of fertilizers in the nursery

   2) Ideas of application of fertilizers in paddy field
      a) Basal dose and top-dressing to increase numbers of tillers
      b) Top-dressing to increase number of grains per panicle
      c) Top-dressing to increase the ripening ratio and weight of 1000 grains

3) Increase of number of hills per unit area

To make one understand the necessity to increase number of panicles per unit area

4) Decrease of number of seedling to be transplanted per hill

To make one understand rice plant character to emerge tillers and increase number of hills per unit area.

5) Strict enforcement of shallow transplanting
   a) To increase the tillering ability of plants
   b) To get more panicles which have more grains

6) Water control

Necessity of irrigation and drainage

7) Plant protection
   a) Stem borer
   b) Army warm
   c) Bacterial Leaf Blight
   d) etc.

8) Growth phases of rice plant
   a) Short duration
   b) Medium duration
   c) Long duration

To make sure the time of top-dressings and drainage for drying paddy fields.

5. AGRICULTURAL MACHINERY

(1) Experiment on mechanization of field operations by using machinery in comparison with local method (Kharif 1969)

Object: - To show the efficiency of machinery in the field operations and to use the results obtained for extension education of extension workers and cultivators.

Method and Results obtained: - The area of the experimental fields were as under:

1. Mechanization - 0.53 acres
2. Local method - 0.33 acres

The variety used for this experiment was Jaya. The date of sowing was June 15. The seedlings used for the methods were grown on raised beds.

Fields selected for the experiment were almost having indentical conditions. In the field of mechanization the Yanmar Power Tiller and other Japanese Agricultural Machinery were used, whereas in the field of local method, the implements used by the local cultivators were used for all the operations. The plant protection measures taken were common for both the methods. The details of various operations and results obtained for both the methods are given in Table No.1 and 2.

Table No. 1: Kind of operations done and comparison of labour hours needed per acre: -

(A) Mechanization field: -

Kind of operation	Date	Method	No. of labour required for operation	No. of working hours	Total labour hours required
1st tillering	June 17	Rotary tillering	1 M.L.	5.5	5.5
2nd tillering	July 3	- do -	1 M.L.	4.8	4.8
Application of fertilizer as basal	July 9	By hand	2 M.L.	1.42	2.84
Puddling	July 9	Rotary tillering	1 M.L.	3.2	3.2
Levelling	July 9	Leveler & Yanmar P. Tiller	1 M.L.	1.8	1.8
Up-rooting	July 10	By hand	10 M.L.	6.82	68.2
Transplanting	July 11	By hand & transplanting rope	10 M.L.	9.9	99.0
1st top dressing	July 25	By hand	2 M.L.	0.9	1.8
Weeding	July 26	By rotary weeder	2 M.L.	7.6	15.2
Dusting	Aug. 7	By power duster	2 M.L.	0.2	0.4
Chemical spraying	Aug. 18	By power sprayer	4 M.L.	0.9	3.6
2nd top dressing	Aug. 22	By hand 2	2 M.L.	0.8	1.6
Dusting	Sept. 12	By power duster	2 M.L.	0.2	0.4
Cutting of rice Plant along bund	Oct. 27	By hand	3 M.L.	1.0	3.0
Harvesting	Oct. 27	By Kubota Harvester	1 M.L.	5.3	5.3
Threshing	Nov. 6	By Kubota thresher	3 M.L.	7.0	21.0
Total					237.54

(B) Local Method field

Kind of operation	Date	Method	No. of labour required per operation	No. of working hours	Total labour hours required
1st ploughing	June 17	Ploughing by bullock drawn plough	1 M.L.	16.7	16.7
2nd ploughing	July 3	- do -	1 M.L.	13.2	13.2
Application of fertilizer as basal	July 9	By hand	1 M.L.	0.6	0.6
Puddling	July 9	Ploughing by bullock drawn plough	1 M.L.	10.5	10.5
Levelling	July 9	Leveler drawn by two bullocks	1 M.L.	5.4	5.4
Up-rooting of seedling	July 9	By hand	10 M.L.	10.3	103.0
Transplanting	July 10	Local method by hand	3 W.L.	12.5	37.5
1st top dressing	July 25	By hand	1 M.L.	0.6	0.6
Weeding	July 30	By hand	5 M.L.	6.0	30.0
Dusting	Aug. 7	By hand duster	1 M.L.	1.2	1.2
Spraying	Aug. 18	By hand sprayer	1 M.L.	8.0	8.0
2nd top dressing	Aug. 22	By hand	1 M.L.	0.6	0.6
Dusting	Sept. 12	By hand duster	1 M.L.	1.2	1.2
Harvesting	Oct. 29	By hand	10 W.L.	5.4	54.0
Threshing	Nov. 3	By hand	3 M.L.	22.5	67.5
Total					350

Table No. 2: Quantity of fertilizers and agricultural chemicals used per acre

(A) Mechanization field

Kind of operation	Date	Kind of materials used	Quantity of materials used
Fertilizer for basal	July 9	Compound fertilizer (14 - 17 - 16)	257 kgs.
Fertilizer for 1st top dressing	July 25	Compound fertilizer (16 - 0 - 16)	115 kgs.
Dusting for plant protection	Aug. 7	B.R.C. 3%	12 kgs.
Spraying for plant protection	Aug. 18	Selzion	200 gm.
Fertilizer for 2nd top dressing	Aug. 22	Compound fertilizer (16 - 0 - 16)	38 kgs.
Dusting for plant protection	Sept. 12	Sankel	12 kgs.
- do -	- do -	B.H.C. 3%	12 kgs.

(B) Local Method field

Kind of operation	Date	Kind of materials used	Quantity of materials used
Fertilizer for basal	July 9	Compound fertilizer (14 - 17 - 13)	26 kgs.
Fertilizer for 1st top dressing	July 25	Compound fertilizer (16 - 0 - 16)	11 kgs.
Dusting for plant protection	Aug. 7	B.H.C. 3%	12 kgs.
Spraying for plant protection	Aug. 18	Selzion	200 kgs.
Fertilizer for 2nd top dressing	Aug. 22	Compound fertilizer (16 - 0 - 16)	4 kgs.
Dusting for plant protection	Sept. 12	Sankle	12 kgs.
- do -	- do -	B.H.C. 3%	12 kgs.

Results and discussion

1. Yield obtained per acre

	Paddy	Straw
Mechanization field	1,928 kgs.	1974
Local Method field	1,401 kgs.	1062

2. Cross income: - Price of paddy is Rs. 62.00 per 100 kgs. and that of straw is Rs. 6.00 per 100 kgs.

	Income
Mechanization field	Rs. 1311.80
Local Method field	Rs. 932.34

3. Expenditure for use of agricultural machinery, fertilizer and and chemical and labour wages: -

Table No. 3

(A) Mechanization field

Kind of operation	Total labour hours required per acre	Expenditure for use of machinery and production materials Rs.	Total labour wages Rs.	Total Expenditure Rs.
Tilling & levelling	15.3	68.24	9.56	77.80
Up-rooting seedling and transplanting	167.2	0	62.68	62.69
Weeding	15.1	0.15	9.44	9.59
Plant protection S.B. B.F.	4.1	C 35.00 M 12.12	2.75	49.87
Application of fertilizer	6.2	F 256.00	3.91	259.91
Harvesting	3.0 5.3	0 47.97	1.13 3.31	52.41
Threshing	21.0	21.63	13.13	34.76
Total				547.03

(B) Local Method field

Kind of operation	Total labour hours required per acre hrs.	Expenditure for use of machinery and production materials Rs.	Total labour wages Rs.	Total Expenditure Rs.
Tilling and levelling	45.8	103.05	28.63	131.68
Up-rooting seedling and transplanting	140.5	0	* 52.69	52.69
Weeding	30.0	0	11.25	11.25
Plant protection S.B. B.F.	10.4	C 35.00 M 2.75	6.51	44.26
Application of fertilizer	1.8	F 25.6	1.13	26.73
Harvesting	54.0	0.01	20.25	20.26
Threshing	67.5	0.01	42.19	42.20
Total				329.07

Remarks: * Shows women labour wage which is Rs. 3.00 and men labour wage per day is Rs. 5.00
C shows agricultural chemicals
F shows fertilizer
M shows agricultural machinery

Comparison of income and expenditure between mechanization and local method field:

Table No. 4

	Mechanization field	Local method field
Gross income in Rs.	1311.80	932.34
Expenditure in Rs.	547.03	329.07
Net income in Rs.	764.77	603.25
%	127.	100.

Discussion:

(A) First it can be said that the quality of work done by machinery is definitely superior to that of the bullock drawn implements. Further, in case of local method, it can be said from Table No.3 that introduction of agricultural machinery is necessary in case of tilling and threshing by power tiller and threshing machine respectively. By introduction of power tiller the efficiency of tilling can be increased two times of that by bullock and hence it is possible to expand the area under the management, and also the expenditure for managing would be reduced by about half and by this reduced expenditure, more fertilizers can be purchased and made use in getting more yield. This will bring stability to farmers.

Regarding use of threshing machine, this will become necessary in double cropped area, where harvesting and threshing have to be quicken for preparation of the next crop. From this point of view the introduction of machinery will make the management more efficient and possible to increase the area under the management.

(B) Regarding other machinery, although their importance is not considered here, for interculturing rotary weeder will be efficicnt from the point of view of weeding and supplying oxigen into the soil.

Regarding plant protection machinery, it also can be said that introduction of the machinery by each cultivator may not be so effective. But it will be quite effective if such machinery are used on co-operative basis by a group of farmers. In other words, farmers should carry out the plant protection measures co-operatively.

(2) Experiment on mechanization of field operations by using machinery in comparison with local method (Summer 1969-70)

Object: - To show the efficiency of machinery of field operations and to use the results obtained for extension education of extension workers and cultivators.

Method and results obtained: - The area of the experimental fields were as under

1. Mechanization 0.33 acres
2. Local method 0.33 acres

The variety used for this experiment was Jaya and the date of sowing was Dec. 26. The seedlings used for the experiment were grown on raised beds.

Fields selected for the experiment were almost having identical conditions. In the field of mechanization the Yanmar Power Tiller and other Japanese Agricultural machinery was used, whereas in the field of local method the implements used by the local cultivators were used for all the operations. The plant protection measures taken were common for both the methods. The details of various operations and results obtained for both the methods are given in Table 1 and 2.

Table No. 1: Kind of operations done and comparison of labour hours needed per acre: -

Kind of operation	Date	Method	No. of labours required per operation	No. of working hours	Total labour hours required
1st tilling	Nov. 5	By rotary tiller	1 M.L.	5.45	5 45
2nd tilling	Jan. 2	- do -	1 M.L.	3.94	3.94
Application of fertilizers as basal	Jan. 30	By hand	2 M.L.	1.26	2.52
Puddling	Jan. 31	By rotary tiller	1 M.L.	2.27	2.27
Levelling	Jan. 31	By leveler of power tiller	1 M.L.	1.88	1.88
Up-rooting of seedlings	Jan. 31	By hand	10 W.L.	4.55	45.5
Transplanting	Feb. 1	By hand & trans-planting rope	10 W.L.	6.43	64.3
Dusting	Feb. 19	By power duster	2 M.L.	0.34	0.68
1st top dressing	Feb. 20	By hand	1 M.L.	1.27	1.27
Weeding	Feb. 31	By rotary weeder	2 M.L.	3.79	11.37
Spraying	Mar. 11	By power sprayer	4 M.L.	0.87	3.48
Weeding	Mar. 13	By hand	6 W.L.	11.15	50.9
2nd top dressing	Mar. 26	By hand	1 M.L.	0.67	0.67
3rd top dressing	Apr. 21	By hand	1 M.L.	0.64	0.64
Cutting of rice plant along bund	May 20	By hand	3 W.L.	1.51	4.53
Harvesting	May 20	By power harvester	1 M.L.	5.3	5.3
Collecting	May 22	By hand	10 W.L.	3.94	39.4
Threshing	May 24	By auto thresher	3 M.L.	7.6	22.8
Total:					306.90

(B) Local method field

Kind of operation	Date	Method	No. of labours required per operation	No. of working hours	Total labour hours required
1st ploughing	Nov. 5	By bullock drawn plough	1 M.L.	16.67	16.67
2nd ploughing	Jan. 2	- do -	1 M.L.	13.37	13.37
Application of fertilizers as basal	Jan. 30	By hand	1 M.L.	0.52	0.52
Puddling	Jan. 31	By bullock drawn plough	1 M.L.	12.64	12.64
Levelling	Feb. 1	By bullock drawn leveler	1 M.L.	3.79	3.79
Up-rooting of seedling	Feb. 2	By hand	10 W.L.	4.38	43.80
Transplanting	Feb. 3	- do -	5 W.L.	6.67	66.70
Dusting	Feb. 19	By hand duster	1 M.L.	2.12	2.12
Spraying	Mar. 11	By hand sprayer	1 M.L.	7.85	7.85
1st top dressing	Mar. 26	By hand	1 M.L.	0.30	0.30
Weeding	Apr. 2	- do -	10 W.L.	7.27	72.7
2nd top dressing	Apr. 21	- do -	1 M.L.	0.56	0.56
Harvesting	May 22	- do -	10 W.L.	7.58	75.8
Collecting	May 23	- do -	10 W.L.	4.55	45.5
Threshing with cleaning	May 25	- do -	4 M.L.	24.33	96.92
Total:					459.24

Table No.2: Quantity of fertilizers and agricultural chemicals used per acre.

(A) Mechanization field

Kind of operation	Date	Kind of materials used	Quantity of materials used
Fertilizer for basal	Jan. 30	Compound fertilizer (14:14:14)	215 kgs.
Dusting for plant protection	Feb. 19	Sumithion 3%	12 kgs.
Fertilizer for top-dressing	Feb. 20	Urea 45%	23 kgs.
Spraying for plant protection	Mar. 11	Sumithion	200 kgs.
Fertilizer for 2nd top dressing	Mar. 26	Ammonium sulphate 21%	60 kgs.
Fertilizer for 3rd top dressing	Apr. 21	- do -	30 kgs.

(B) Local method field

Kind of operation	Date	Kind of material used	Quantity of material used
Fertilizer for basal	Jan. 30	Compound fertilizer (14:14:14)	22 kgs.
Dusting for plant protection	Feb. 19	Sumithion 3%	12 kgs.
Sprying for plant protection	Mar. 11	Sumithion	200 kgs.
Fertilizer for 1st top dressing	Mar. 26	Ammonia sulphate 21%	15 kgs.
Fertilizer for 2nd top dressing	Apr. 21	- do -	10 kgs.

Results and discussion

1) Yield obtained per acre:

	Paddy	Straw
Mechanization field	3786 kgs.	4345 kgs.
Local method field	2290 kgs.	2625 kgs.

2) Gross income: - Price of paddy is Rs. 62.00 per 100 kgs. and that of Straw is Rs. 6.00 per 100 kgs.

Mechanization field	Rs. 2607.4
Local method field	Rs. 1577.3

3) Expenditure for use of agricultural machinery, fertilizers and chemicals, and labour wages: -

Table No. 3

(A) Mechanization field

Kind of operation	Total labour hours required per acre. Hrs.	Expenditure for use of mechineries & Production materials Rs.	Total labour wages Rs.	Total expenditure Rs.
Tilling & levelling	13.54	M 67.56	8.46	76.02
Up-rooting seedlings & transplanting	109.8	0	*41.18	41.18
Weeding	11.37 90.9	M 0.68 C 28	7.11 *34.09	41.88
Plant protection	4.16	M 13.25	2.6	43.85
Application of fertilizer	5.1 4.53	F 208	3.19 *1.7	211.19
Harvesting	5.3	M 49.93	3.31	54.94
Collecting & Threshing	39.4 22.8	M 20.37	*14.78 14.25	49.40
Total:				518.46

(B) Local method field

Kind of operation	Total labour required per acre hrs.	Expenditure for use of machineries & production materials Rs.	Total labour wages Rs.	Total expen-diture Rs.
Tilling & levelling	46.47	103.16	29.04	132.2
Up-rooting seedlings & transplanting	110.5	0	41.44	41.44
Weeding	72.7	0	27.26	27.26
Plant protection	9.97	C 28.00 M 2.94	6.23	37.17
Application of fertilizer	1.38	F 25.00	0.86	25.86
Harvesting	75.8	0.01	28.43	28.43
Collecting & Threshing	45.5 96.92	0.01	17.6 60.58	77.68
Total:				370.02

Remarks: * Shows women labour wage which is Rs. 3.00 and men labour wage per day is Rs. 5.00

C shows agricultural chemicals

F shows fertilizers.

M shows agricultural machinery.

4) Comparison of income and expenditure between mechanization and local method field

Table No. 4

	Mechanization field	Local method field
Gross income in Rs.	2607.4	1577.3
Expenditure in Rs.	518.46	370.02
Net income in Rs.	2088.94	1207.28
%	173	100

5) Discussion

(A) First it can be said that the quality of works done by machinery is definitely superior to that of the bullock drawn implements. Further in case of local method, it can be said from table No.3 that introduction of agricultural machinery is necessary in case of tilling and threshing by power tiller and threshing machine respectively. By introduction of power tiller the efficiency of tilling can be increased two times of

that by bullock and hence it is possible to expand the area under the management, and also the expenditure for managing would be reduced by about half and by this reduced expenditure more fertilizers can be purchased and make use in getting more yield. This will bring stability to farmers.

Regarding use of threshing machine this will be necessary in double cropped area, where harvesting and threshing have to be quickened for preparation of the next crop. From this point of view the introduction of machinery will make the management more efficient and also possible to increase the area under the management.

(B) Regarding other machinery, although their importance is not be considered here, for interculturing rotary weeder will be efficient from the point of weeding and supplying the oxygen into the soil.

Regarding the plant protection machinery, it can be also said that introduction of the machinery to each cultivators may not be so effective. But it will be quite effective if such machinery is used on co-operative basis by a group of farmers. In other words farmers should carry out the plant protection measures co-operatively.

(3) Training

Since Kharif 1969, the training of machinery operations were imparted individually to those who want to be done. However the systematical training of farmers has been imparted after Kharif 1970 as follows:

Batch	Period	No. of participants
I	9/11/70 - 14/11/70	16
II	26/11/70 - 30/11/70	16
Total		32

In the training, the following machinery are used:

Power tiller
Threshing machine
Auto spraying machine
Auto dusting machine

Emphasis was laid on the cheques at the commencement of work and the end and operations of machinery.

(4) The state of utilization of machinery

The state of utilization of main machinery from Jan. to Dec. 1970 is as follows.

Name of machine		Number of machines (operatable only)	Total hours operated
1)	Kubota four wheel tractor	4	170.5 (230)*
2)	Power tiller	23	2,708.0 (1,269.5)
3)	Auto spraying machine	19	705.0 (340.0)
4)	Auto dusting machine	28	719.5 (690.0)
5)	Binder (Kubota harvester)	2	54.0
6)	Combine	1	88.0
7)	Auto thresher	6	914.0 (676.0)
8)	Ensilage cutter	15	111.5
9)	Water pump	2	46.5
10)	Vertical pump	8	0
11)	Bulldozer	1	210.0

* Figures in bracket show hours operated outside the Centre for popularization.

As the above indicates, power tiller and auto thresher are in great demand. It is sure to be caused by industrialization around Khopoli becoming short of labour. In fact, many farmers who borrowed these machines are those from families, some of whose members are factory workers. However, farmers seem to be little interested at present in constructing farm roads that are essential for the mechanization of farming. In the circumstances, machines, especially power tiller, are carried across the other farmers' field and over the tall bunds. As this may cause a mishap to machines we call farmers' attentions to use them carefully and explain to farmers the necessity of the farm road construction for mechanization.

Thus it may be concluded that it is not altogether hopeless to introduce the modern machinery to India (Kolaba district, Maharashtra), but it is necessary to teach to farmers the importance of farm roads and other basic arrangements.

Any farmer can borrow any machine from the Centre. Rents of power tiller and threshing machine are now fixed, but as to other rents they are still under consideration with officers of the Agricultural Department.

Rents of the above mentioned two machines are as follows:

Power tiller	Rs. 25/- per day
Automatic Thresher	Rs. 25/- per 100 kg.

6. MANUAL

The booklet titled "How to get two and three tons of paddy grains from one acre in Kharif and Summer Season" is used as a manual of the Government officers in their extension works. A copy is available with the Centre.

IV. VIEWS AND PROPOSITION

It is the agricultural extension works that teach a certain agricultural technique to farmers and bring up them. In other words, that is not to force farmers to take up the given techniques, but to make them solve the present problems by themselves and let them to develop their agriculture practically, technically, systematically and scientifically. For instance, in taking up an increase of yield as an extension work, it is impossible to succeed in this work, that however seriously the government authorities may deal with the problem, unless farmers consider themselves as a practical farmer who has a responsibility for his life and they feel keenly the necessity for an increase of yield of rice for their lives and the local society.

From this point of view, it may be indicated that at present farmers in Kolaba district do not realize themselves as mentioned above. That is;

(1) They do not seem to have the reasons why the yield of rice must be increased. They may be satisfied by producing only the amount of rice for their families' consumption.

(2) How have the following policies been carried out by the government in leading farmers to production increase? Have those policies been one sided?

1) price support policy
2) introduction of high yielding varieties
3) Implementation package programme for the increase of rice production
4) Loan of funds for fertilizers, seeds, pesticides, etc.
5) Plant protection

(3) Have not the government officers been trained as to how to conduct the extension works one-sidedly without paying due consideration to the farmers' conditions?

It is thus concluded that it is to make government officers know thoroughly the method of the true extension works through their training on techniques, and to make farmers realize the necessity of production increase and lead them to a good use of their techniques by the indirect instructions that are requested at present in extension works.

PART IV. INDO-JAPANESE AGRICULTURAL EXTENSION CENTRE AT MANDYA IN MYSORE
(January 1969 - March 1971)

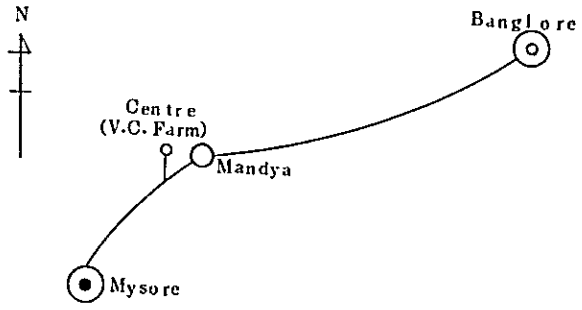
I. SURROUNDINGS

1. Location

The Centre is set up in the site of Regional Research Station, Mandya, belonging to University of Agricultural Science, Bangalore, which is about 6 kilometers west of Mandya town along the Bangalore-Mysore national road as shown in Map IV-1. Mandya town is about 100 kilometers south-west of Bangalore. The Regional Research Station was originally established as a Sugarcane Research Station in 1932 after Vesveswaraiah Canal of K.R.S. dam was completed in 1930, being transferred to University of Agricultural Science, Bangalore. For the reason, the area around the Centre is called V.C. Farm, or Vesveswaraiah Canal Farm. Out of 250 hectares of Regional Research Station, 6 hectares are brought to the service of the Centre and about one hectar for buildings.

It takes about 2 hours from Bangalore airport to the Centre and about 50 minutes from the Centre to Mysore by car.

Map IV-1 Rough sketch around Mandya



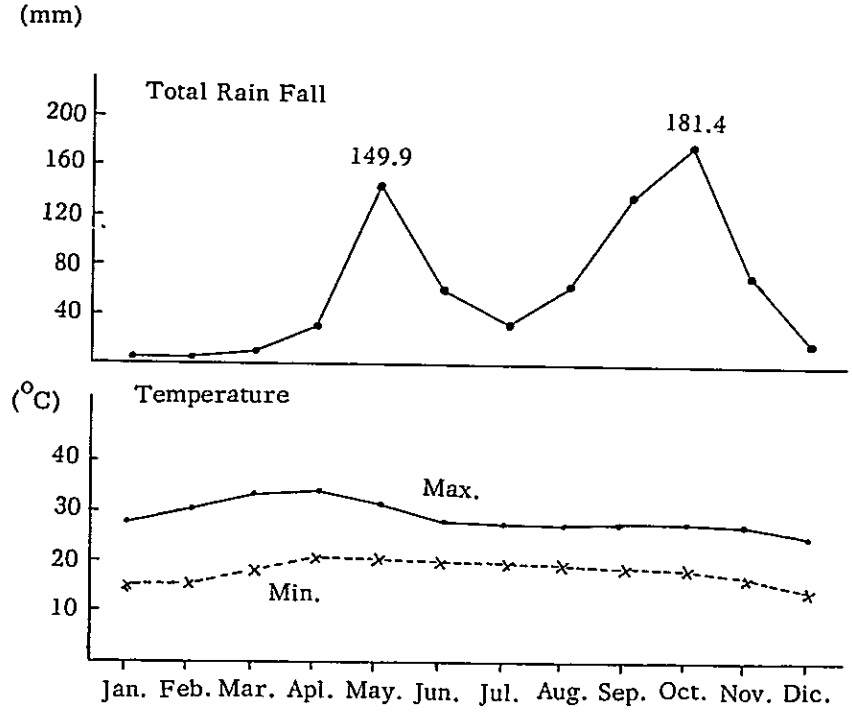
2. WEATHER CONDITIONS

Weather conditions are as shown in Table IV-1 and Chart IV-1 according to the Meteorological Observation Office in the Centre established in 1932.

Table IV-1 Results of Meteorological Observations
R.R.S., Mandya (Average of 10 years, 1957-1966)

		JAN.	FEB.	MAR.	APR.	MAY	JUN.	JUL.	AUG.	SEP.	OCT.	NOV.	DEC.
Rainfall in mm.	No. of rainy days	0.3	0.3	0.7	4.5	6.5	4.9	6.1	4.6	6.9	8.8	5.0	1.7
	Total rainfall	3.0	3.1	8.9	38.4	149.9	60.9	38.3	58.1	131.4	181.4	74.7	17.2
No. of hours of blight sunshine (per day)		9.8	10.2	10.0	9.6	8.5	6.4	4.3	5.4	6.3	7.5	7.4	7.8
Humidity (%)	AM (7.23)	89	84	85	83	86	86	89	90	90	92	92	92
	PM (14.23)	40	32	33	30	50	56	62	60	57	61	57	42
Temperature (^{o}C)	Maximum	28.5	31.9	33.7	34.0	32.4	29.7	28.4	28.4	29.0	28.9	29.6	27.6
	Minimum	15.0	16.3	19.0	21.4	21.5	20.7	20.6	20.5	20.0	19.6	17.5	16.1

Chart IV-1 MONTHLY RAINFALL AND TEMPERATURE



The average rainfall of ten years: 763.3 mm with 50.3 rainy days;

The average maximum temperature: 34.0°C in April; minimum: 15.0°C in January.

3. AGRICULTURAL SITUATION

(1) Introduction

Mandya District is situated in a southern part of Mysore State. It covers a Taluka which is divided into 10.1/4 Community Development Blocks, having 1333 villages. The total population, according to 1961 Census, are 8.99 Lakhs, out of which 89% are classified as rural population. The density of population is 189 per square kilometer, and male is 457,143 and female 442,067.

These population are classified as follows by occupation.
(1961 Census)

1.	Cultivators	311,645
2.	Agricultural Labourers	46,219
3.	Mining, quarrying, livestock, forestry, hunting and plantation orchards	2,584
4.	Household Industry	19,031
5.	Manufacturing, other than Household industry	9,492
6.	Construction	4,723
7.	Trade and Commerce	7,666
8.	Transport, storage and Communication	1,470
9.	Other services	23,865
10.	Non-workers	472,515
	Total:	899,210

(2) Rainfall and soil

The average rainfall in the district ranges from 550 mm to 690 mm, the number of rainy days being 65. The rainfall is concentrated mostly during the period from May to October. Soil ranges from red gravelly and red sandy to red clayey loam, being shallow in the higher elevations while comparatively deep in the valley portions. Water holding capacity of the soil is very poor. Most areas of the district are neutral in alkaline reaction under the poor drainage conditions.

(3) Land utilization

Approximately 6.57% of the net sown area is double cropped, totalling to 2.62 lakhs hectres of cropped area. About 28% of the net sown area, or 36% of the gross cropped area is irrigated. The Vesveswaraiah Canal irrigates more than 80% of the irrigated area of the district. The other sources are tanks, wells and river canals.

(4) Cropping patern

In the irrigated area paddy is the main cereal crop accounting for about 22% of the gross cropped area. In the rainfed area, ragi is the main crop covering 28% of the gross cropped area. The rest of the area is shared by a variety of crops, the important being sugarcane, groundnut and sesamum, and sorghum. Green manure crops constitute the subsidiary crops of paddy in the irrigated area. Summer paddy is raised to a limited extent in low lying reaches. In the rainfed area, horsegram, miger, sesamum and sorghum are the other subsidiary crops. The area under major crops is given below in table IV-2.

Table IV-2. Area under major crops in hectare (1968-69)

Crop	Mandya Distt·	Mysore State
Rice	61,821	1,099,425
Jowar	8,000	3,059,065
Ragi	80,245	732,964
Sugarcane	14,146	95,305
Groundnut	6,228	881,537
Others (Pulses, castor and sorgum)	91,900	1,702,653
Total:	254,420	7,480,949

The distribution of land holding is shown below in Table IV-3.

Table IV-3. Distribution of land holdings (1955-56)

	Mandy Distt:		Mysore State	
	No. of holdings in '00	Area in Hectare	No. of holdings in '00S'	Area in Hectare
Below 2 hectare	655	57,915	11,644	1,119,420
2 - 4	200	55,080	5,403	1,585,575
4 - 6	47	22,275	2,634	1,313,820
6 - 12	29	22,680	3,166	2,674,620
12 - 24	5	6,885	1,385	2,150,955
24 - 40	1	2,025	296	895,050
40 - 80	.2	810	107.7	580,770
Above 80	-	-	29.8	526,095

The situation of agricultural production is seen below in Table IV-4.

Table IV-4. Agricultural production in hectares (1966 - 67)

	Mandya Dist.	Mysore State
Cereals	154,393	6,060,854
Pulses	46,166	1,237,100
Total food crops	221,100	7,748,533
Oil seeds	14,818	1,318,152
Plantation crops	-	111,691
Others	18,367	1,288,751
Total non-food crops	33,185	2,718,594
Total food & non-food crops	254,285	10,467,129

4. LOCAL RICE CULTIVATION TECHNIQUES

A. Traditional method

(1) Traditional transplantation method

The common method of growing paddy is to transplant seedlings from seed beds. Especially in the irrigated area of the district, this method is followed as a rule. The field is well-ploughed soon after the previous crop was harvested, and the water is let in and green manures are trampled in. After this, the field is again ploughed. The bunds are trimmed and the puddle is levelled. Seedlings, about 30 to 45 days old, are transplanted in bunches containing five to ten plants on an average at intervals of about a span. Water is let in slowly till yellow color of the transplanted seedlings changes into green. The field is continually irrigated till about ten days before harvesting, when water is completely stopped.

(2) Mole method

The sowing of sprouted seeds in puddled land is called the mole method of cultivation, and practised under big tanks, more especially in the case of the Vaishakha or summer paddy, that is generally sown in December and harvested in April. Under this method, the paddy field is watered and the soil is softened and then ploughed in puddle. The ploughing is repeated four or five days till the stubble of the old crops nots well and the soil is thoroughly stirred up. The excess water is then drained off. Leaves and twigs are spread over the field uniformly and then trampled in. Sprouted seeds are then sown by broadcast method. The seeds sink in the soft mud. The next day the field is drained thoroughly. For two weeks thereafter, water is let in carefully for a few hours daily and then drained off, till the crop is well established, then irrigated copiously. After a month, harrowing is done both with hand and bullock, this being repeated both cross-wise and diagonally. Hand weeding follows this and the crop requires no further attention except continued irrigation till the harvest time. The sprouting of seeds for this method as well as for raising seedlings for transplantation is done by soaking seeds wrapped up in a bag for one full night. The bag is then taken out of water and heaped in a cool place covered up with straws and leaves. This heap is kept moist for two days when sprouting begins.

B. Japanese method

The Japanese method of paddy cultivation is a new method of intensive cultivation of paddy which is becoming quite popular in India. Adoption of this method showed encouraging results in several parts of the country. The Mysore state experimented with this method for the first time in 1953. As a result of sustained hard work with this method the yield of paddy per acre increased from one to one and a half times or even double the normal average yield. Besides this higher yield there is also another advantage under this method. That is, there is a considerable saving of the seeds as lesser seed rate per acre is enough. In this method the nursery plot required for raising seedlings per acre is only two guntas. The plot is well-ploughed, levelled and divided into several beds of eight feet by four feet, leaving a space of one foot between the beds. The length of the bed may vary from eight feet to 25 feet, depending on the length of the nursery plot. The beds are covered with a thin layer of wood ash. The paddy seeds are sown very thin on the beds. After sowing the seeds are covered well with earth or manure. The beds are well irrigated. Care is particularly taken to see that the beds are fully wet during the first week after sowing. During the second week and the third water is let in. In 25 days after sowing the seedlings become ready for transplanting. The transplanting is completed when the seedlings are 25 to 30 days old. The field for transplantive paddy under the Japanese method is well ploughed with eight to ten cart-loads of green manure. At the time of transplanting

four maunds of ammonium sulphate per acre is applied. After a month, another two maunds of ammonium sulphate is given as top dressing. In the Japanese method line planting is an important feature. This is in contrast with the old traditional method, in which planting is done at random. This line planting makes interculturing easy. The spacing between rows is nine to ten inches.

C. Expansion of Japanese method

In order to step up rice production in the Mandya district, the Japanese method was tried with a modest target of coverage of 75,000 acres in 1958-59. The achievement exceeded anticipation and in that year 79,509 acres were brought under this new method. During 1959-60, a target of 80,000 acres was fixed and a record acreage of 86,000 acres was achieved. In 1964-65 the target was 110,000 acres and the achievement was 92,120 acres. In order to give sufficient impetus, provision was made for providing short term and medium term loans to farmers. The increase derived from the adoption of this new method was roughly 440 kgs of grains per acre. The good achievement was due to intensive propaganda undertaken by the Agricultural Department. Nursery beds were invariably raised and many cultivators came forward to take up this improved method based on the suggestion by the Department. This new method is gaining ground in all parts of the district and quite popular with cultivators.

D. High yielding paddy varieties and their performances

Taichung-65, which was introduced in the year of 1966-67 had made some head-way in the district on account of its short duration and also somewhat better yield. However it could not be further popularised because of several reasons such as coarseness of grain, unattractive market price, and also its poor cooking quality. On the other hand, the variety did not yield much higher than the local varieties although it was tried extensively. In the circumstances, the variety could not replace the local improved variety of S-701. In fact since 1969-70 all trials for introduction of Taichung-65 have been given up.

It was in 1967-68 that IR-8 was introduced in the district. Although the performance of this variety, which was tried in different parts of the district, was much better than the local improved varieties, its adoption was not commensurate with the efforts made especially because of its high cost of production.

The fairly low yield of IR-8 was caused by certain factors such as late planting and lack of proper scientific knowledge of its cultivation. The yield did not go up beyond 55 quintals during 1967-68. It was again tried more systematically on a limited scale by following all packages of practices, and it was fairly well during 1968-69, giving the yields ranging from 60 to 75 quintals. In the meantime the precise agronomical practices required for cultivation of this variety, IR-8, were gradually established. It was found more ideal to be introduced as a summer crop especially in Mandya, and if grown in the Kharif season, it was to be transplanted by the end of July. The latter factor made it difficult to introduce IR-8 in the Kharif season so far as Mandya district was concerned because irrigation channels always pose a problem on account of the main reservoir, namely K.R.S., not getting enough water well in advance of the season. During 1969-70 it was tried over 250 hectares in a selected pocket of Mandya district, namely Poorigali in Malavalli taluk Where it gave an average yield of 87 quintals per hectare. In the same year, during the summer season, the variety was tried on 1100 hectares. Many farmers got yields ranging from 80 to 100 quintals. The average per-hectare yield in the district was expected to be around 80 quintals. The local varieties of paddy like S-701 and S-1092 gave an average yield of 35 quintals per hectare in the district. Other good variety is Jaya, which gave the best yeild of 110 quintals per hectare. The variety of Manilla has been tried during the summer season and giving a promising performance. The success of IR-8 has encouraged the Department to take up a bigger H.Y.V. programme during 1970-71.

E. Recent trends of fertilizer application

The fertilizer for growing more paddy became quite popular along with the rapidly advancing technique in farming practices after the advent of a package programme in the district. Necessary trials were conducted and in all the trials, the application of nitrogen was found to increase the paddy yield during the first several years. There has been a substantial increase in the off-take of fertilizers as a result of the implementation of the programme. There is a steady progress in the off-take of fertilizers from the inception of the programme. The details are given below in Table IV-5.

Table IV-5. Trend of Fertilizer Off-Take in Mandya District (Since inception of the I.A.D.P.)

Year	Nitrogen	In terms of nutrients in metric tonnes	
		Phosphoric Acid	Potash
61 - 62	3052	1090	107
62 - 63	7440	1744	300
63 - 64	7982	3514	463
64 - 65	7660	2025	619
65 - 66	9178	1990	1161
66 - 67	9718	3756	4200
67 - 68	10596	2904	2701
68 - 69	11305	4154	1970
69 - 70	12489	3558	1367

Fertilizer mixtures are also being used as complex fertilizers in appreciable quantity and their consumption is going up steadily year after year. The off-take of fertilizers for dry land crops is, however, not very encouraging yet.

F. Plant protection and implements

Farmers were not responsive to taking up plant protection measures in the initial stages, but due to intensive offorts taken up in the IADP, there has been a measure of change in the minds of farmers, coming forward to take up plant protection measures. Up to the end of 1968-69, 1,548 hand operating sprayers were procured and supplied to farmers on 50% subsidy. During 1969-70 the subsidy was reduced to 25% and a total of 195 hand operating sprayers were distributed to farmers at 75% cost. Besides that, 181 power sprayers have been distributed to several blocks in the district for demonstration purpose. Apart from this, some Taluk Development Boards have purchased and distributed plant protection equipment like sprayers and dusters from their own funds at concessional rates. The area under plant protection is given below in Table IV-6.

Table IV-6 Area under plant protection

Year	Target	Area covered
1962-63	-	3854 ha.
1963-64	-	2567
1964-65	-	6072
1965-66	-	12469
1966-67	36000	16203
1967-68	48000	34560
1968-69	70000	62152
1969-70	95000	78068

Farmers have, however, not noticed the importance and benefit of prophylactic spray and resorted to plant protection measures only after pests and diseases occur.

During 1968-69 aerial spraying was organized on an area of 5,000 acres of paddy crop in Mandya block spreading over 30 villages, with four rounds of spraying, to show the benefit of prophlactic measures. During 1969-70 an area of 10,000 acres of paddy crop was aerially sprayed with three rounds of spraying.

Use of tractors and power tillers as a labour saving devices and mechanization of cultivation is slowly gaining popularity in the district. A total number of 35 tractors are privately owned by the farmers.

G. Summary of rice situation in the State and around the Center

The State of Mysore has been mostly advanced not only in agriculture but also in various industries and called "Giant of South India". Mandya is the typical agricultural area in the State. Mandya was therefore chosen as the area of the IADP in view of its proper irrigation facilities, existence of efficient cooperatives and village institutions, and promising farmers in changing over to modern methods of scientific farming. The Programme put into operation on January 1, 1962 and has now completed 8 years of implementation.

It was mentioned earlier how rice production in Mandya had been developed after chosen as the area of the IADP. Rice production in other districts in the State has been also much improved, its situation being analysed and reported in the Advice Report No. 5. How rice production has been progressed in the State is also found in "India 1969" (Page 232) published by Publication Division, being mentioned as follows:

"The highest yields per hectare reported by some States in respect of different varieties were: Paddy-TN-1-5, 568 kgs (Kharif) and 11,565 kgs (rabi); Tainan-3-6,455 kgs (Kharif) and 8,407 kgs (rabi)/ (Average) and Taichung-65-9,637 kgs (in Mysore State).

As mentioned above, the State of Mysore was described as the typical high yielding state in rice, Rajasthan and Uttar Pradesh being in wheat.

Although there are much to be technically improved as mentioned later, the State can be said to be much advanced in rice production. Therefore, what should be done relating to development of rice production here in the district and the State is not to extend the Japanese method itself directly to the area, but scientifically advanced techniques.

II. FUNCTION AND OPERATION

1. General

Since inauguration of the Center in January in 1969, policy and programme have been drawn up and decided by Joint Director of Agriculture, Mysore and Chief Advisor of Japanese experts, and they have been implemented with mutual consultations between Indian Counterparts and Japanese experts. Japanese Chief Advisor have been in touch mainly with JDA. Mysore who has been acting on behalf of the State Government, but he has been also giving advices from time to time, directly to the Minister of Agriculture and other leaders of the Government, as occasion calls.

In order to operate the Center more effectively, the Joint Committee comprising the following member was set up in March 1971, according to the suggestion made by the survey mission headed by Mr. T. Sakamoto who visited India October/November, 1970. The Committee will examine and decide the important things in operating the Center.

(Member of the Joint Committee)

Chairman	(1)	The Director of Agriculture
Member	(2)	Japanese chief Advisor
"	(3)	The Joint Director of Agriculture, Mysore Division
"	(4)	The Joint Director of Agriculture, (Dev. & ICP), Bangalore
"	(5)	The Director of Extension, University of Agriculturel Sciences, Hebbal, Bangalore
"	(6)	The Crop Botanist, Bangalore
"	(7)	Rice Specialist, University of Agricultural Sciences. Hebbal, Bangalore
"	(8)	The Deputy Director of Agriculture, Mandya

The meeting of the Committee will be held regularly on 1 and 15 of every month, the chairman being the Director of Agriculture and the secretary being the Indian Chief Counterpart.

2. Staff

Staff working at the Center are as follows:

(1) Japanese experts

1)	Dr. I. Suetsugu	Chief Advisor
2)	Mr. M.Nozaki	Agronomist
3)	Mr. A. Yoshino	Soil and Fertilizer Specialist
4)	Mr. K. Kanemitsu	Agricultural Engineer

(2) Indian counterparts

1)	Mr. K.R. Bhagwat	Agronomist
2)	Mr. H.B. Ananda	Agronomist-cum-Farm Management Specialist
3)	Mr. H.P. Karishetty	Soil and Fertilizer Specialist
4)	- vacant -	Agricultural Engineer
5)	Mr. C.C. Gowda	Farm Manager

(3) Other staff

1)	1st Division Clerk	1
2)	Store Keeper	1
3)	Clerk-cum-Typist	1
4)	Peons	3
5)	Cooks	4
6)	Drivers	3
7)	Mechanic	1
8)	Permanent Labourers for Farm Work	3
9)	Watchmen	2

(4) Additional staff proposed

1)	1st Division Clerk	1
2)	Typist	1
3)	1st Division Store Keeper	1

3. Establishments and Facilities

Buildings:

(1)	Office building (I)	1
(2)	Office building (II)	1
	Lecture halls	2
	Laboratories & dark room	4
(3)	Implement Store cum workshop	1
	" (extension)	1
(4)	Net house	1
(5)	Seeds & Fertilizer godown	2
(6)	Garages	2
	" (Additional)	4
(7)	Farm Implement Shed & Stores	1
(8)	Compost shed	1
(9)	Irrigation Tank	1
(10)	Quarters for the Japanese experts	4

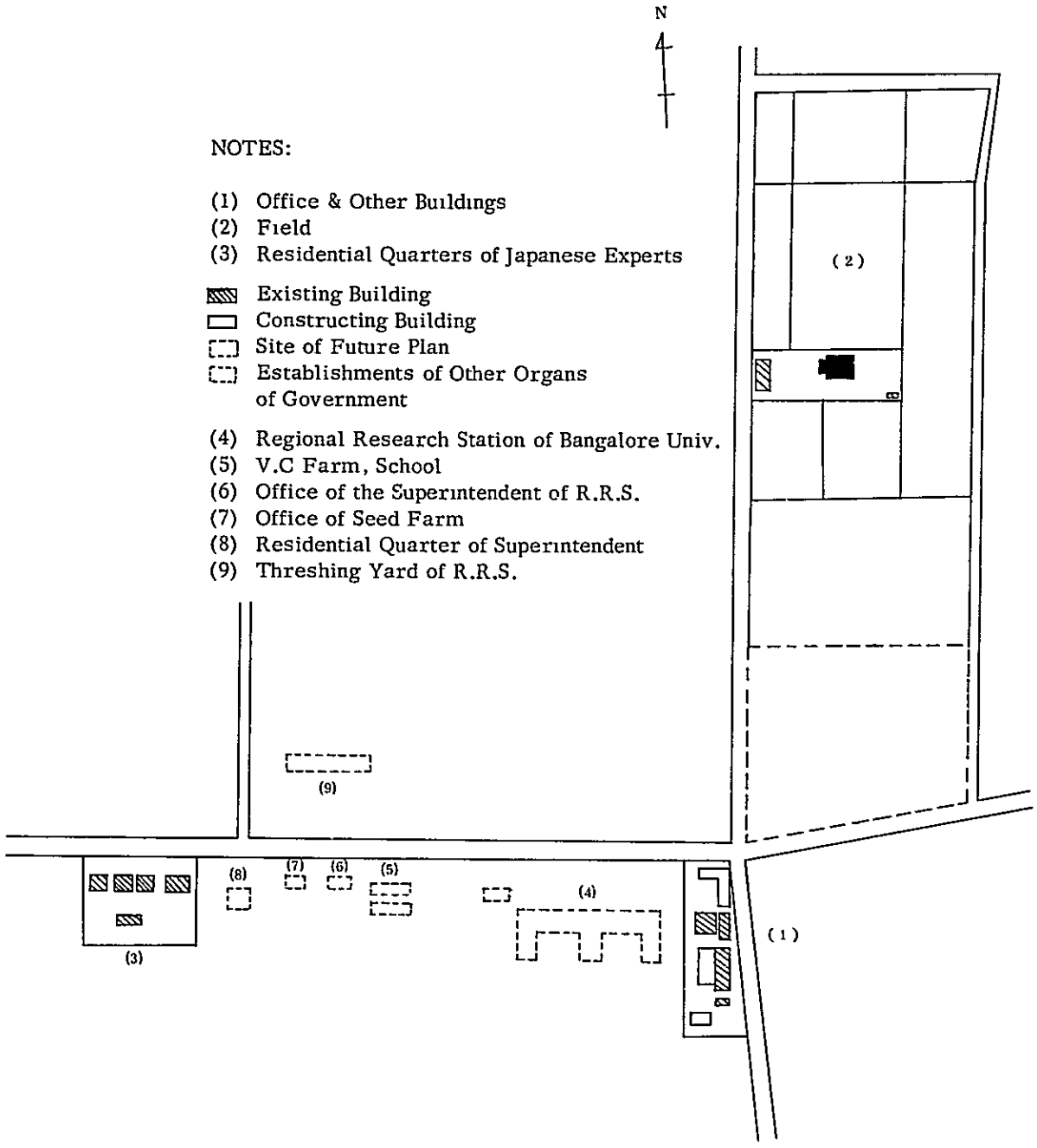
(Future Programme)

(1)	Hostel	1
(2)	Dormitory	1
(3)	Kitchen & Dining hall	1
(4)	Auditorium	1
(5)	Study room	1
(6)	Library	1
(7)	Symposium room	1
(8)	Investigation room	1
(9)	Officers Quarters	4
(10)	Official Quarters	3
(11)	Guest House	1

Experimental Fields: 12 acres

These arrangements is shown below in Map IV-2.

Map IV-2 Arrangement of buildings and others



4. AGRICULTURAL MACHINERY AND EQUIPMENT

(1) Agricultural machinery and equipment provided at the time of the Demonstration Farm

SL No.	Item	Quantity
1	(Vehicle and tractor)	
1	Motor Bicycle	1 (under repair)
2	Bicycle	4
3	Rear Car	2
4	Monocycle	5
5	4 Wheel Tractor	1
6	Power Tiller (Mitsubishi)	4
7	- do - (Satoh)	2
8	Jeep	1
9	Station Wagon	1
	(Sprayer and duster, and other implement)	
10	Manual Weeder	5
11	Rice Planting Rope 27.3 cm	10
	30.3	10
	33.3	10
12	Rice Huller	1
13	Rice Polishing Machine, Hand Operating	1
14	Rope making Machine, Manual, Hand Operating	1
15	Winnower Tancho-go	2
16	Ensilage Cutter	1
17	Cutter, Manual Fuji-go	1
18	Scythe	1 (lost)
19	Sickle (Jagged)	100 (53 lost)
20	Sickle (Mowing)	40
21	Sickle (Fire wood)	20 (all lost)
22	Whetstone (Nake-to)	10
23	Whetstone (Ara-to	10
24	Whetstone (Kama-to)	20
25	Whetstone (Emery-to	5 (2 used)
26	Shoevel i) Round point No.2 wooden -Y-	10
27	ii) Square point, No.2 wooden-Y-Handle	10
27	Fork-4 tines-D-handle	10
28	Rake 12 teeth, 54" handle	10 (3 broken, 2 lost)
29	Hoe (Bittyu)	10
30	Hoe (Kana)	10 (all lost)
31	Hoe	10
32	Winnower (Large)	3
33	Winnower (Small)	3
34	Sieve Mesh 3 mm, 30 cm 1 pc.	2
	Mesh 6 mm, 30 cm. 1 pc.	2
35	Hatchet 400 g. oak handle	33 (2 lost)
36	Axe - 1,100 g type 900 mm, oak handle	2
	550 g type 300 mm, oak handle	1
37	Hoe (Toguwa) 1,120 gm, handle	20 (4 lost)

SL No.	Item	Quantity
38	Flat hoe - teeth length 300 mm, oak handle	20 pcs. (8 lost)
39	Power Thresher, Yanmar Model DD	4
40	Manual operating Thresher	1
41	Centrifugal pump, Mizota Model ML-3 with engine	2
42	Diesel engine. Mitsubishi Model SD 6	2
43	Oil Engine	
	Gasoline 2 PS - Mitsubishi Model G2	1
	Gasoline 4 PS - - do - G4	1
	Kerosene 4 PS - Kubota Model A2	1
	Gasoline 4 PS Mitsubishi Model G6	1
	Kerosene 6 PS - - do - R6	1
44	Fertilizer Mixer	1
45	Power sprayer, Kyoritsu Model HBE-12 with attachment and standard accessories	4
46	Power Knapsack mist Duster, Kyoritsu model DM-3AG with attachment and standard accessories	4
47	Knapsack type - Kyoritsu MSS-S with attachment and accessories	2
48	Shoulder type Kyoritsu PS-3 with attachments and accessories	1
49	Breast hand duster Kyoritsu-6 with attachments and accessories	2
50	Peanut thresher without engine	1
51	Peanut Sheller without engine	1
52	Corr. sheller without engine	1
53	Animal drawn plot - fixed type	2
54	Animal drawn harrow	2
55	Reversible type	2
56	Animal drawn rake	2
57	Rope 100 m	2
58	Riggings	2
59	Animal drawn weeder	2
60	Manual Weeder 18 cm	15
	21 cm	15
	24 cm	15
61	Reaping Harvester - gasoline 0.8PS	1
	(Metal and wood working tool)	
62	Anvil 65 kg., cast steel	1
63	Swage Block - cast iron	1
64	Hammer	5
65	Scale- Stainless 300 mm	4 (one lost)
66	Curved scale - Stainless 500 mm	1
67	Calipars - 150 mm, with dips	1
68	Compass - 100 mm	1
69	Inside outside micrometer - 100 mm	2 (all lost)
70	Steel square - 100 mm, with stand	1 (no stand)
71	Angle Gauge - 150 mm	1
72	Tap 1 set (up and down), oak handle	1 (lost)
73	Punch - 6 mm round	1 (lost)
74	Electric Soldering iron 300 W	2
75	File (rough)	1
76	File (Smooth	1
77	File (Finishing)	1

SL. No.	Item	Quantity
78	Plier 200 mm	2 (one lost)
79	Tin snip 240 mm straight out	1
80	Set files set of 8 pcs.	1
81	Vise 100 mm,horizontal	1
82	Vise for pipe No.2	1
83	Tool wrench set	1
84	Dies holder set	1
85	Ostar	1
86	Steel lever 1,050 mm	1 (lost)
87	Jack for 3 tons, Daruma type	1 (damaged)
88	Electricity tester - Rotary	1
89	Driver- Electricity Tester for plug	1 (lost)
90	Table type small vise -GP type	1
91	Manual Grinder 5"	1
92	Torch Lamp, portable, for gasoline IL	1
93	Blade for metal cutting saw with blade, spare 6 pcs.	1
94	Soldering iron, wedge type	1
95	Paste Canned	1
96	Solder 1 kg. resin added	1
97	Saw for fire wood 450 mm	2
98	Saw double edge 300 mm	2 (damaged)
99	Plane - 54 mm, 48 mm, with bed and blade	2
100	Drill - 15 mm (thick), 15 mm (Oliver), 24 mm 1 pc. each	3 (lost)
101	Stone - hammer - 450 g type, with handle	2 (lost)
102	Folding scale - stainless - 6 fold	1
103	Bar large, small 900 mm, 400 mm 1 pc. each	2
104	Working tool - 9 mm with blade oak	1
105	Driver - 75 mm, 125 mm, 1 pc. each	2
106	Knife - 18 mm, type	1 (lost)
107	Ink jar - 210 mm, with 1 set of accessories	1
108	Kakeya - 150 mm type (wooden hammer)	1
109	Pickaxe Standard type, oak handle	2
110	Auger - four way handle	1 (lost)
111	Condenser, IKVA Primary 220 V, Secondary 100V	1 (damaged)
112	Cap tire-cord, 4 pcs. of cord folded 20 m	1
113	Electric Drill Wood working drill; 5 pcs. to each set Metal working drill; 5 pcs. to each set	1
	(Scientific instrument)	
114	Balance - 150 kg. Yuusui type hand operating	3
115	Table weighing machnne: 5 kg. Yuusui type, hand operating with scale	1
116	- do - 10 kg	1
116	Scale beam: 80 kg. Yuusui type, hand operating with scale	1
117	Soil boring stick	2
118	Anemometer - with tripod	1
119	Cylinder, graduated IL. plastic	2
	500 cc plastic	2
	100 cc plastic	2

SL No.	Item	Quantity
120	Screen 60 x 60 x 45 mm No.2 type	1
121	Vinyl hose 20 mm 100 mm	1
122	Cooler 1 ps 2000 cal	1
123	Electric Refrigerator 200 L	1
124	Surveying Rope - 50 m (ramia, Vinyl, piano)	2
125	Sampling bag - vinyl 15 x 33 cm	200
	vinyl 10 x 22 cm	200
126	Seed sampling bag - 30 mesh 50 - 30 cm	200
	30 - 20 cm	
127	Almite bowl - 40 cm	40
128	Poly pail Sekisui 15 type with lid	20
129	Air compressor with 1/4 UP motor, hose 20 m, chuck and accessories	1
130	Air pump	2
131	Test tube	300
	Large: 100 pcs.	
	Medium: 100 pcs.	
	Small: 100 pcs.	
132	Beaker	90
	50 cc: 30 pcs.	
	100 cc: 30 pcs.	
	200 cc: 30 pcs.	
133	Drying machine for moisture test	
	45 cm x 40 cm x 40 cm	1
134	Weighing bottle - 50 cc	50
135	Tension meter - 30 cm	2
136	Balance, table	
	1 kg, Yuusui type	1
	Hand operating with scale 200 g	1
137	Tape measure	
	50 m	3
	2 m	2
138	Stop watch - Seiko	1
139	Soil testing kit	
	F.H.K. 3 type, with 2 sets each spare (Medicine (100 pcs.)	2
140	Irrigation water testing kit	
	F.H.K. Testing Kit	1
141	Soil Hardness - Yamanaka type	1
142	Soil Correcting Kit	2
143	Colour sample note	2
144	Counter for record H-100 type	2
145	Taw-Meter:	
	Hassler type: HL	1
	Horn type	
	Max. 10,000 4 sets changer	1
146	Plant tissue testing kit with 2 sets, each of spare medicine (100)	2
147	Cup for measure 1 L, with handle	1
148	Cup for measure 5 L, with handle	1
149	Thermometer	2
150	Temperature	2

SL No.	Item	Quantity
151	Soil 20 cm pipe	2
152	Water 20 cm in copper tube	2
153	Hygrometer - Rooth type	1
154	Rain gauge - 20 cm copper, glass cup set of bottles	1
155	Bend type thermometer max. and min.	
	5 cm	3
	10 cm	3
	20 cm	3
156	Thermometer max. and min. Rusaford	1
157	Magnifying glass 16 mag.	1
158	Counter-Hand type	1
159	Scale sliding - 25 cm standard	1
160	Plane table with pole	1
161	Cabinet 90 x 30 x 90 cm	1
162	Cover glass Matsunami 1,000 pcs. in a box, 18 mm x 18 mm	1
163	Slide glass - 50 pcs. in a box 18 cm	4
164	Evaporating gauge-20 cm copper 10 cm depth	1
165	Roud speaker hand type transisor megaphone 6V battery (1.5 vx4)	1
166	Horn 5" hand operating	1
167	Tank, Vat.	10 (lost)
168	Sample tube - 15 cm x 3 cm, round glass	100
169	Oil Heater	2
170	Hydrometer - 1-1, 5 set of 7 pcs.	3
171	Autofeed thresher	2
	(Audio-Visual aids)	
172	Camera (Minolta Model SR-1 Single lenz forcal plane Shutter with hood, filter (UK skylight 1 each) ease, exposure meter and accessories	1
173	Tripod Elevator type with case	1
174	Film(i) 35 mm black and white	55
	(ii) 35 mm colour reversal	30
	(iii) 8mm colour	20
	(iv) 8mm black and white	10
175	Tape recorder Sony Model TC-357 r Tape 10 pcs. to each set (7", 6 pcs. 5" 4 pcs.) Real 2 pcs. to each set (7", 1 pc. 5" 1 pc.) with accessories	1
176	Slide projector Master auto lux., with auto changer with tape recorder synchronizer	1
177	Calculating machine Hand operating H62-20, Standard: JIS	1

SL No.	Item	Quantity
178	Typewriter Alpina 13" with accessories and typing paper.	1
179	Screen Daylight 150 x 150 cm	1
180	8 mm Camera Elmo STL F 1.8 with grip and case and accessories	1
181	8mm Projector Elmo FPS F 1.4 spare bulb 10 pcs. to each set with accessories	1
182	16 mm Projector Elmo DM-16 bulb 10 pcs. each exciter lamp 5 pcs. to each set, with accessories	1

(2) Agricultural machinery and equipment provided in 1969

SL No.	Item	Quantity
1	Farm Tractor-R-2400	1
2	Rotary Leveller	1
3	Spare parts of the above	1 set
4	Trailor accessory	1 set
5	Bottom plough	1
6	Disk harrow: MDO 1614	1
7	Tooth harrow: MTH 302	1
8	Puddling harrow: H-;117	1
9	Floating sub-wheel CWI-202	1
10	Rotary Rigger-CRF-600	1
11	Power Tiller Model-CT95	7
12	Crushing wheel	7
13	Lugged wheel	7
14	Riding equipment & Rake accessory	7
15	Rotary Furrower	7
16	Spare parts	1 set
17	Details as per attached sheet	1 set
18	Auto-Feed Thresher-JTN 540	6
19	Paddy cut combine machine	2
20	Diesel engine -KND-40	2
21	Spare parts for the above machines details as per attached sheets	1 set
22	Huller	2
23	Grain Sieves Shaker	1
24	Ensilage cutter-S-type	6
25	Winnower (Laboratory type)	1
26	Winnower (Tanchogo)	2
27	Pump vertical type	2
28	Ditto, Volution type	1
29	Rope making machine type: HYS-0	1
30	Thresher (Leg thresher)	1
31	Knapsack type power duster & mist blower	8
32	Power sprayer-model JPE39 3-4HP Gasoline engine cap. 30L/min. w/accessories	7

SL No.	Item	Quantity
33	Air Compressor 220 V/HP	1
34	Battery Charger	1
35	Electric Carpenter Set	1
36	Electric welder	1
37	Hand operating calculator	1
38	Typewriter	1
39	Slide transformer	1
40	Copying machine	1
41	Generator	1
42	Transistor Megaphone	1
43	Electric Grinder	1
444	Shaker for 6 pcs. complete with motor	1
45	Vacuum pump vertical type	1
46	Centrifuge model - H-15A	1
47	Infra Red moisture meter Model F1A-Kett	1
48	Chemical balance cap. 100 Model No.20-55A	1
49	Table balance cap. 100 gms	1
50	- do - 200 grms	1
51	Photo-Electric Calorimeter	1
52	Water Purifier	1
53	Electric Drying Oven	1
54	Distilling apparatus	1
55	True volume Determinator	1
56	Nitrogen Digester	1
57	Tire guage	1
58	Radio plier	1
59	Vinyl tape	5
60	Tape & dies	1
61	Adjustable angle wrench	1
62	Wire brush	10
63	Hydraulic garage jack	1
64	- do - Oil Jack	1
65	Chain block	1
66	Vinyl coat	10
67	Vinyl sheet	1
68	Rice planting rope	10
69	Cotton sheet	10
70	Hatchet sickle	20
71	Saw sickle	100
72	Rake-12 teeth	10
73	Flower scissors	2
74	Diamond whet stone	3
75	Saw small size	2
76	Saw reversing type	2
77	Saw medium size	2
78	Planter	2
79	Crow bar	10
80	Driver	1
81	Bar	2
82	P.H. Meter Model-HIM-7A	1
83	Portable P.H. Meter Model DM-1	1
84	Redox Meter Model RM-1	1
85	Conductivity meter Model-CM-3M	1

SL No.	Item	Quantity
86	Polyethylen bag 17 cm x 27 cm (soil sample 13 ag)	1000
87	Polyethylene bag (soil sample bag)	200
88	Burette (Micro)	4
89	Burette	4
90	Rubber Stopper No. 4	30
91	- do - No. 5	30
92	- do - No. 6	30
93	- do - No. 7	30
94	- do - No. 8	30
95	- do - No. 9	30
96	Evaporation dishes 9 cm Dio	20
97	Polyethylene Bottle 200 cc	10
	- do - 500 cc	10
	- do - 1000 cc	10
	- do - 10 L	10
	- do - 20 L	10
98	Polyethylene washing bottle - 500 cc	5
99	Vinyl pipe 12 mm, 4M	5
100	Crucible with cover Porcelain	20
101	Crucible Tong-30 cm long	1
102	Rubber Tube Out Dia/inner 6 mm 4 mm	20
	- do - 8 mm 6 mm	20
	- do-- 9 mm 7 mm	20
	- do - 11 mm 5 mm	10
103	Glass Rod 3 mm x 1 m	5
104	- do - 6 mm x 1 m	5
105	Glass Tube 3 mm x 1 m	5
	- do - 5 mm x 1 m	5
	- do - 7.5 mm x 1 m	5
	- do - 8 mm x 1 m	5
106	Capillary Tube 1 mm x 70 cm	20
107	File for Glass cutting	5
108	Filtering Tube L3	30
109	Cork Borer	1
110	Pinch Cork - Large	10
	- do - Medium	10
	- do - Small	10
111	Asbestos wire gauge	5
112	Stainless Spoon large	10
	- do - Medium	10
	- do - Small	10
113	Wrapping Paper 10 x 10 cm	5
114	Gauge	1
115	Abarbeet	1
116	Clear Vinyl Tube	30
117	Brush	1
118	Filtering paper No. 101	10
119	Rubber Tube 19 mm	25
120	Rubber Tube 25 mm	25
121	Komagome Pipette 2 cc	5
	- do - 5 cc	5
	- do - 10 cc	5

SL No.	Item	Quantity
122	Measuring Pipette 2 cc	5
	- do - 5 cc	5
	- do - 10 cc	5
123	Volumetric Pipette 2 cc	5
	- do - 5 cc	5
	- do - 10 cc	5
	- do - 20 cc	5
-	- do - 25 cc	5
	- do - 50 cc	5
124	Measuring Cylinder 100 cc	2
	- do - 200 cc	2
	- do - 500 cc	2
	- do - 1000 cc	2
125	Test Tube	50
126	Measuring Flask 50 cc	20
	- do - 100 cc	20
	- do - 200 cc	20
	- do - 500 cc	10
	- do - 1000 cc	5
127	Erlenmeyer Flask 100 cc	30
	- do - 200 cc	30
	- do - 300 cc	30
	- do - 500 cc	10
	- do - 1000 cc	5
128	Beaker 50 cc	20
	- do - 100 cc	20
	- do - 200 cc	20
	- do - 300 cc	20
	- do - 500 cc	10
129	Tall Beaker - 500 cc	20
	- do - 1000 cc	20
130	Funnel 6 cm dia	20
131	Weighing Bottle 2 x 3 cm	20
132	Glass Mortar	1
133	Y-shaped tube	20
134	Calcium tube 15 mm x 90 mm	2
135	Desicator 24 cm dia	5
136	Plant tester	1
137	Electric Heater	2
138	Field volume-weight determinator	1
139	Soil sampler set	25
140	Soil hardness tester	1
141	Handlevel	1
142	Rock Hammer	1
143	Soil resistance tester	1
144	Motor	1
145	Seed samples bag	100
146	Tape Measure	2
147	Seed Tray	50
148	Crucible Tong	1
149	Thermometer	5
150	Foreceps	5
151	Magnifier	2

SL No.	Item	Quantity
152	Grain Counter	2
153	Beam Balance 10 Kgs	1
	- do - 1 Kg	1
	- do - 100 Kgs	1
154	Grain Divider	1
155	Hydrometer	1
156	Soil Tester	1
157	Vasculum	1
158	Root system sampler	1
159	Wagners pot	20
160	Substitution cap determinator	1
161	Bicycle Model-W.03	3
162	Captire cord	1
163	Oil Bunner	1
164	Abacus	2
165	Screen	1
166	16 mm Film	5
167	8 mm Film	6
168	Books	7
169	Slide Film	3
170	Rear Car	3
171	Monocycle	5
172	Bamboo Rule 1.5 m	5
173	Insect Collecting set	1
174	Germination tester	1
175	Soil sampler	1
176	Soil size analyser	1
177	Water Tester	1
178	Active Iron tester	1
179	Soil Max. water tester	1
180	Soil Sieves	1
181	Watering Pots	2
182	Yield examining compasses	1
183	Nitrogen determinator	1
184	Boring sticks	22
185	Filter paper No. 211 cm 10s	10
	- do - No. 611 cm 100c	10
	- do - No. 5A 11 cm 100s	10
	- do - No. 131 11cm 100s	10
186	PH testing paper 7 sets "Toyo"	2
187	Water bath	1
188	Hot Plate	1
189	Large type grass pump	1
190	Battery tester	1
191	Torque wrench	1
192	Double off set wrench	1

(3) Agricultural machinery and equipment provided in 1970

SL No.	Item	Quantity
1	Sprinkler Set	1
2	Land Leveller	1
3	Rice Planting Machine	1
4	Microscope	1
5	Microscope Binocular	1
6	Dispensing Balance Direct Reading	1
7	Analytical Balance Directreading	1
8	Dispensing Balance Automatic	1
9	Spring Balance	1
10	Plane Photometer	1
11	Forceps	4
12	Magnifier	10
13	Thermometer 100	10
14	- do - 150	5
15	Inverter Specimen Tray	100
16	Dird Protective Net	5,000
17	Rope for Rice Planting	20
18	Germination Apparatus	5
19	Scale Bamboo	5
20	Filtering Paper	10
21	Beaker	50
22	Disc	100
23	Tube Sucker	5
24	Scissors Plant	10
25	Sieves Grain	5
26	Tube Hard PVC	150
27	Poly Ethylene Container	4
28	Wagners Pot	50
29	Hoe Hand	10
30	Hoe Three Clowed	10
31	Micro Diffusion Analyzing Apparatus	50
32	Plant Dissecting Set	10
33	Tube Centrifuge	12
34	Filtering Column	12
35	Table Crusher	1
36	Sliding Rule	1
37	Ink Stone	1
38	Ink Stick	1
39	Writing Brush	5
40	Magic Ink	33
41	Magic Bottle	10
42	Gauge	5
43	Cellophane adhesive tape	2
44	Knife	10
45	Film Monochrome	20
46	Film Color	20
47	Printing Paper	4
48	Developer	49
49	Note Book	20

SL. No.	Item	Quantity
50	Polyethylene Bag	1,500
51	Fuel Pipe	4
52	Oil Seal	1
53	Carburetor	2
54	Spark Plug	5
55	Dipe Duster Hose 20 m	2
56	Dipe Duster Hose 30 m	2
57	Garburetor	2
58	Magnet	1
59	Piston Ring	7
60	Recoil Starter	2
61	Snapping Tolls	2
62	Piston Ring tool	2
63	Bush Blocker set	1
64	Bulvlifter	1
65	Thickness gauge	1
66	Socket Wrench set	2
67	Spanner set	2
68	Hammer	3
69	Drill set	1
70	Wrench set	2
71	Vinyl Tape	18

III. ACTIVITIES AND RESULTS

1. AIMS

The Center's activities are aiming at not only increase of rice production but also expansion of labour saving mechanization, thereby bringing on epochal development of rice production, through the training programmes of Deputy Directors of Agriculture, Agricultural Extension Officers and Gramsevaks which are letting them learn the theory and practice on rice cultivation techniques and putting them to a good use in their planning and practical guidance of extension works.

For attaining these aims, the Centre has been operating about two years mainly training programmes on long and short terms. In future, the activities are to be expanded further based on the aims mentioned above and the most important activity of long term training of AEO is to be extended not only to those from the State of Mysore but also those from four States of Southern India. In order to make these training programmes more effective various trials are continued to be carried out and their results to be presented to the State as advices in further development.

2. CONTENTS

The activities at the Centre under the Agreement concerning the Indo-Japanese Agricultural Extension Centres and also plans drawn up by the State Government are enumerated below in order of importance.

(1) Training

	Subject	Trainee	Duration (per annum)
1)	Long term training on rice cultivation techniques	AEO, GS	Six months
2)	Short term training on rice cultivation techniques	DDA, etc.	10 days
3)	Short term practical training on rice cultivation techniques	Progressive farmers	10 days (five times/annum)
4)	Training on agricultural machinery	Power tiller owners	20 days (five times/annum)

(2) Trial

1) Trials connected with training programmes such as practical and educational trials (used as teaching materials)

2) Trials connected with the basis of future development (research type)

3) Investigation into the actual conditions for extension works of rice cultivation techniques.

(3) Demonstration

1) Demonstration on how to use agricultural machinery

2) Demonstration on how to improve rice cultivation techniques

(4) Technical advices to the State by presenting papers titled "Advice Report" containing the results of both trials and local investigations into the actual conditions

(5) After-training cares to trainees of long term training programmes

3. SPECIAL FEATURES

Out of activities done at the Centre as mentioned above, the special feature is the long term training programme of middle class officers like AEO. Furthermore, training programmes of high and low class officers like DDA and GS on rice cultivation and also training of progressive farmers and power tiller owners are also the Centre's special features.

These programmes are, in other words, aiming at training men of abilities. The reason why the activities at the Centre have been different from three other Agricultural Extension Centres at Arrah, Vyara and Khopoli is only differnce among them in agricultural and rice situation as mentioned earlier, and these activities of training are understood to have been appropriate to be taken up in the Centre judging from the circumstances.

The Second special feature of the activities is that the Centre is operated not only for increasing rice production but also introducing labour saving mechanization, or preparing the next phase of "Green Revolution". At present, yield per acre, or land productivity, has been tried to be increased. It is, however, very foreseeable that a question of increase of labour productivity may come out. In main rice producing areas in the State, labour shortage has been already seen especially at the time of transplanting and harvesting, and some progressive farmers have demanded of introduction of new techniques on labour saving mechanization.

It can be mentioned as another special feature that four Sub-centres are planned to be set up for training local farmers and demonstrating improved practices.

4. PERFORMANCES

(1) Technical training

Programme	Period	No. of trainees	Plan (1971)	No. of trainees
A. Long term training	(1) 1969 Jun-Dec (2) 1970 Jun-Dec	23 23	(3) Jun-Dec.	25
B. Special training of DDA, etc.			(1) Sep.	16

Programme	Period	No. of trainees	Plan	No. of trainees
c. Power tiller owners training	(1) 1969 Apr	22	(6) Jan	20
	(2) 1969 Jun	8	(7) Feb	20
	(3) 1970 Jan	7	(8) Mar	20
	(4) 1970 May	7	(9) Apr	20
	(5) 1970 Nov	18	(10) May	20
D. Progressive farmers training	(1) 1970 Sep	8	(6) Jun	20
	(2) 1970 Oct	18	(7) July	20
	(3) 1970 Nov	19	(8) Aug	20
	(4) 1970 Nov	31	(9) Nov	20
	(5) 1970 Dec.	20	(10) Dec	20
E. Operator training	(1) 1970 Sep	9		5
Total No. of trainees		210		246

(2) Main items and subjects of trials

Main Item	Subject	1969	1970
I. Introduction of new varieties	A. Preliminary test of variety introduction	0	0
	B. Regular test of variety introduction	0	0
II. Technical improvement of cultivation	C. Density test of planting	0	0
	D. Comparative study between Indica and Japonica varieties on the ecological response of top-dressing of N-fertilizer		0
	E. Test for making standardisation of fertilizer application	0	0
	F. Experiment on the method of effective application of N-fertilizer		0
III. Strengthening of countermeasures to reclaim saline and alkali soils and plant protection	G. Test for reclamation of Alkali Soil	0	
	1) Survey of Alkali fields	0	
	2) Ecological variation of plant growth	0	
	3) Preliminary test of countermeasure	0	
	4) Effect of various reform materials of the desalinization process		0
	H. Experiment on the countermeasures of "AKAGARE" disease in paddy field		0
	I. Local test of Blast disease	0	

Main Item	Subject	1969	1970
IV. Promotion of mechanization and labour saving device	J. Test for weeds control	0	
	K. Test for transplanter introduction		0
	L. Harvesting test by Binder and Combine harvester		0
	M. Comparative test between power tiller and animal power	0	0
	N. Preliminary test of direct sowing cultivation		0
V. Introduction of improved techniques of rice cultivation	O. Analytical studies of yield components in high yielding fields in Mysore State	0	
	P. Technical analysis of rice cultivation in Mandya Distt.		0

5. RESULTS OBTAINED SO FAR

The following two reports were published to illustrate the working of the Centre and to make the results obtained from experiments and investigations conducted by the Centre to the concerned people including the State Government officers

A. Training Report
B. Advice Report

The training report is divided into two parts, part one on the long term training course and part two on the other training course.

The advice report consists of two parts: one is the experimental results at the Centre, and the other is the advice based on the results of survey and investigation of the main rice growing tracts of Mysore State. Advice reports are expected to contribute to improvement of rice cultivation in the State.

The training report No.1 and Advice Reports No.1 to No. 5 were published as the performance of the first year of the Centre. These are as follows:

Training Report:

No. 1 A report on the First Long Term Training, March 1970.

Advice Reports:

No. 1 A report on the Incidence of Discloured and under-fertilized Grains on Rice Panicles in South Kanara, Kharif 1969

No. 2 Improvement of Paddy Nursery and Demonstration Practice of Rice Growing Nursery, April 1970

No. 3 Distribution of Bacterial Leaf Blight in Mysore State, May 1970

No. 4 Weeds of Paddy Fields in Mysore State, May 1970

No. 5 An analysis of Yield Components in High Yielding Fields in Mysore State - Estimate of Paddy yields in the Fields of Main Rice growing Areas in Mysore State, June 1970

The following results of the Second Year (1970) will be published in 1971.

Training Report

No. 2 A report on the Second Long Term Training

No. 3 Reports on the Power Tiller Training and the Progressive Farmer Training

Advice Reports

No. 6 Studies on the Ecological Response to Paddy Growth in Saline/Alkali Soils and their Control Measures

No. 7 Symptoms and Control of Zinc Defficiency in Paddy

No. 8 A Comparative Test of Ploughing between Power Tiller and Animal Power

No. 9 Harvesting Test of Japanese Small Type of Binder and Combine Harvester

No.10 A report on the Technical Analysis of Rice Culture by Farmers in Mandya District.

6. RICE CULTIVATION PRACTICES TO BE IMPROVED

In order to find out the best practice of not only rice cultivation but also any other industries, the present situation has to be analysed based on the historical development and to be compared with that of advanced countries, and then it could be found that should be improved along the line of future direction of development. It is naturally impossible to find out points to be improved only by comparing them with Japanese situation without catching the history andunderstanding the situation about Indian rice cultivation practices through the full investigation into the actual conditions.

In India, Japanese cultivation methods have been introduced and extended for 20 years, and high yielding varieties like IR-8, Jaya, etc., have been adopted for a few years. These good results have been obtained already. The higher yield in the rice competition in India than in Japan is one example. As the possibility of high yield has been found already, the most important thing in agricultural policy making can be said to analyse high yield technically and extend it equally to all farmers.

It is much felt as Japanese experts that we should study more about Indiaca type rice based on the knowledge of Japonica type. Keeping in mind these vies, we could not help taking a prudent attitude in giving advice on improvement of rice cultivation practices in the State, but considering the data and actual conditions the following points must be advisable.

(1) Nursing of strong and healthy nursery plants by improving the technique of raising seedling and saving of quantity of seed to be sown in nursery beds (also see Advice Report No. 2)

(2) Early securing of number of stems and controlling of weeds by improving transplanting technique and making water management proper.

(3) Promoting of labour saving practices and improving of ripening by applying rational water management and timely weeding.

(4) Rationalizing of application of fertilizers and increasing of fertilizer effect by applying timely top dressing.

(5) Finding out of countermeasures on saline/alkali fields

(6) Rationalizing of cultivation practices by applying timely works of transplantation, plant protection, top dressing, water stopping, etc.

(7) Proper understanding of characteristics of varieties

(8) Solving of technical and economic problems in promoting mechanized farming

In future, after what should be improved is made clear, by analysing yield component elements to find factors restricting high yield, extension works should be strengthened.

With regard labour saving mechanization, progress of mechanization in Japan will help India find technical and economic problems and solve them.

IV. VIEWS AND PROPOSITION

1. FUTURE COOPERATION OF JAPAN WITH INDIA ON RICE RESEARCH AND EXTENSION WORKS

India is one of advanced countries on the organization of research and extension works in South East Asia, that was recognized at the First National Seminar of Agricultural Research System held in Delhi on March 8 - 13, 1971, and in this Seminar, it was found that in countries where research institutes are well organized like India fundamental research is given priority on one hand, in other countries priority is given on applied research and extension works on the other. In India, generally speaking, the Central Research Institutes are taking up fundamental research, and Local Institutes are taking up applied research. In India, where organizations are well arranged, Japan should direct its cooperation towards the followings: -

(1) Cooperation in the Central and Local Institutes for strengthening the Indian weak fields of agriculture

(2) Research cooperation on labour saving mechanization of rice cultivation by referring to that of Japan as a model

(3) Cooperation relating to assistance to small farmers by promoting research programmes on intensive utilization of land

(4) Cooperation for re-arranging and re-organizing research institutes in close contact with extension works, referring to those in Japan and other advanced countries as a model

(5) Cooperation for training of officers and others taking charge of extension works

2. FUTURE DEVELOPMENT BASED ON THE PRESENT CENTRES ACTIVITIES

(1) It is not advisable to seek for only new features. In developing agriculture step-by-step progress is essential.

(2) Main features of future programmes should be prepared by the State.