Report
on
Activities
of
Former Expert
on
Agronomy, JADP(Rapti Model Farm)
NEPAL

February, 1981

Japan International Cooperation Agency

Report
on
Activities
of
Former Expert
on
Agronomy,JADP(Rapti Model Farm)
NEPAL

February,1981

Japan International Cooperation Agency

CONTENTS

I. Foreword

The Nepal Agricultural Development Project at the Rupti Model Farm has now only one and half years left before completion. The project has been carried out towards its initial goal for the last five and half years including the two for the preparatory period.

It has now been decided to transfer the model farm to hilly area of Janakpur. This is to be welcomed as it is an indication of the fact that the role played by the model farm in the project has now entered its final stage. This report is intended to describe the history of the farm and the results of its activities so that they may be of some use in administering future projects.

As this farm has the responsibility of contributing to the development of hilly area agriculture in Janakpur zone, if the results obtained at this farm can be utilized in future activities, the main objective of this farm will have been achieved. Though there is the question of geographical distance between the two locations, it is hoped that the data obtained and the approach adopted at this farm be applied after considering common factors as well as differences.

Chapter 3 is devoted to agricultural techniques (vegetable cultivation) which is the special field of the present writer.

The specialist working within the framework of a project is limited in his scope of activities and his tenure of office is also limited. In view of these factors, the present writer has, throughout his tenuere of office, paid attention to manpower development, given the responsibility of managing a farm apart from his duties as a specialist. In the light of the conditions of the farm, project and Nepal, the conclusion he reached was none other than the fostering of basic knowledge and techniques.

It is important to study the method and organization of extension; but it is urgent to develop and foster the techniques (materials) to be adopted to form the basis. When one has to select cultivation techniques suitable for Napal and provide guidance, the amount of relevant data is still small. In order to solve this problem even to a limited extent, the present writer placed emphasis on the collection of information concerning agricultural leaders and extension personnel.

With this approach in mind, the present writer gave guidance at the model farm not only on techniques but also on approaches to cultivation.

This report contains a part of the results obtained, which may hopefully be expanded in the future with additional data on various aspects of the project including the details from various areas.

Finally, the present writer wishes to express his sincere thanks to the Director of Agricultural Bureau, Project Manager and other Nepal Government officials concerned and the Japanese Embassy in Nepal for giving him all the help he needed. He also wishes to record his warm thanks to his counterpart, staff of the model farm and the members of the Japan Overseas Cooperation Volunteers (JOCV) for their cooperation.

Toshihisa MURATA

Head,
Agricultural Development Department
Japan International Cooperation Agency
(JICA)

II. History of the Rapti Model Farm

1. The farm prior to the project

The history of the farm dates from about 22 years back; this corresponds to the history of diafforestation in Chitwan. Before the diafforestation this area was subtropical monsoon jungle forming a hotbed of malaria, inhabited by a small number of tribes including the native Tharus. Consequently, WHO initiated the eradication of malaria and diafforestation was also commenced.

The H.M.G. (His Majesty of Government) Rapti Agricultural Experimental Station was established at Yagyapuri in 1956 immediately after the diafforestation. However, this station was transferred in 1959 at Rampur, about 10 km away, leaving the former site unattended. It was then reopened in 1965 as the H.M.G. Yagyapuri Horticulture Farm; at the same time the Tokyo University of Agriculture established a farm occupying a part of the site. This was in fact the forerunner of the present Rapti Model Farm which was formally inaugurated on January 1, 1966, as the Rapti Experimental and Model Farm of Tokyo University of Agriculture.

About six years later on November 26, 1971, the Record of Discussions was concluded between the Japanese Government and the His Majesty's Government of Nepal concerning the establishment of a regional agricultural development project. This project was intended to carry out agricultural development of Janakpur zone, allowing a preliminary period of two years from August 17, 1972. It was decided at the same time to place the Rapti Experimental and Model Farm of TUA under the project, changing the name to the Rapti Model Farm; it was officially changed to the JADP Rapti Model Farm at the Janakpur Zone Agriculture Development Border (JADB) Conference held on November 19, 1972. Preparations for the establishment of the JADP were also initiated at the farm.

2. Development after the conclusion of the project agreement

i) With the conclusion of the Five-Year Program Agreement of the JADP on November 7, 1974, the farm undertook the responsiblity for hilly area-agricultural development in Janakpur zone for a period of five years, though preliminary work had begun two years before.

ii) In November, 1972, a Japanese expert in agricultural techniques was assigned to the farm to be engaged in the improvement of the farm with members of the JOCV (Japan Overseas Cooperation Volunteers).

iii) In order to ascertain the environmental conditions of the farm and of the Chitwan district, soil survey was carried out with farm improvement forming the main bulk of activities in 1973. The conclusion of the project agreement also made it necessary to clarify the responsibility, role and the goal of the farm.

iv) In 1974 farm land consolidation was carried out together with the construction of the office and the living quarters for personnel. Wireless communication was set up in May with the Project Center and Kathmandu. Survey of Shindhuli Area was conducted for the extension of hilly area agriculture in Janakpur; it was also decided to send personnel to the Shindhuli Farm to provide guidance.

v) The living quarters for personnel B and C were completed in January, 1975, for occupation. The office and the quarters for the JOCV members were also completed in December, thus completing the construction work at the farm.

As for irrigation, it was decided to rely on the Chitwan Irrigation Project; but an irrigation pump was installed as a temporary measure, making use of a well with 3-inch piping installed at the farm. Basic cultivation tests were also carried out at the farm, experimenting with new species brought over from Japan.

vi) The Nepalese counterpart of the Japanese specialist was given training in Japan in 1976; the Japanese specialist was relieved by another.

Emphasis was placed on the control of farm land consolidation, taking various steps such as the adoption of crop rotation, control of soil pests and technical experiments. A textbook was also compiled for the Junior Technician (JT) Junior Technical Assistant (JTA).

vii) Cultivation techniques were formulated in 1977 and basic trial cultivation was carried out. The production target for the farm was fully achieved.

With the problem of move to the Shindhuli Farm emerging in earnest, compilation of the past activities was commenced with the collection of basic cultivation data.

viii) Final consolidation of farm land and cultivation techniques was carried out in 1978. It was decided to increase earnings from production (reduction in production cost). The specialist was transferred to the JADP and the move to the Shindhuli Farm began. The work of handing over to the H.M.G. horticulture farm was also commenced.

3. Outline of the management of the farm

The objectives of the farm were determined under the agreement concluded. The activities carried out at the farm may be outlined as the chart below (See Fig. 1).

i) Annual production of the farm:

Production quota for one year is allocated to each government farm during the previous year and the activities at the farm are geared to the production target while other objectives are also pursued. The table 2 below shows the products and production volumes of the farm. It shows that the production targets were achieved during the last two years, indicating stable production activities at the farm.

ii) Farm management:

Farm personnel are deployed as shown by the Fig. 2 below and the list of Japanese Experts and members of the JOCV with their terms is also given below Table 2.

Fig. 1 RAPTI MODEL FARM ACTIVITIES CHART

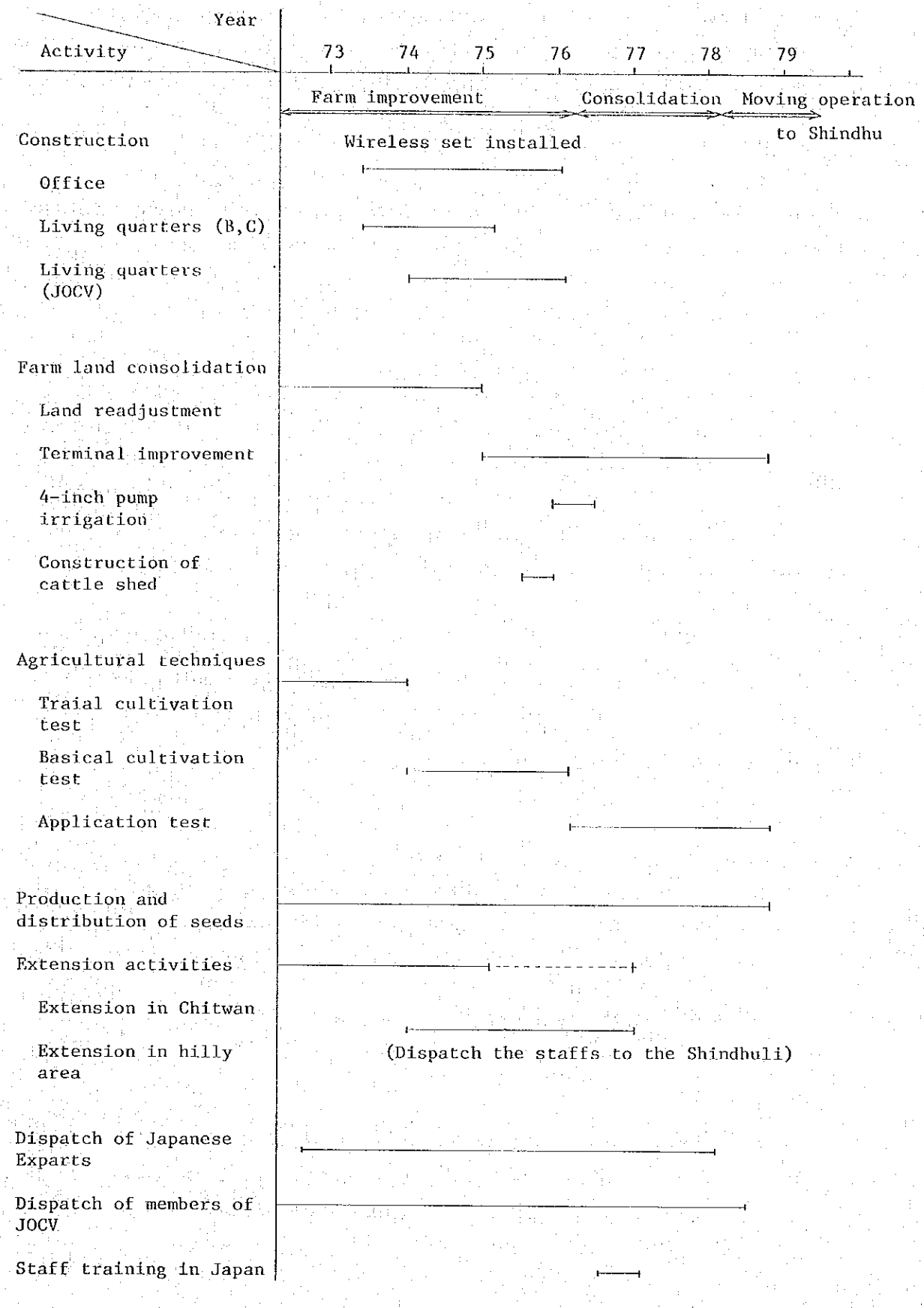


Table 1 RAPTI MODEL FARM; YAGYARURI

Projects	Fiscal year 1972-73 2029-30		Fiscal year 1973-74 2030-31		Fiscal year 1974-75 2031-32		Fiscal year 1975-76 2032-33		Fiscal year 1976-77 2033-34		Fiscal year 1977-78 2034-35	
	Target	Production	Target	Production	Target	Production	Target	Production	Target	Production	Target	Production
Paddy Production	-	27 Muri 10 Pathi	-	-	-	-	-	-				
Wheat Production	-	63 Muri 14 Pathi Mona2	-	-	-	-	-	-				
Radish Vegetable Production	-	1649 Mutha	-	-	-	-	-	-				
Plaintain Vegetable Production	-	46 Kgs.	-	- -	-	-	-	-				
Maize (Green) Production	-	257 Jhutte	-	-	-	-	-	-				
Tomato Production	-	300.700 Kgs.	-	-	-	-	-	-				
Sugarcame "	-	2,408.000 Kgs.	-	-	-	-	-	-				
Grass "	-	12 Ehari	-	-	-	-	-	-				
Fruits & Vegetable Production	-	-	1200 Kgs.	7,213.380Kgs	70.000kgs	8.260Kgs.	-	-				
Other crops Production	-	-	400 Kgs.	2,300.030Kgs	-	-	-	-				
Fruit Vegetables seed Production	-	-	-	-	-	-	-	-				
Paddy Seed Production	-	-	-	-	3,600.000kgs	2,650.000Kgs.	3,600.000Kgs	2,889.500Kgs	3,000.000Kgs.	3,049.000Kgs.	3,000.000Kgs.	2,280.330Kgs.
Wheat " "	-	-	-	-	3,000.000Kgs	2,673.500Kgs.	3,000.000Kgs.	3,036.000Kgs.	3,000.000Kgs.	3,581.000Kgs	3,000.000Kgs	6,334.550Kgs.
Maize " "	-	-	-	-	1,000.000Kgs	2,673.500Kgs.	1,000.000Kgs.	1,298.800Kgs.	1,000.000Kgs.	1,257.500Kgs	1,200.000Kgs	1,443.200Kgs.
Vegetable Seed "	-	-	100 Kgs.	46.300Kgs	490.000Kgs	117.910Kgs.	500.000Kgs.	252.035Kgs	500.000Kgs.	532.148Kgs.	400.000Kgs	890.701Kgs.
Pulses & Dil seed Crops seed Production	-	-	-	-	-	-	-	-	-	-	1,500.000Kgs	2,133.355Kgs.
Other Crops seed PProduction	-	-	8000 Kgs.	3,272.000Kgs	2,000.000Kgs	443.980Kgs.	2,000.000Kgs.	1,398.800Kgs	2,000.000Kgs.	2,149.722Kgs	-	892.100Kgs.
Fresh Vegetable Production	-	-	-	-	35,000.000Kgs	12,629.730Kgs.	20,000.000Kgs.	15,023.925Kgs	10,000.000Kgs.	10,818.905Kgs	10,000.000Kgs.	32,308.356Kgs.
Farmers day	-	-	4 (nos)	4 (nos)	2	2	-	2	-	1	-	1
Trial/Demonstrations	-	-	16 (nos)	16 (nos)	-	-	-	-	-	-	4	4

Fig. 2 Organization Chart of Personnel JADP Raputi Model Farm

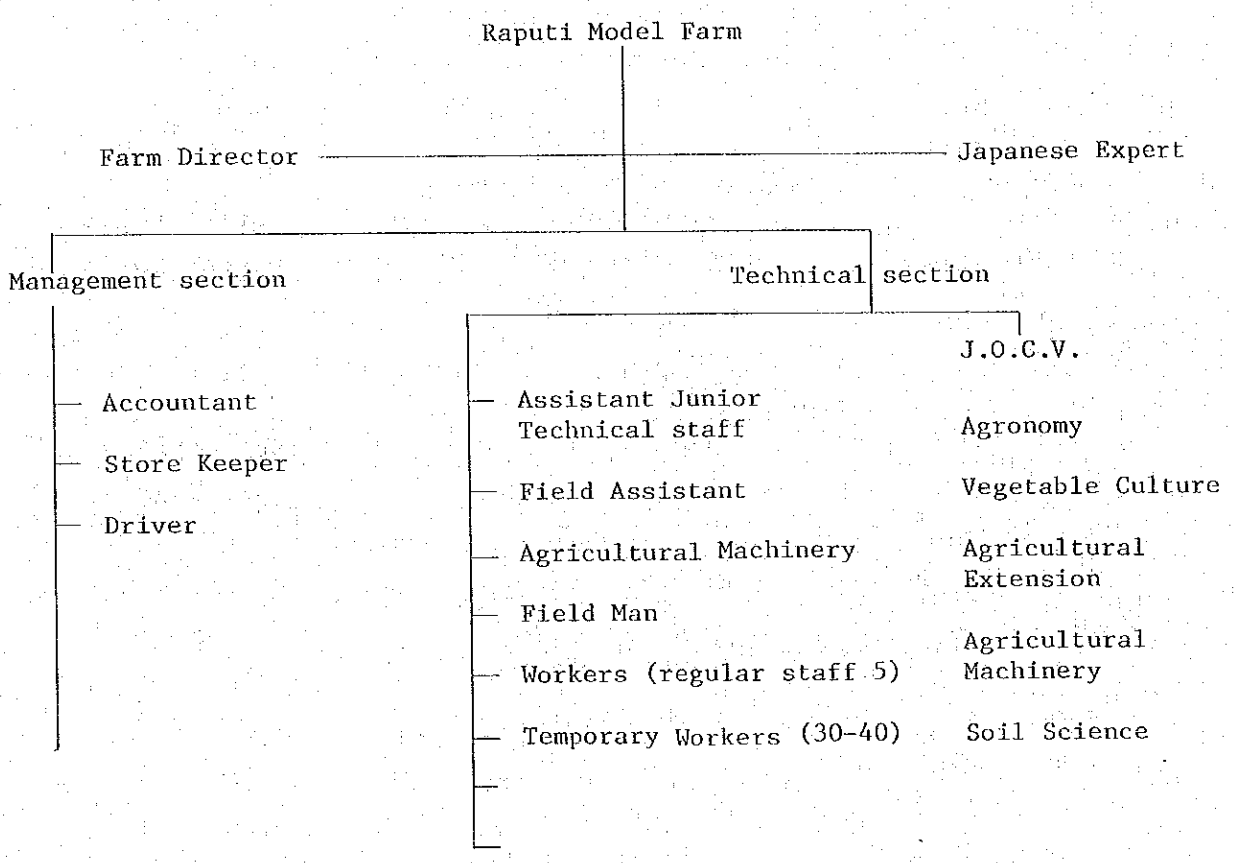


Table 2 List of Japanese Experts and JOCV Members

I. Experts

Speciality	Name	Term
Agronomy:	Sataro YAZAWA	Nov.72-Mar.76
Agronomy:	Yoshihiko NISHIMURA	Mar.76-Mar.78

II. JOCV Members

Agricultural extension:	Fumio OTA	Dec.72-Dec.75
Agronomy:	Masatoshi MAMENARI	Dec.72-Apr.75
Horticulture:	Takeo HIDAKA	Dec.72-Dec.75
Agricultural machinery:	Yasutaka TOKUDA	Dec.72-Dec.75
Soil:	Hiromasa SOEJIMA	Mar.73-Mar.75
Agricultural extension:	Yuichi TOMIYASU	Apr.75-Apr.77
Agronomy:	Yasuo OIZUMI	Aug.75-Aug.77
Vegetable cultivation:	Yoshio TERADA	Aug.75-Aug.77
Agricultural machinery:	Soeji SATO	Feb.75-Aug.79
Vehicle maintenance:	Toshihiro FUKUSHIMA	Dec.76-Apr.77
Horticulture:	Akio MAEDA	Nov.71-Nov.72
Horticulture:	Masuo HAMADA	Nov.71-Nov.72
" :	Tetsuo SHIMIZU	Nov.71-Nov.72
Agricultural machinery:	Osamu OTA	Nov.71-Dec.72
Soil:	Toshio HAMADA	Nov.71-May 73

III. Research and guidance on cultivation techniques and the results

Agricultural guidance may roughly be divided into two categories.

a) Guidance on management (farm management).
b) Guidance on techniques (cultivation).

Correct guidance in agriculture cannot be given unless the guidance leader has an accurate knowledge of agriculture and techniques. The guidance leader also requires guidance material.

Accordingly, the farm placed emphasis on the preparation of such material and made every effort in establishing such techniques as to provide guidance on cultivation by taking account of regional and natural conditions. The material is to provide sufficient data for extension staff to convince farmers. It is important therefore to prepare the data in such a way that testing and exercise may be repeated scientifically under guidance. The staff were thus trained to make it a habit to carefully observe the crop and collect data for analysis.

It is also necessary to acquire the capability of developing agriculture on the basis of the data obtained by taking account of suitable cultivation methods for various areas and social conditions. The present writer believes that every effort was made in such a way that the Nepalese staff would acquire that sense and hopes that an increasing number of people will make efforts so that this concept will be put into practice throughout the country.

Though this report contains the results obtained from the farm, they cover only a part of agriculture and they may not be utilized directly in some areas. However, it is necessary to understand the concept so that data suitable for each area may be prepared.

This report will be confined to cultivation of mainly upland crops because a) this farm will operate as a H.M.G. horticultural farm in the future; b) rice cultivation is being carried out mainly at the Hardinath Agriculture Farm; and c) there is a shortage of data on upland crops and horticulture.

1. Climatic conditions

Chitwan, where the farm is located, is a subtropical monsoon area belonging to Inner Tarai; Shindhuli also belongs to the same climatic zone. It is wellknown that climatic conditions form one of the important factors in agriculture, which require patient and steady study. It is an important task in agriculture to make use of climatic conditions. On the basis of the data obtained at the farm, agriculture in this area may be envisaged as below.

To begin with, the climate in this area may be classified into three seasons.

a) June - September : hot rainy season
b) October - February : cool dry season
c) March - May : hot dry season

Details are given below.

1) Hot rainy season

Normally the rainy season starts in June preceded by the pre-monsoon period of April and May. Pre-monsoon is important in the sowing of rainy season. Sowing of corns and beans such as Asparagus bean, main crops of Chitwan, is also carried out.

The rainy season is of a positive nature; the rain is often heavy, particularly in the morning and in the evening, but with sunny intervals during the day. Crops should therefore be protected from the heavy rain; mulchi may be used to protect those crops and seedlings which are especially susceptible to rain. As the temperature differential is small, attention should be paid to pest control because of a marked number of generations.

Rice planting is carried out in June and July; it is preceded by sowing one month before. As the amount and pattern of rainfall vary from year to year, sowing and planting of rice require special attention. Okra, Bitter Gourd, cucumber and Chinese leek may be considered as rainy season crops; but the number may increase by taking steps such as drainage. During the latter half of the rainy season it is necessary to prepare for the raising of vegetable seedlings for the dry season. Raising of seedlings may be carried out by means of plastic tunnels and plastic houses to avoid the damage by rain so that planting can be carried out as soon as the wet season ends.

2) Cool dry season

The rainy season normally ends in October. The temperature then begins to fall; the fall is drastic in November, especially with the minimum temperature. Humidity also begins to fall; it is low during the day and high during the night showing a large daily fluctuation.

Rice is harvested in October and November. Sowing and planting of upland crops immediately after the rainy season bring out the best results as sufficient moisture is contained in the soil. With the

increase in daily humidity fluctuation fogs occur in Chitwan and Shindhuli districts. They occur mainly from the end of October into January and often at the foot of mountains in hilly area. The fog normally occurs with the sunrise and covers the surface all morning when it persists.

The lowest temperature is recorded from the end of December through the beginning of January, registering 3-4°C; but no frost occurs. The temperature begins to rise at the end of January and the daily fluctuation begins to increase from February. There is hardly any rainfall and humidity continues to fall, requiring attention to the possible shortage of water.

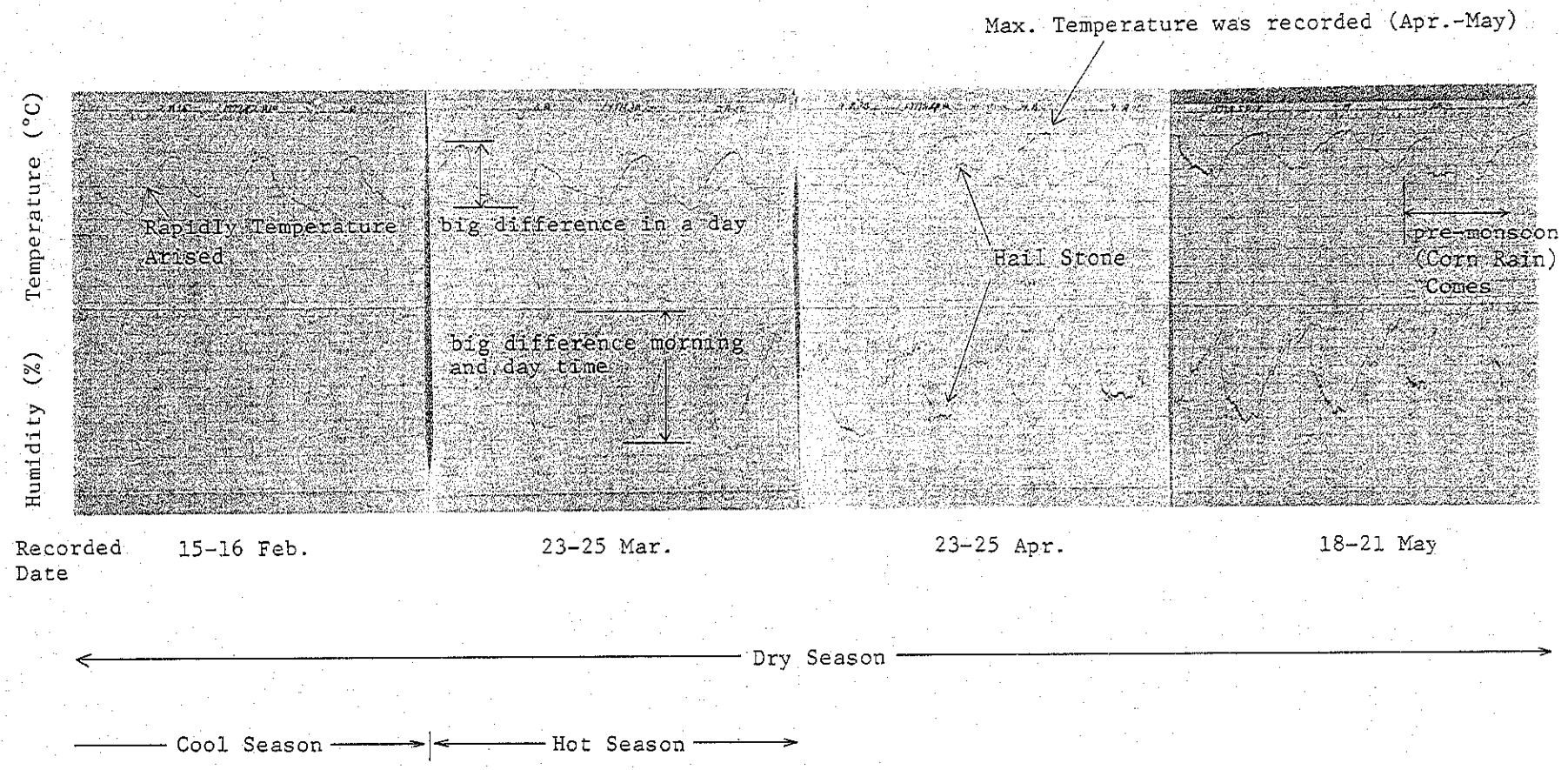
3) Hot dry season

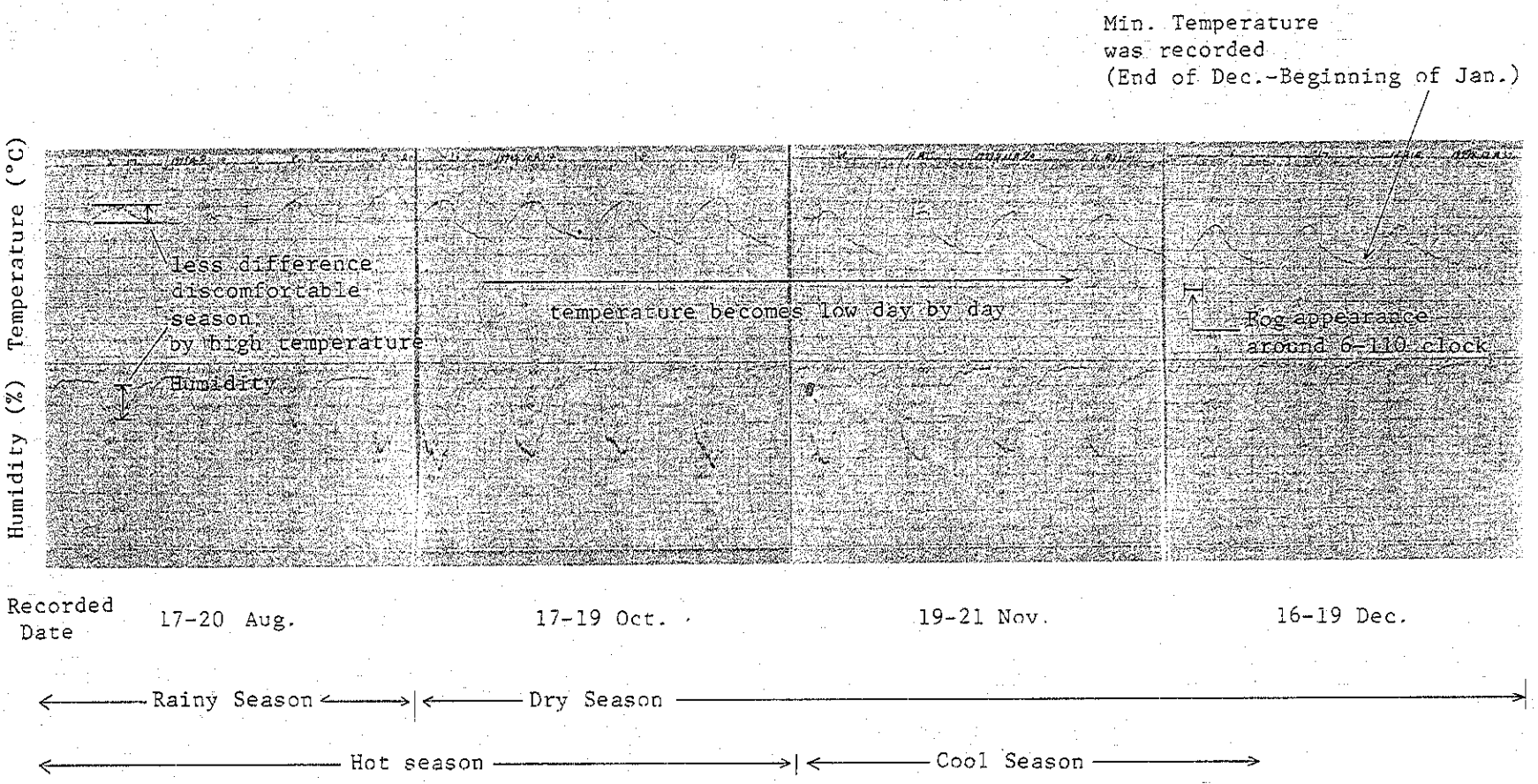
As the latter half of the dry season corresponds to a high temperature period with further fall in humidity. Dust storms begin to occur from March and April and May may see hails. The highest temperature is recorded around April, registering nearly 40°C.

The dust storm normally occurs in the after, and is accompanied by sand storm, thunderstorm and gust; it may sometimes by accompanied by hails. It normally lasts for a few hours, receding by the evening. Pre-monsoon then brings the first rain of the rainy season, providing valuable water during the dry season. The humidity is at the lowest immediately for the first rain.

Weather Record at Rapti Model Farm

(Recorded by self-registering thermometer & Hydrometer)




Min. Temperature
was recorded
(End of Dec.-Beginning of Jan.)
Temperature (°C)
Humidity (%)
less difference
discomfortable
season
by high temperature
Humidity
temperature becomes low day by day
Fog appearance
around 6-110 clock
Recorded
Date
17-20 Aug.
17-19 Oct.
19-21 Nov.
16-19 Dec.
Rainy Season
Dry Season
Hot season
Cool Season

Weather Record at Rapti Model Farm

Table 3

Temperature (°C)

Year	1972	1974	1975	1976	1977	Average
Jan.	-	14.2	13.8	13.7	14.5	14.1
Feb.	-	16.3	17.2	17.5	18.6	17.4
Mar.	-	22.0	22.0	*(24.3)	23.6	22.5
Apr.	27.9	27.8	28.1	27.2	26.7	27.5
May	27.3	228.8	29.9	28.1	28.0	28.4
Jun.	26.8	29.0	29.9	28.4	29.6	28.7
Jul.	29.3	27.7	27.9	28.7	29.1	28.5
Aug.	28.9	28.2	29.0	29.0	28.8	28.8
Sep.	27.6	26.9	27.5	27.6	28.5	27.6
Oct.	24.8	26.4	26.3	25.3	24.5	25.5
Nov.	19.3	20.4	18.9	21.9	21.4	20.4
Dec.	15.4	13.8	14.8	16.6	15.9	15.3

Year Average 23.7°C

*-- Average of 19th - 31th

Table 4

Precipitation (mm)

Year	1973	1974	1975	1976	1977	Average
Jan.	-	18.5	21.0	15.8	2.4	15.9
Feb.	-	2.5	8.0	14.5	8.6	8.4
Mar.	-	14.5	3.0	-	6.6	8.0
Apr.	-	35.5	22.0	60.0	138.8	64.1
May	-	54.5	109.0	107.0	190.1	115.2
Jun.	-	285.0	348.5	444.5	136.9	303.7
Jul.	294.5	649.5	793.0	569.9	403.5	543.0
Aug.	296.0	618.0	407.8	401.3	677.0	480.0
Sep.	461.5	518.0	468.5	129.5	177.4	351.0
Oct.	260.5	59.5	110.5	0	160.0	118.1
Nov.	0.5	3.1	0	0	74.8	15.7
Dec.	0	4.0	0	0	44.0	9.6
Total	-	2262.6	2296.3	(1742.5)	2026.1	**2195.0mm (Year Total)

**-- 3 Years Average

Table 5

Maximum Temperature (Average of the Month) (°C)

Year / Month	1973	1974	1975	1976	1977	Average
Jan.	-	21.6	20.5	20.3	22.0	21.1
Feb.	-	24.8	24.5	24.6	26.9	25.2
Mar.	32.0	30.6	31.0	*33.5	33.0	31.7
Apr.	36.1	35.2	36.9	34.9	33.1	35.2
May	32.6	34.8	36.5	33.7	33.5	34.2
Jun.	30.1	34.1	34.6	32.6	34.4	33.2
Jul.	33.2	31.0	31.3	32.4	33.1	32.2
Aug.	32.6	31.9	33.0	32.2	32.9	32.5
Sep.	31.3	30.3	31.1	30.9	33.0	31.3
Oct.	29.5	31.4	31.3	31.1	30.0	30.7
Nov.	26.1	28.5	26.3	28.7	27.0	27.3
Dec.	22.5	21.4	22.2	24.3	22.7	22.6
Year Max.	41.0	39.7	39.7	38.0	39.1	
Record and it's date	Apr.15	Apr.24	Jun.13	Apr.18	May 31	

Table 6

Minimum Temperature (Average of the Month) (°C)

Year / Month	1973	1974	1975	1976	1977	Average
Jan.	-	6.7	7.1	7.0	7.0	7.0
Feb.	-	7.7	10.0	10.3	10.3	10.0
Mar.	13.4	13.4	13.1	*15.0	14.2	13.5
Apr.	19.8	20.5	19.2	19.5	20.3	20.0
May	21.9	22.8	23.3	22.4	22.5	22.6
Jun.	23.5	23.8	25.2	24.1	24.8	24.3
Jul.	25.4	24.4	24.5	24.9	25.1	24.9
Aug.	25.1	24.5	25.0	25.8	24.7	25.0
Sep.	24.0	23.5	23.8	24.2	24.0	23.9
Oct.	20.3	21.5	21.2	19.5	18.8	20.3
Nov.	12.8	12.4	11.5	15.2	15.6	13.5
Dec.	8.1	6.1	7.4	8.9	9.0	7.9
Year Min.	(4.6)	3.3	3.4	4.0	3.8	
Record and it's date	(Dec.30)	Feb.7	Jan.8	Jan.22	Jan.1	

*-- Average of 19th - 31th

Table 7

Humidity (Daily average in each month) Feb. 1977 - Jan. 1978

Month	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Max. (%)	100	99	95	93	94	97	96	96	97	99	99	100
Min. (%)	47	35	27	38	47	53	65	63	59	55	56	55

Table 8

Evaporation (mm)

Month / Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1975	1.6	3.5	6.7	8.6	5.9	5.8	4.0	3.7	2.5	4.0	3.2	2.0
1977	2.5	4.2	6.8	5.6	5.6	5.6	3.9	3.7	4.1	3.5	2.7	2.0

2. Guidance on the cultivation of upland crops during the rainy season

The rainy season in Chitwan is a difficult season for cultivation as it corresponds to a high temperature period and crops are often damaged by heavy rain, high temperatures and pests. In addition, with poor transport facilities there may occur an acute shortage of goods, particularly those of a low storage quality. Vegetables start running short from about May and the shortage becomes acute around July as distribution is hampered by the lack of transportation. Accordingly, guidance should be given in such a way that each area makes self-supporting arrangements.

During this season rice is the main crop where irrigation is provided, while corns and finger millet are the main crops on high ground. The planted area of main crops should be increased and, at the same time, steps should be taken to increase self-sufficiency during the rainy season when goods become scarce.

In cultivating vegetables during the rainy season we are faced with important tasks as outlined below.

1) Consolidation of field (drainage facilities).
2) Selection of suitable crops.
3) Raising of pest-resisting species or varieties.
4) Disinfection.
5) Development of weeding and crop cultivation techniques (measures to be devised).

Below are given those points on which guidance was found to be effective.

1) High ridge cultivation

Ridges make crop control easy not only with wet crops but also after sowing and planting. High ridges are particularly effective for cultivation during the wet season as good drainage prevents the damage by inundation due to torrential rainfall.

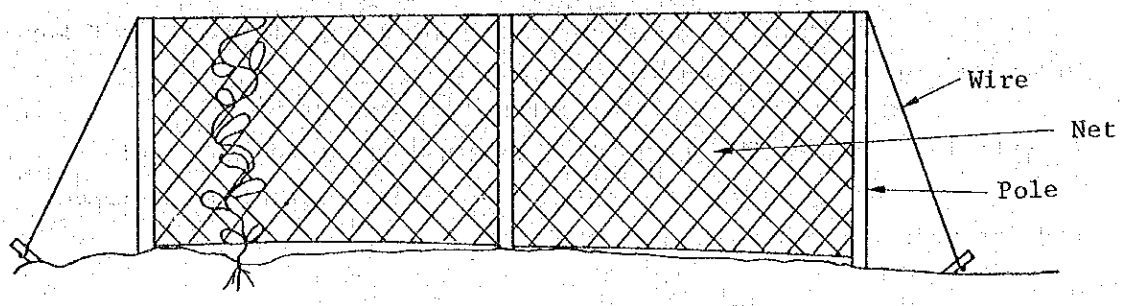
Effects increase further with drainage provided around the field. They were found to be effective with soy beans, radish, sweet pepper and hot pepper. (Photograph of radish)

2) Encouragement of support cultivation

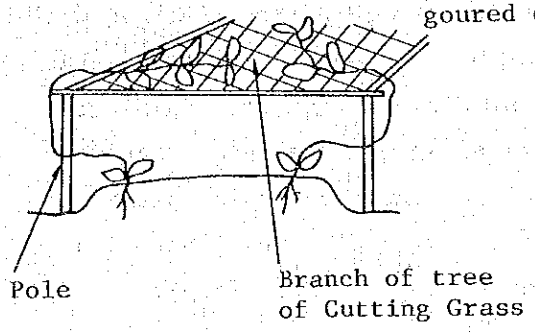
Support is necessary for tall or climbing crops and is effective with gourd family and pulse crops such as Asparagus bean. Merits of this method are: 1) easy harvesting; 2) easy disinfection and training; 3) protection from mud splashing by rain; 4) ventilation effect, etc. It is difficult to obtain the material for the support in this area; bamboo and steel pipes are costly. Therefore, withered Arhar, sun hemp, Dhimcha, etc. may be used as the support. (See Fig. 4)

Fig. 4 Example of Support

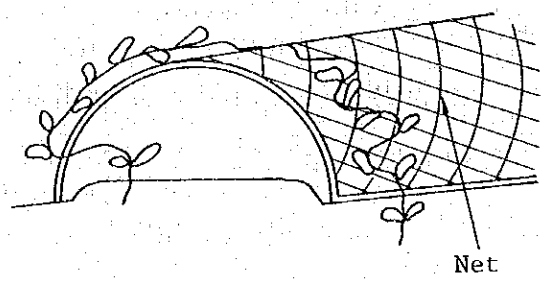
(1) Beans, Asparagus bean etc.



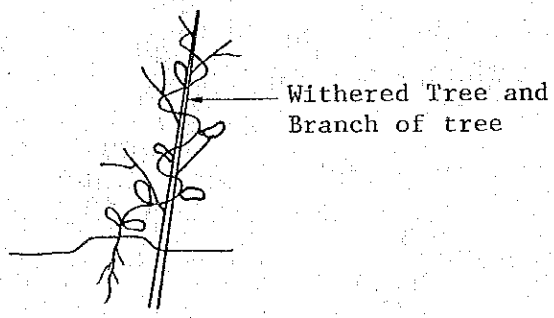
(2) Cucurbits; Snake gourd, Bitter goured etc.



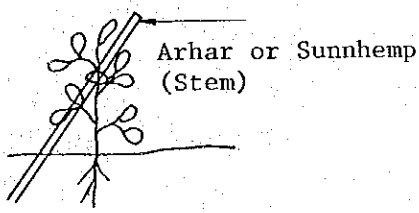
(3) Cucurbits; Snake gourd, Bitter gourd etc.



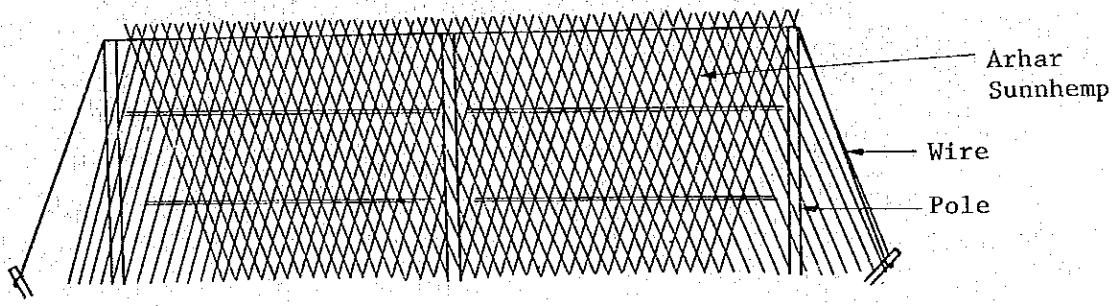
(4) Bottle gourd, Sponge gourd



(5) Solanaceous fruits (Pepper, Tomato, Eggplant etc.)



(6) Peas etc.



3) Encouragement of weeding

Weeds grow extremely quickly during the rainy season. Since they not only check the growth of crops but also provide a hotbed for pests, weed control is indispensable in agriculture. Further, weeds may be left as compost to serve as an important fertilizer for the next crop and to be used for the mulch.
Don't use the weeds in the field if weeds have seeds.

3. Guidance on upland crop cultivation during the dry season

The dry season can be divided in two: the low temperature period from October through February and the high temperature period from March through May. The method of cultivation varies accordingly.

1) Low temperature period

This is the most favorable period for cultivation and is the main season for vegetables specially, leaf and roof vegetables. However, as the temperature may fall to 4°C sometimes cultivation of fruit vegetables is somewhat difficult.

i) Methods of sowing and planting

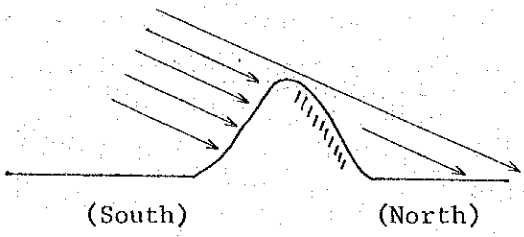
The water condition greatly affects the crop situation during the dry season. Initial cultivation control is important as the germination ratio and the successful planting ratio of vegetables and root crops greatly affect growth and yield. In this respect it is most important to secure soil moisture at sowing and planting.

Technical achivece was given through the trials described below.

a) Ridges are to be prepared running E-W with sowing and planting on the mid-slope of the north side.
b) Furrow irrigation is to be provided after sowing and planting.

This method is very effective with radish and cauliflower. Level rows are sufficiently effective for Tori. (Brassica rapa)

Fig. 5 Dry winter season culture
(must sow seed in north part of row)



Conditions: To be applied to areas such as Chitwan where the minimum temperature is above 4-5°C and the daytime temperatures are reasonable and where the water condition rather than the temperature condition affects germination and growth.

Trial 1:

Observation of the germination ratio with E-W ridges and level rows.

1. Ridges are to be prepared as shown below with sowing at three levels and also on the level row.
2. Crops to be tested are radish, rayo and tori.
3. The layout is as shown Fig. 6.

Results: See Table 9

1. The germination ratio is markedly high with the north ridge and the level row compared with the south ridge and the peak sowing.
2. Effects of sowing on the north ridge and the level row appear in the order of rayo, radish and tori

Trial 2:

Observation of germination ratios on E-W and S-N ridges.

1. Sowing is to be carried out in both directions as shown below.
2. Crops to be tested are radish, rayo and tori.
3. The layout is as shown Fig. 7.

Results: See Table 10 and Fig. 8

1. In the case of radish, sowing on the north side was found to be effective, followed by east, west and south.
2. In the cases of rayo and tori, north and east were found to be

effective while south and west were not.

3. Radish is more susceptible to soil moisture than other two crops; tori can bear a considerable degree of aridity.

4. The east ridge shows the same condition as the north ridge because of the morning fog.

Trial 3:

Observation of soil temperature and moisture of each ridge

While conducting Trial 1, observation was made of changes in soil temperature and moisture giving weight to the conditions in the morning.

1. Though the surface temperature begins to rise with the sunrise, the north ridge was 10°C lower than other ridges.

2. Soil moisture greatly affects germination and planting. The results obtained by measuring the moisture of a specific amount of soil after 24 hours of drying at 100°C showed a marked difference between north and south ridges.

3. Moisture in the south ridge falls to nearly 1% during the day, indicating a marked shortage of moisture in the soil.

4. The result is as shown Fig. 9. , Table 11.

Table 9

Radish

Plot	Jan.23			Jan.29			Feb. 5		
	Rep.1	Rep.2	Total	Rep.1	Rep.2	Total	Rep.1	Rep.2	Total
A. (south)	0	3	3	16	27	43	18	27	45
B. (Top)	0	0	3	8	5	13	16	6	22
C. (North)	29	36	65	40	42	82	40	42	82
D. (Flat)	20	46	66	30	49	79	32	48	80

Rayo

Plot	Jan.23			Jan.29			Feb. 5		
	Rep.1	Rep.2	Total	Rep.1	Rep.2	Total	Rep.1	Rep.2	Total
A. (South)	1	0	1	14	5	19	12	3	15
B. (Top)	0	0	0	19	5	24	13	6	19
C. (North)	23	24	47	41	43	84	40	3	83
D. (Flat)	24	43	67	43	47	90	37	45	82

Tori

Plot	Jan.23			Jan.29			Feb. 5		
	Rep.1	Rep.2	Total	Rep.1	Rep.2	Total	Rep.1	Rep.2	Total
A. (South)	2	0	2	14	28	42	15	23	38
B. (Top)	0	0	0	28	24	52	23	22	45
C. (North)	38	42	80	40	43	83	40	43	83
D. (Flat)	44	47	91	47	51	98	45	49	94

Fig. 6

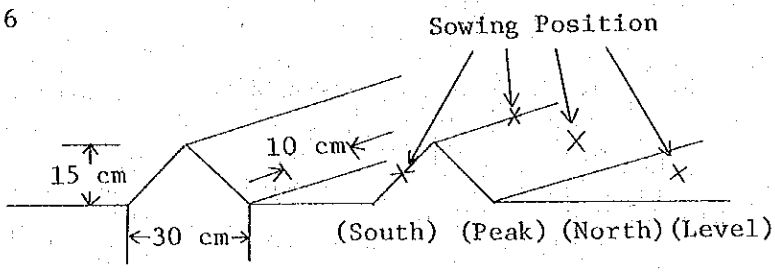

Sowing Position
10 cm
15 cm
30 cm
(South) (Peak) (North) (Level)

Fig. 7

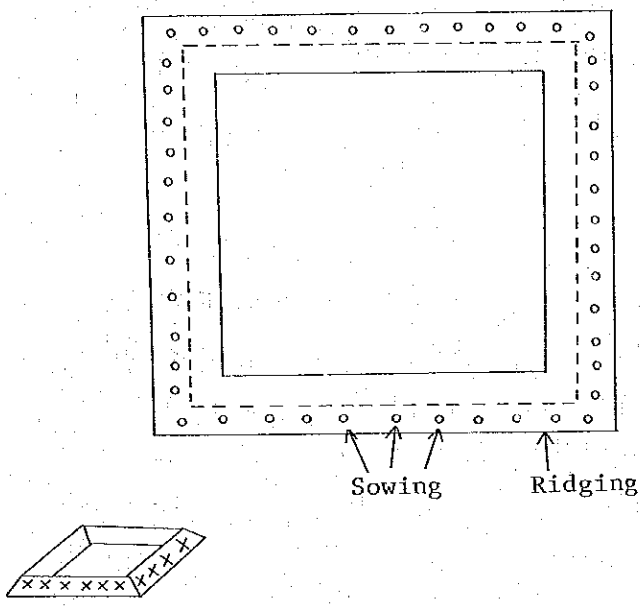

Sowing
Ridging

Table 10 Number of Germination at each direction

Radish

	Rep.1	Rep.2	Rep.3	Total	Rep.1	Rep.2	Rep.3	Total	Rep.1	Rep.2	Rep.3	Total
North	15	12	14	41	15	14	14	43	15	14	15	44
East	9	14	13	36	11	14	14	39	11	14	14	39
South	0	0	0	0	5	10	8	23	5	10	8	23
West	2	5	3	10	9	11	11	31	9	11	13	32

Rayo

	Rep.1	Rep.2	Rep.3	Total	Rep.1	Rep.2	Rep.3	Total	Rep.1	Rep.2	Rep.3	Total
North	10	11	10	31	12	15	14	41	12	15	14	41
East	12	13	7	32	13	15	14	42	13	15	14	42
South	0	1	3	4	10	13	14	37	11	13	14	38
West	6	5	4	15	11	13	12	36	11	14	12	37

Tori

	Rep.1	Rep.2	Rep.3	Total	Rep.1	Rep.2	Rep.3	Total	Rep.1	Rep.2	Rep.3	Total
North	15	15	15	45	15	15	15	45	15	15	15	45
East	14	15	15	44	14	15	15	44	14	15	15	44
South	0	4	0	4	15	13	12	40	14	13	12	39
West	4	2	2	8	14	13	13	40	14	13	13	40

Table 11

Time / Water content in the soil	8 o'clock AM	10 o'clock AM	12 o'clock AM
North	13.85 %	12.82 %	10.24 %
South	5.99	2.25	1.24

Fig. 8

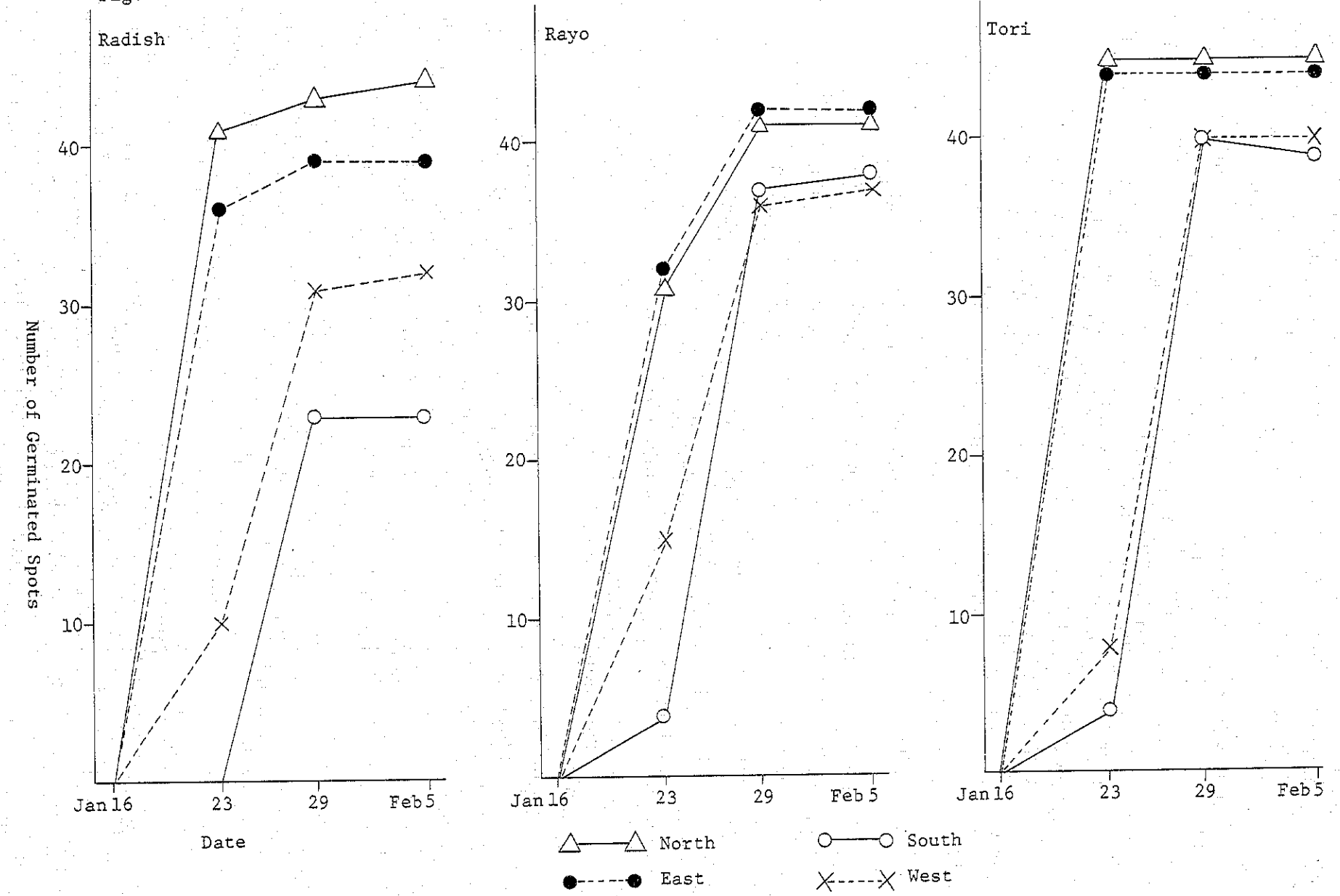

Radish
Rayo
Tori
Number of Germinated Spots
40
30
20
10
Jan 16
23
29
Feb 5
Date
North
South
East
West

Table 12 Observation of soil temperature in each part
(Feb. 22, 1978)

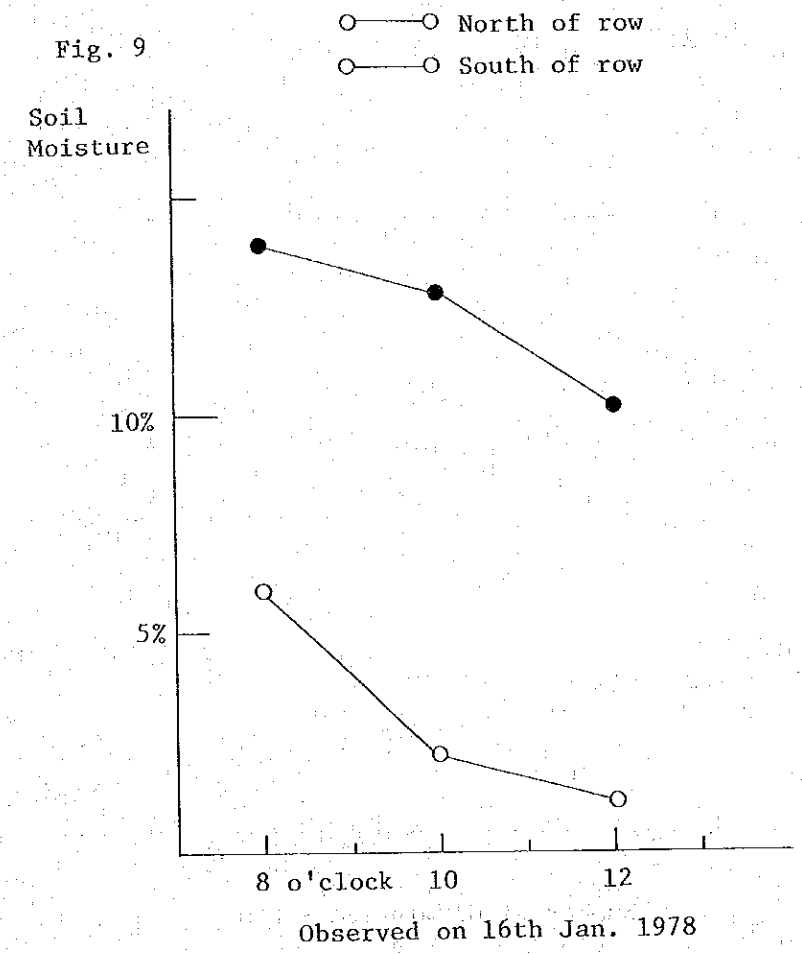
5 cm Depth

	7 o'clock	9 o'clock	11 o'clock
South	11.2 C	20.6 C	27.0 C
Peak	11.0	16.5	25.0
North	10.2	14.1	19.0
Flat	11.5	18.0	26.5

0 cm (Surface)

	7 o'clock	9 o'clock	11 o'clock
South	11.4	20.0	28.8
Peak	11.2	17.6	29.5
North	10.5	14.0	19.0
Flat	11.6	17.9	28.8

Fig. 9



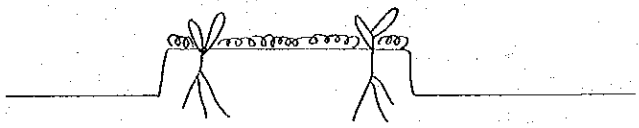
Observed on 16th Jan. 1978

(ii) High temperature period

1) Use of mulch

The high temperature period of the dry season shows the highest aridity in the year. Consequently, the soil temperature also rises with crops showing damages and drooping. Guidance was therefore given on the use of mulch using simple materials. These materials were first tested as shown by the Attached and soil temperatures data were measured to confirm the scientific basis before using them one by one on the field.

Fig.10 Hot Season Culture
(Mulching utrization in the row)

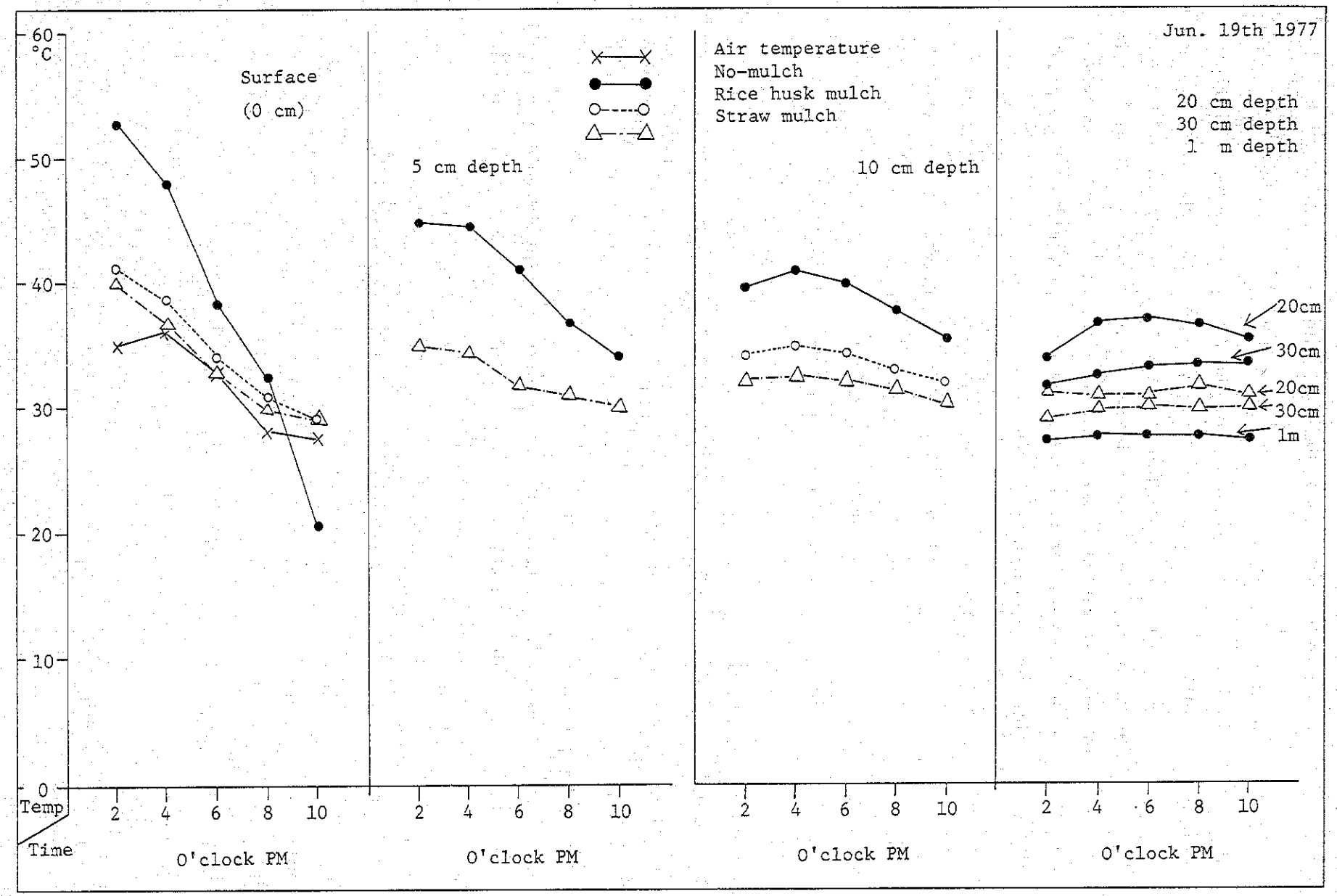


Materials: a) Rice straws.
b) Wheat straws
c) Cut grass
d) Chaff

Trial 1:

Observation of soil temperatures during the high temperature arid period and changes due to the use of mulch. The results of the observation are as shown Fig. 11.

Fig. 11


Jun. 19th 1977
Air temperature
No-mulch
Rice husk mulch
Straw mulch
Surface
(0 cm)
5 cm depth
10 cm depth
20 cm depth
30 cm depth
1 m depth
20cm
30cm
20cm
30cm
1m
60
°C
50
40
30
20
10
0
Temp
Time
2
4
6
8
10
O'clock PM

Results:

1) The effect of the air temperature was seen up to the depth of 30 cm underground; but the soil temperature was almost constant at 1 m depth.

2) It seems that the effect of the use of mulch on soil temperature is up to 30 cm in depth and the use of straws and rice husk lowers the soil temperature sufficiently during the day.

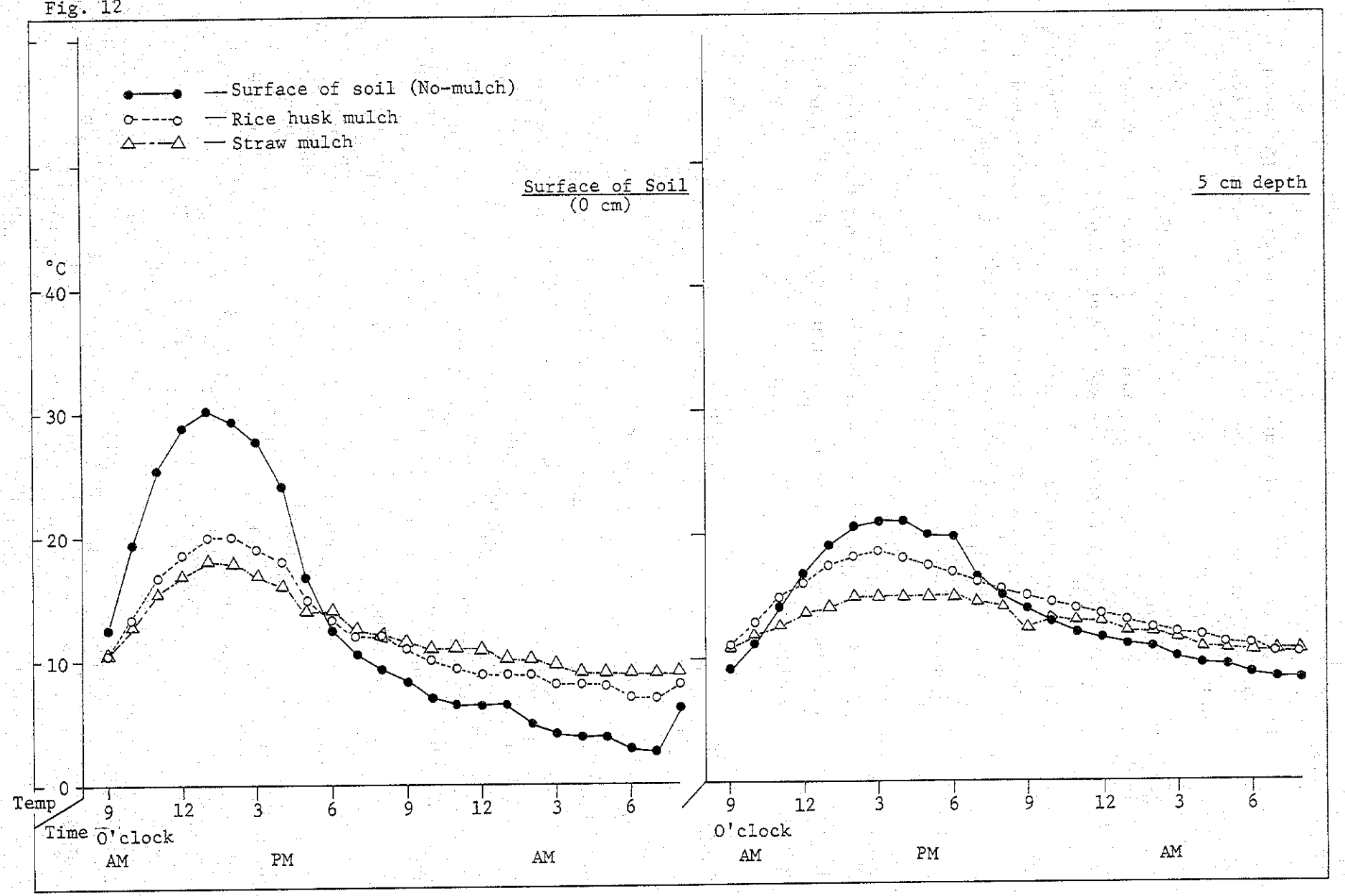
3) The straw mulch workes better than the chaff mulch in lowering the soil temperature, e.g., the difference in temperature is nearly 15°C on the surface and nearly 10°C at a depth of 5 cm.

4) These results constitute a general tendency.

Trial 2:

Observation of soil temperatures during the low temperature arid period and changes due to the use of mulch. The results are as shown Fig. 12.

Fig. 12


Surface of soil (No-mulch)
Rice husk mulch
Straw mulch
Surface of Soil
(0 cm)
5 cm depth
°C
40
30
20
10
0
Temp
Time
O'clock
9
12
3
6
9
12
3
6
AM
PM
AM
O'clock
9
12
3
6
9
12
3
6
AM
PM
AM

Results:

1) The use of mulch has the effect of lowering the soil temperature during the day compared with bear land and of maintaining the temperature during the night.

2) The rice husk mulch has the intermediate effect between bear land and the straw mulch.

3. In the light of the soil temperature condition in cultivation, mulch may be used only during the night to obtain high temperatures, effective for fruit vegetables.

4. Guidance on pest control

Pests occur all the year round, forming one of the important factors affecting the yield. In providing guidance on pest control, attention was paid to the following points: 1) detection of a pest outbreak and its source; 2) method of pest control; 3) not only the use of Pesticide or Agriculture Compounds but the solution in cultivation or the method of effective control should be found; and 4) correct and effective use of pesticide. Encouragement was given to careful observation of pest outbreaks so that pest control would be treated as the problem in crop cultivation by finding out under what conditions they are likely to occur, thereby appropriate methods of cultivation may be found. Below are the examples taken from the farm.

1) Crop rotation in the field for the prevention of soil bourn disease

In cultivating various crops in the same field, soil pests and nematode cause a problem; their occurances vary from crop to crop. This farm was subjected to the damage by soil pests as a variety of crops was cultivated for many years. The adoption of crop rotation is intended to prevent such damages. As damage is often caused to those of the solanaceous family and okra, special attention is required in cultivating these crops. However, no serious problem will rise if planting allocation in the field to the solanaceous family and okra is carried out carefully. The planting pattern adopted at the farm is as shown below.

2) Cultivation prior to the outbreak of pests

Though there is no frost in Tarai from November into January, the temperature falls considerably. Consequently, there is no outbreak of pests during this period, and cultivation can proceed satisfactorily, given the necessary humidity and water condition. Further, as it

provides an ideal period for the raising of s edlings, cultivation should be intensified in this period.

3) Manual control of insects (Chacking the in ects by hands)

When the price of insecticide is high or difficult to obtain, manual catching of insects, especially large ones, proves to be effective. Especially when the insecticide is limited in variety the control of Coleoptera such as beetles is difficult. Accordingly, it is necessary to control them completely during the raising of seedlings and immediately after planting.

4) Protection by net

Any damage to the crop during its seedling age greatly affects the growth in the next stage. The initial condition is particularly important for fruit vegetables such as melons. The use of netting during this period to protect seedlings from insects is very effective, particularly with cucumber leaf beetle. It is desirable that the crops are protected until their growth can catch up with the damage caused by insects.

5) Observation and the method of control of insects

The similar insects cause different damages depending on the crop and the growth stage of the insect. Constant observation of insects is therefore to be carried out so that the ecology of insects and the method of control may be ascertained. For instance, spraying of insecticide should be carried out during the most effective period.

Examples: Okra (stem borer) -- pupa goes into the crop
-- spraying during the growth.
Eggplant (stem borer) -- pupa goes out of the crop
-- to be removed manually.

6) Early cultivation of potatoes for the prevention of diseases

The disease which affects potatoes spreads from November through December; this period coincides with the growth period of potatoes. Accordingly, planting of potatoes may be brought forward by one month so that they have grown to a certain extent before the disease begins to cause damage.

7) Necessity of the control of small animals such as mice, birds, etc.

The damage caused by animals is large because of their sizes. In

Tarai, mice and Suga (a parakeet species) cause a large damage. Though cyanic acid gas and traps may be used for mice, they may be effective only temporarily; systematic control is therefore necessary. The use of nets and traps may be considered for birds; protection by scaring birds is found to be most effective. However, unless it is carried out systematically, animal control is not very effective.

8) Weeding

Weeding serves not only for the growth of crops but also for the prevention of pests. Weeds often provides a hotbed for pests; they survive in the weeds even after harvesting. Accordingly, weeding of the field eliminates the hotbed for pests and is, therefore, absolutely necessary.

5. Cropping pattern

Main crops in Chitwan are maize (52%), rice (49%) and oil seeds (35%). The arable land utilization ratio is low at 150%. These ratios are similar to those of Shindhuli. (See Table) The current pattern of planting is as shown below.

Areas of good irrigation: paddy -- paddy
Areas of fair irrigation: paddy -- wheat; tori
Areas of poor irrigation: milst -- tori, wheat, maize

These patterns are found to be most stable in Chitwan. However, some improvement is desirable as 1) production is low; 2) possible problem in field management, e.g., continous cropping; specially nutrision for maize; and 3) necessity of utilizing the merits of location.

The basic cropping pattern will be paddy where there is good irrigation and upland crops such as upland rice, wheat, corns where irrigation is poor. Cultivation of oil seeds also should not be ignored as it provides an important source of energy for national life.

1. Maize - (radish) - wheat
(Pattern of cultivating vegetables in addition to the main crops of maize and wheat.)

1) Aimed at shipment for the Dasai Festival.

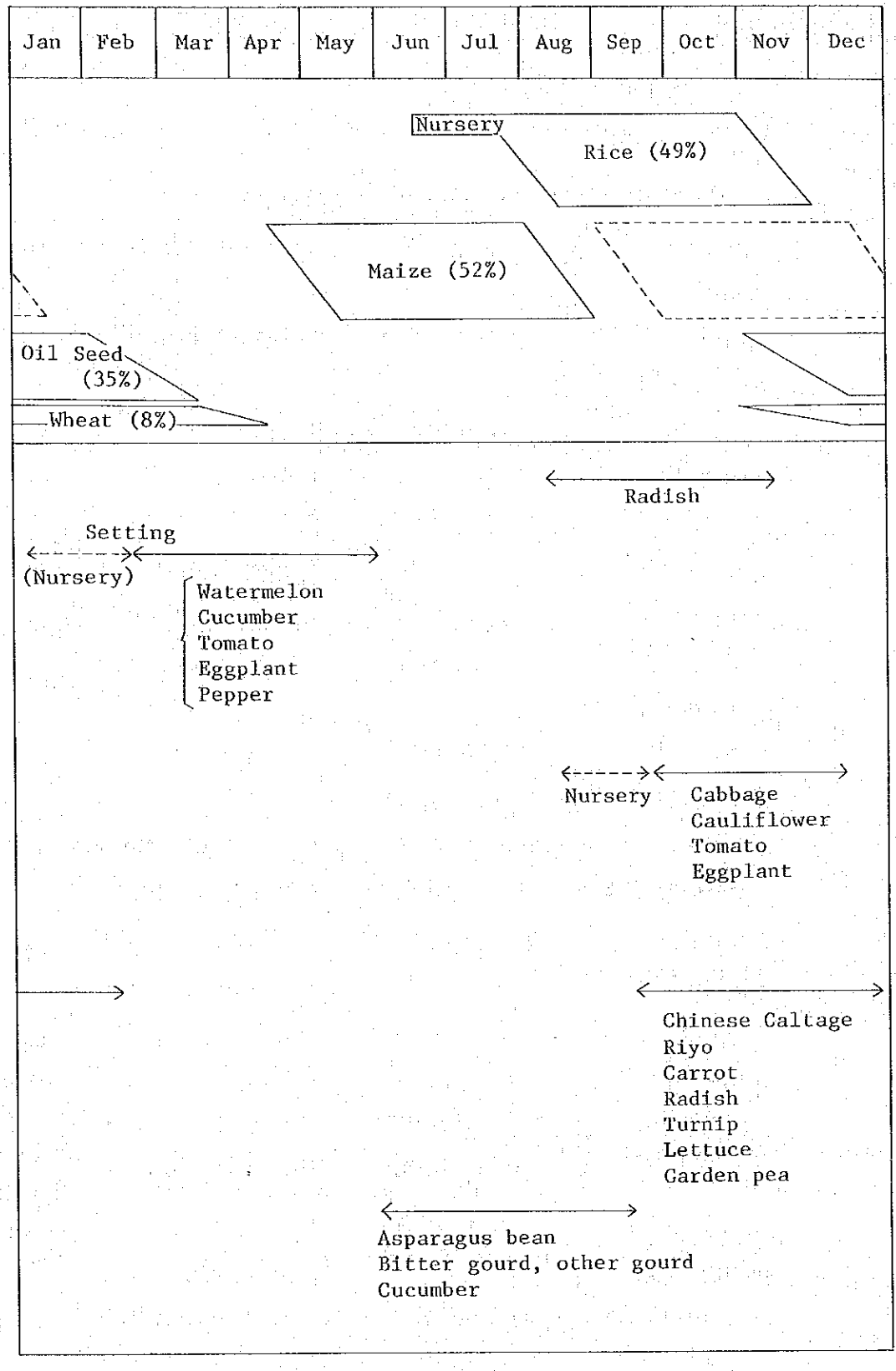
2) High ridges and mulchi are to be used as sowing falls in the rainy season.

Table 13 Comparison of Agriculture between Chitwan and Shinduli

	Cultivated Area	Culture Land	Ratio of Cultivation
Chitwan	249,000 ha.	48,000 ha.	150.2 %
Shinduli	259,000 ha.	14,000 ha.	154.9 %

Crop	Cultivation Area	Cultivation Area/ Culture land (%)	Yield (M/T)
Paddy (Chitwan)	23,500	48.95	49,350
(Shinduli)	6,000	42.86	14,400
Maize (C)	25,200	52.50	51,660
(S)	7,350	52.50	12,863
Wheat (C)	3,800	7.91	2,964
(S)	1,750	12.50	1,540
Millet(C)	1,100	2.29	1,182
(S)	1,670	11.93	1,837
Barley(C)	110	0.23	4
(S)	55	0.39	49
Potato(C)	850	1.77	4,590
(S)	600	4.29	3,600
Oilseed (C)	17,000	35.42	9,864
(S)	4,100	29.29	2,747
Sugarcane (C)	350	0.73	4,550
(S)	85	0.61	1,148
Jute (C)	25	0.05	16
(S)	30	0.21	20
Tabacco(C)	155	0.32	108
(S)	55	0.39	38

Fig. 13 Cultivation Pattern in Chitwan



	1st.	2nd.	3rd.
Crops	Maize	Radish	Wheat
Variety	Khumaltar Yellow	Mino Wase	RR-21
Cultivation period	Beginning of Apr.	Middle of Aug.	End of Nov.
(Sowing to harvesting)	Beginning of Aug.	End of Oct.	End of Mar.

2. Maize - (Radish) - Tori

(Pattern of adding the cultivation of radish between maize and tori.)

1) Aimed at shipment for the Dhasai Festival.

2) High ridges and mulch are to be sued as sowing falls in the rainy season.

3) Cultivation is to be carried out on high ground (rather dry area).

	1st.	2nd	3rd
Crops	Maize	Radish	Tori
Variety	Khumaltar Yellow	Mino Wase	Local
Cultivation period	Beginning of Apr.	Middle of Aug.	End of Nov.
(Sowing to harvesting)	Beginning of Aug.	End of Oct.	End of Feb.

3. Maize - Radish - Cole

(Pattern of mainly winter crops)

1) Radish is to be shipped for the Dasai Festival.

2) As for coles, raising of seedlings is to be carried out with sowing in August and planting at the end of October.

3) Cole crops are to be cabbage and cauliflower (lettuce is acceptable).

	1st	2nd	3rd
Crops	Maize	Radish	Cabbage
Variety	Khumalter Yellow	Mino wase	Succession
Cultivation Period	Beginning of Apr.	Middle of Aug.	Beginning of Aug.(Sowing) End (Nursery) of Oct.(Setting)
(Sowing to harvesting)	Beginning of Aug.	End of Oct.	End of Dec.

4. Maize - Soy bean - Tori

(Maintenance of soil fertility and the extension of pulse crops)

1) Sowing of soy beans is to be completed by July; if delayed the intrarow space is to be reduced to increase the yield.

2) Cultivation of maize is to be completed early so that sowing of soy beans can be carried out early.

	1st	2nd	3rd
Crops	Maize	Soy bean	Tori
Variety	Khumaltar Yellow	Hardy	Local
Cultivation period	End of Mar.	Middle of Jul.	Middle of Nov.
(Sowing to harvesting)	Middle of Jul.	Beginning of Nov.	End of Feb.

5. Asparagus bean - Paddy - Wheat

(Pattern of cultivating asparagus bean (cash crop) before the double cropping of rice)

1) Cultivation of asparagus bean is to be adopted in areas where double cropping of paddy rice is not possible.

2) As sowing of asparagus bean falls in the high temperature period, attention is to be paid to irrigation.

	1st	2nd	3rd
Crops	Asparagus bean	paddy	wheat
Variety	Kuro Sanjaku	PP-1	RR-21
Cultivation period	End of Apr.	End of Jun.(Sowing) End of Jul.(Trans-planting)	Middle of Nov.
(Sowing to harvesting)	Beginning of Jul.	End of Oct.	End of Mar.

6. Tori - Water Melon (squash) - Paddy

(Pattern of adopting the cultivation of water melon and pumpkin (cash crop) as off-season cropping of the paddy)

1) In the case of water melon, raising of seedlings is to be carried out with sowing at the end of December and planting at the end of January.

2) In the case of direct sowing, it is to be carried out at the end of January and the use of netting is desirable.

	1st	2nd	3rd
Crops	Paddy	Tori	Watermelon
Variety	PP-1	Local	Shin-yamato
Cultivation period	End of Jun.(Sowing) End of Jul.(Trans-planting)	Middle of Nov.	End of Dec.(Sowing) End of Jan.(Nursery) (Setting)
(Sowing to harvesting)	End of Oct.	Middle of Jan.	End of Apr.

7. Paddy - Wheat - Gram (Green)

(Adoption of the cultivation of pulse crops to maintain soil fertility)

1) Cultivation of green gram after wheat to be ploughed back as green manure.

	1st	2nd	3rd
Crops	Paddy	Wheat	Green Gram
Variety	PP-1	RR-21	Local
Cultivation period	End of Jun.(Sowing) End of Jul.(Trans-planting)	Middle of Nov.	Beginning of Apr.
(Sowing to harvesting)	End of Oct.	End of Mar.	Beginning of Jul.

8. Millet - Fruit vegetable - Maize

	1st	2nd	3rd
Crops	Millet	Fruits Vegetable	Maize
Variety	Local	Eggplant,Tomato etc.	Khumaltar Yellow
Cultivation period	Middle of Jul. Beginning of Aug.	End of Dec.(Sowing) End of Feb.(Nursery) (Setting)	Middle of Apr.
(Sowing to harvesting)	Beginning of Dec.	Beginning of Apr.	Beginning of Aug.

9. Maize - Tori - Squash

	1st	2nd	3rd
Crops	Maize	Tori	Squash
Variety	Khumaltar Yellow	Local	Tetsukabuto
Cultivation period	End of Apr. Middle of Aug.	Middle of Oct. End of Dec.	End of Jan. End of Apr.

10. Potato - squash - Maize

	1st	2nd	3rd
Crops	Potato	Squash	Maize
Variety	Local	Tetsukabuto	Khumaltar Yellow
Cultivation Period	Middle of Oct.	End of Jan.	End of Apr.
	Beginning of Jan.	End of Apr.	Middle of Aug.

6. Guidance on seasonable cultivation of vegetables and forcing cultivation

An important factor in vegetable cultivation is the problem of market. A pattern of cultivation was formulated by taking account of various conditions in Chitwan and trial cultivation was conducted in the field. The objectives were to be:

a) Cultivation aimed at shipment for the Dasai Festival.
b) Cultivation aimed at shipment to large cities for Christmas and the New Year.
c) Forcing cultivation and shipment of fruit vegetables during the high temperature period (March - April).

1) Cultivation and shipment for the Dasai Festival

The Dasai Festival, the largest one in Nepal, produces the largest consumption and no price fall is expected under the present conditions. Prices are in fact high at this time and there is no problem in selling the products. Shipment objectives are to be selfsupport and elementary and junior high school bazaars.

(1) Purposed vegetable: radish
(2) Points in cultivation
    a) Sowing is to be completed by the end of August.
    b) High ridges and mulch are to be used as sowing falls in the rainy season. Attention is also to be paid to disinfection, etc.
    c) In selecting the variety, attention is to be paid to the heat and disease resisting qualities. Good results were obtained from the Mino wase variety (early variety).

2) Cultivation and shipment to large cities for Christmas and the New Year

Only Katmandu may be classified as a large city where consumption

increases drastically in December and January due to a large number of tourists from overseas. Chitwan may serve as the supply base of vegetables for Katmandu. In view of the nature of the demand, those varieties which can make full use of the frost-free condition and high-grade varieties for hotels may be selected for cultivation.

1) Purposed Vegetable:
   a) Lettuce
   b) Cabbage
   c) Cauliflower
   d) Tomato
   e) Strawberry

2) Seedlings are to be raised from about September so that they may be planted immediately after the rainy season.

3) Forcing cultivation and shipment of fruit vegetables during the high temperature period

As it is the most favorable season for the cultivation of vegetables, the objective is to be forcing cultivation of fruit vegetables. Cultivation in the vicinity of Kathmandu and in Tarai begins around March when the temperature begins to rise. In Chitwan, however, sowing may be carried out in January as forcing cultivation is possible with the use of tunnel and mulch. Harvesting may be brought forward by one month if the techniques of raising seedlings described below are employed.

1) Merits of forcing cultivation
   a) As it is possible to ship fruit vegetables including water melon before the shipment of mango, etc., it will not involve concurrence.
   b) Damage by hails may be kept at a minimum.
      (Hailing normally occurs from the end of April into May; harvesting can be completed before then.)
   c) Prevention of damage by pest
      Damage by pest begins to occur from the end of February. However, as it does not occur so often from January into February, raising of seedlings and planting during this period provide large merits for later growth.
   d) Early shipment of fruit vegetables to hilly area areas including Katmandu.

2) Purposed vegetable:

a) Water melon
b) Tomato
c) Sweet pepper

3) Points in cultivation techniques:

a) Sowing from the end of December into January.
b) Seedlings are to be raised and they are to be kept in rather warm places.
c) In the case of direct sowing, it is to be carried out around the end of January with tunnel, hot cap, etc. provided.
d) Setting is to be carried out around the end of February with attention paid to the possibility of irrigation.

7. Cultivation trial of new crops and varieties.

The farm carried out cultivation trial and seed production to adopt crops and varieties suitable for Nepal. Seed production was carried out with the e emphasis placed on the points below as breeding takes time under the present condition.

1) Pure liline selection and suitable variety selection of local varieties.

2) Variety trial and seed production of varieties to be adopted.

As a result, the farm was able to present the crops, varieties and cultivation periods as listed below.

Table 14 Main crop cultivation in Rapti Model Farm

Name of Crop	Name of Variety	Sowing	Setting	Harvesting
Eggplant	Sendai-naga	Jan--Feb	Mar	Apr -----
	Australia Champion	Aug--Sep	Oct	Nov -----
	Local (Bilganji)	"	"	"
Tomato	Mangrobe	"	"	"
	Pusa rubi	"	"	"
	Local	"	"	"
Peppar	California wonder	"	"	"
	Elephant trunk	"	"	"
	Local	"	"	"
Cucumber	Yameto sanjaku	Feb--	Mar	Apr -----
	Suyo	June	July	Aug -----
Watermelon	Shin Yamato	Jan	Feb	Apr -----
	Asahi Yamato	"	"	"
Bitter gourd	Local	May--Jul		Jun -----
Other gourd (sponge, snake, etc.)	Local	"		Jul -----
Okra	Pusa saune	Mar--Apr		May
Sweet potato	Local	May--Jun		Nov -----
Potato	Local (Daman)	Oct--Nov		Jan -----
Taro	Local	May--Jun		Nov -----
Radish	Mino-wase	July-Nov		Sep -----
		Jan--Feb		Mar -----
	Ookura	Sep--Nov		Oct -----
	Local	"		"
	Tokinashi	Oct--Jan		Jan -----
Turnip	Shogoin	Sep--Nov		Oct -----
Garrot	Kuroda 5 inchs	Sep--Nov		Jan -----
Cabbage	Succession	Aug	Sep--Oct	Dec -----
	Pride of India	"	"	"
	Dram head	"	"	Jan -----
Cauliflower	Snow ball A	Aug	Sep--Oct	Dec -----
	Nozaki-wase	"	"	Nov -----
	Local	"	"	Jan -----
Chinese cabbage	Salad hakusai	Sep--Oct		Dec -----
Rayo	Local	Aug--Sep	Sep--Oct	Oct -----
Other green vegetables		"	"	"

Name of Crop	Name of Variety	Sowing	Setting	Harvesting
Kohlrabi	White vienna	Aug--Sep	Oct	Nov -----
Lettuce	Great lake	Sep--Nov	(Oct--Jan)	Dec -----
Garden pea	Alask	Oct--Nov		Jan ----- (Apr -----)
	France	"		"
Asparagus bean	Kuro sanjaku	May--Aug		Aug -----
Green gram	PusaPusa baisakhi	Apr--		Jun -----
Arhar	Local	May--Jun		Jan -----
Soybean	Hardy	Jan--Jul		Oct -----
Peanut	Local	Jun--Jul		Oct -----
Millet	Local	Aug--Sep	Sep--Oct	Dec -----
Tori	Local	Oct--Nov		Jan -----
Maize	Khumal tar yellow	May		Aug
		Sep		Dec
Wheat	RR-21	Nov--Dec		Mar -----
Rice	Masuli etc.	June	Jul-Aug	Nov -----

8. Fertilizer tests and guidance on the use of manure

The ratio of chemical fertilizer used by farmers was by no means small; but it is more readily available recently under foreign aid programs etc. Ordinary farmers have thus begun to use fertilizer. Though the ratio of fertilizer used by farmers is determined by their economic power, the demand is expected to increase in the future.

The farm carried out fertilizer tests on each crop and set the recommended rate of fertilizer application for the area concerned. Further, in order to encourage the preparation and use of manure, a model case was prepared and guidance was given to the staff and farmers by means of demonstration, etc. As for the preparation of manure, please refer to the Attached.

IV. Reflection

1. The idea of raising seedling centers in hilly area

As the method of hilly area agricultural extension the establishment of a seedling center is proposed. Extension work in hilly area with poor transport facilities is labor-consuming and suffers from inefficiency. Accordingly, seedling centers may be established at key points of transportation so that good seedlings may be raised and distributed to farmers. This method will be effective as a means of extension as the number of farmers wanting to purchase seedlings is increasing every year in Sindhuli farm.

As regards the sale of seedlings, as there is considerable demand not only in hilly areas but also in flat areas such as the vicinity of the Rapti Farm, it will be a promising method of extension. In mountain areas the number of c centers should be large, though they can be of a small scale. They can be economical rather than grand facilities; but attention should be paid to their locations.

It is also effective to train enthusiastic and adroit local farmers so that they may form the core of the seedling center. In view of the fact that when the JOCV members carried out the raising of seedlings at several farmers in Chapauri Village, there was much demand for surplus seedlings, distribution of seedlings is to be recommended.

It is also necessary for the seedling centers to provide information service. Transmission of information by radio seems to be extremely effective. The radio provides the only nation-wide network of information in Nepal and is also the only means of entertainment. The use of radio for extension work is therefore expected to be effective. It is also conceivable that JADP provides its own network of information and agricultural extension service by means of wire broadcasting connecting each sub-center and ADO.

2. Extension method combining techniques and the distribution of seeds and seedlings

Extension of agricultural techniques is one of the important activities of JADP, providing training for the extension staff, demonstrations at the model farm and the distribution of data. However, these activities are of a general nature and not of a concrete and practical nature for farmers. Accordingly, an extension method of combining techniques to be disseminated and the necessary materials was devised. The basic concept is that JADP coordinates the activities of existing organizations and institutions. In other words, JADP provides

assistance to the extension organizations including ADO, AIC and experimental stations in the form of facilities and materials through the actual medium of "seeds" so that the flow of contact from the experimental station down to the farm may be coordinated smoothly. When a new variety is to be introduced to the farmer, therefore, the seeds, techniques (actual method of cultivation) and materials are all to be introduced at the same time.

1) A committee for the extension of seeds is to be set up within the JADP Center to discuss crops and varieties to be extended.

   i) ADO: to ascertain the condition of agricultural management by detecting problems involving farmers and areas.

   ii) AIC: to ascertain the needs and insufficient supplies of materials for farmers and areas.

   iii) JADP farm: to carry out the collection and stocking of seeds and basic cultivation tests and is to be avaiable for communication from the National or international agencies.

2) At the committee's conference, ADO is to present data on crops and varieties wanted by farmers, AIC on the quantity of seeds and materials and JADP farm on cultivation and prospects of new varieties and crops to select the varieties to be adopted.

3) After the selection of crops and varieties, the JADP farm is to secure and purify the stock seeds and determine the actual cultivation method (standard of field husbandry) suitable for the area concerned.

4) Further, the committee is to determine the cultivation area, quantity of seeds and the amount of materials and issue directives to the related bodies.

   i) AIC: preparation of packed fertilizer, insecticide, materials, etc.

   ii) ADO: a) to determine the basic line as to the joint use of materials;
   b) to initiate the distribution of extension material after discussing the technical training of extension staff and the method of extension

   iii) JADP: a) production of selected seeds at the JADP farm and by designated farmers;

b) seeds for distribution are to be sorted and kept at storing facilities.

c) technical training of extension staff is to be provided at centers and the farm for projected crops.

d) literature and teaching material giving data and cultivation methods are to be prepared and printed.

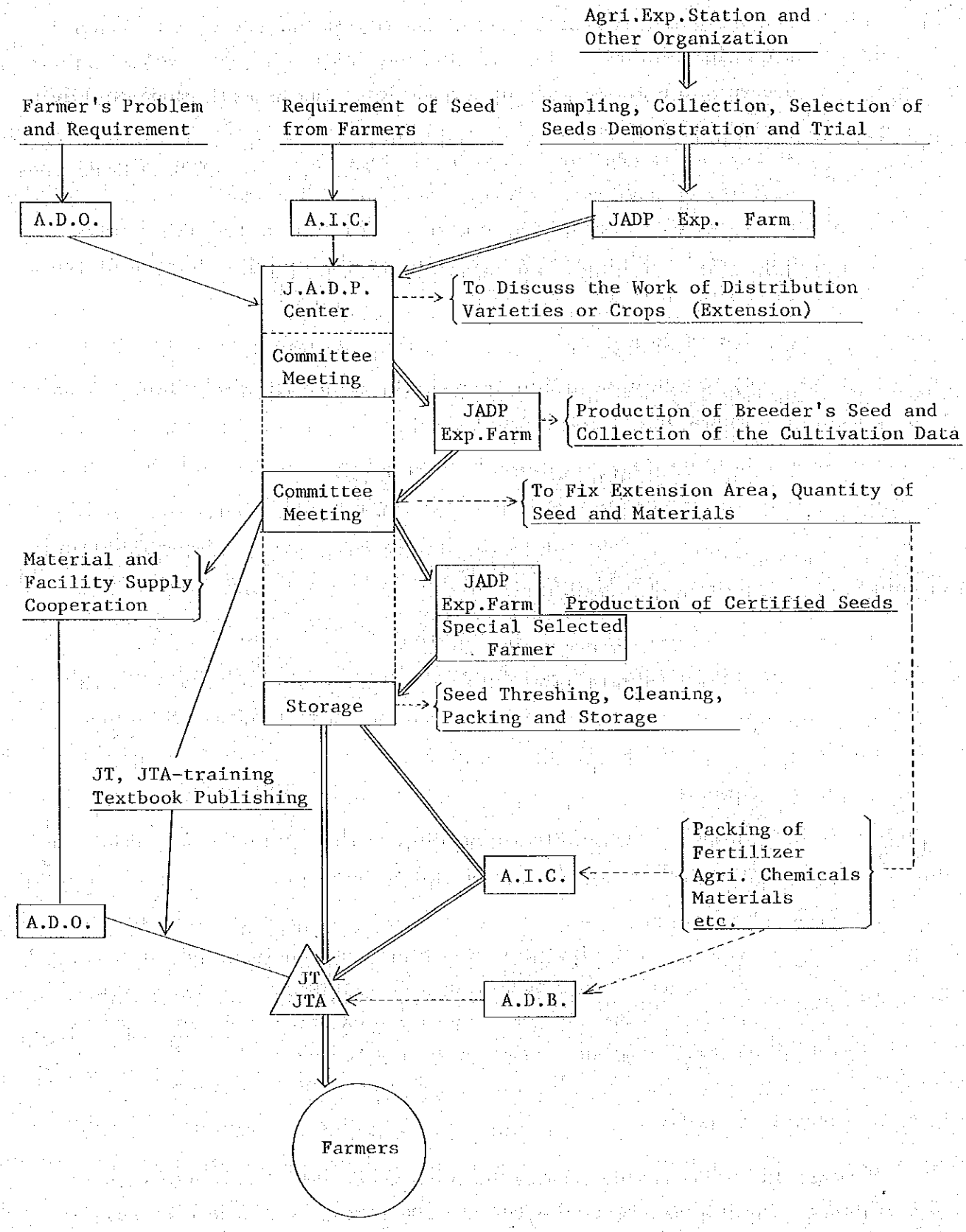
5) Guidance by extension staff

i) Extension staff are to distribute sets of seeds, fertilizer, materials, etc. to the farmers of predetermined areas and provide guidance with teaching material, etc.

ii) Extension staff are to provide guidance in accordance with a pre-determined schedule on mid-cultivation control such as additional fertilization, disinfection, etc.

iii) Extension staff are to receive training in advance at the JADP center as to cultivation methods, etc.

Fig. 14 The Idea of Seed Distribution with Technique in J.A.D.P.



3. Development of agricultural industry:

1) Development of processing (secondary products)

Development of domestic industries is the best way to the economic development of this country. However, in the country where agriculture accounts for 90% of the total population and mineral resources are scarce the development of agriculture determines the country's economy. As regards agriculture, therefore, while those of a good storage capacity do not cause concern, those of a poor storage capacity should be processed to expand their market. As processing will require manpower, it will provide a relief for the unemployed and additional income for farmers.

1) Jam factory

i) Production of jam is possible by the household industry on a small scale.

ii) Materials are easy to obtain.

a) Orange: Prospects are good as hilly area produce many varieties such as suntara and junar. However, as they are not sufficient in quantities for factory production, it is necessary to develop mass production area.

b) Strawberry: Though it is a new crop for Nepal, as the terrain varies a great deal in elevation, year-round cultivation is possible and is promissing as an industry.

c) Mango and other fruits.

2) Cannery

Canning of pineapple is in operation on a small scale and it is necessary to develop fields for expansion.

3) Pickles

Production of pickles is to be projected mainly for tourist hotels and export. Achar (Nepanese pickles) is made in every home and cannot be considered for factory production. As for materials, cucumber, radish, mango, etc. may be used.

4. Exports of seeds:

Nepal is a mountaneous country featured by drastic fluctuations in elevation; the drop may be from 8,000m to 100m within a distance of several

hundred kilometers. This mountain terrain has many disadvantages for cultivation and shipment of fresh fruits and vegetables in terms of transportation; but there are also advantages for seed production.

1) Difference in temperature within a short distance;
2) Isolated cultivation is possible.

Seeds as commodities involve small quantities but relatively high prices; they have the advantage of simple shipment. On the other hand, production of good seeds require breeding and production techniques. Accordingly, adoption of these techniques is closely related to the development of the industry. As for the method, phased development may be envisaged.

i) 1st phase: Exportation of the seeds of crops suitable for low temperatures and are relatively easy for production.
Purposed crops: cabbage, cauliflower, radish, carrot, potato, etc.
Importing countries: Bangladesh, India, Burma, Thai and other Southeast Asian countries.

ii) 2nd phase: As regards those of a technically advanced nature, seed production of those requiring manpower is to be transferred to another country where labor cost is high; production of those experiencing difficulties due to the rainy season is also to be transferred to another place.
Purposed crops: pimento, tomato, eggplant, water melon, lettuce, etc.
Importing countries: Japan, Malaysia, South Korea, Taiwan.

5. Improvement in diet (guidance on living):

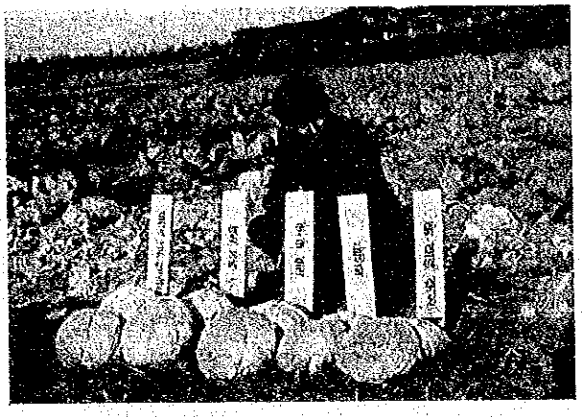
Improvement in diet is intended to enhance the health of farmers and is to be given in accordance with the local conditions (including the religious factor).

Improvement in diet leads to an increase in the consumption of the individual; increase in domestic consumption leads to an increase in demand and finally to the expansion of supplies and production.

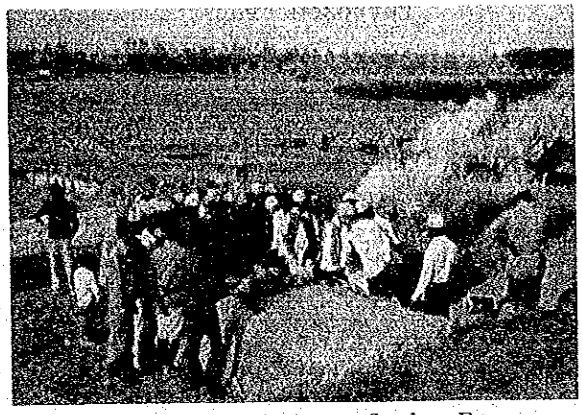
This guidance is to form a part of diversified extension activities which include the solution of problems facing farmers as well as technical guidance on agriculture. Guidance on the improvement in diet may also require female leaders in order that farmers may become aware of the problem.

The view of the field at Rapti Model Farm located

Raoti Model Farm main office building

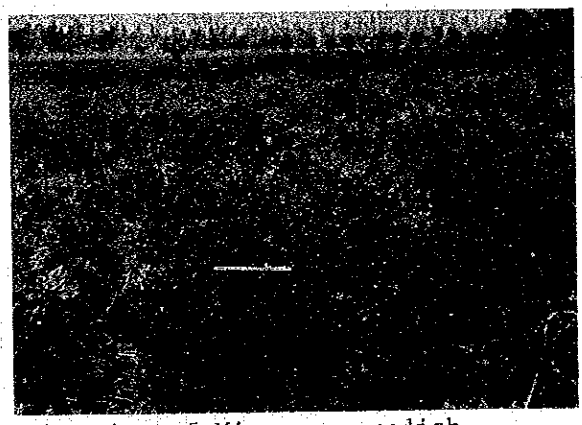


Variety test of cabbages
(Variety from right, K-Y cross, Yoshin, K-K cross, Dram head, Pride India)

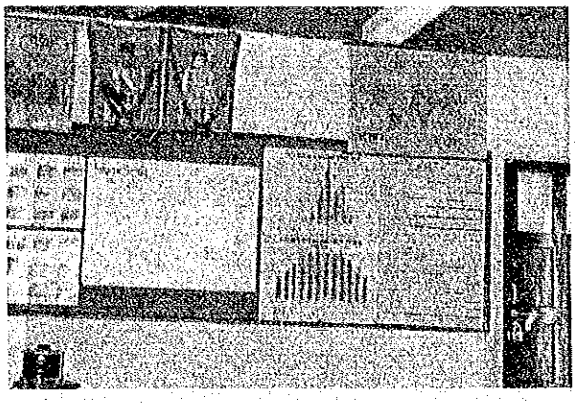


Extension activities of the Farm
Explanation of Nursery management of the crops to the farmers (guidance)

Field preparation by hand-tractor in the farm



The view of Mino-wase radish (recomended variety) seed production in the farm

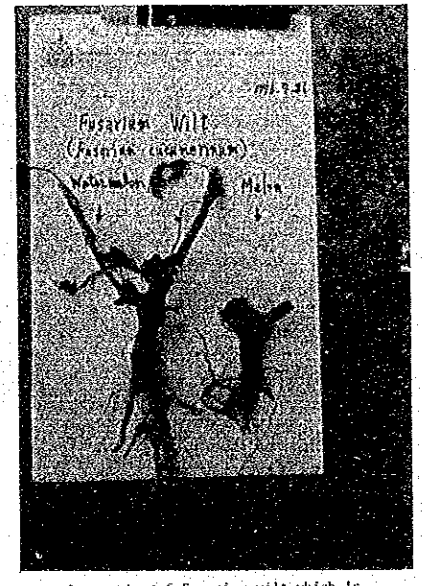


Farm products

Harvested excellent radish (Minowase) in the farm

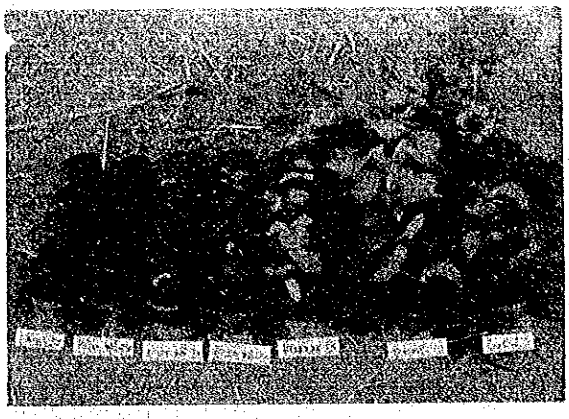
Straw berry cultivation trial in the farm(Taraf) The fruits were setted on January. It will become useful acltivation in this area.

Study of pest and disease



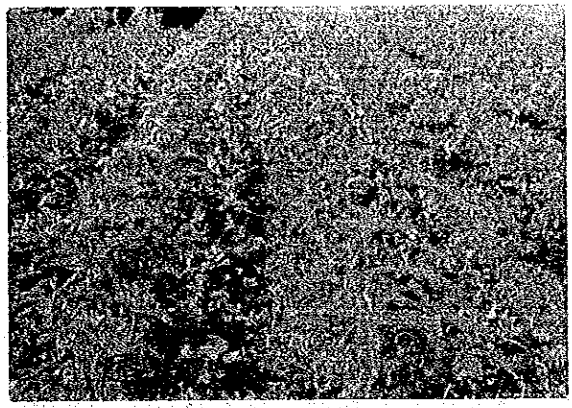
Inspection of Fusarium wilt which is the most common soil borne disease

Inspection of insect; After sumpling the larva damaged on eggplant, the larva is grown in the room to adult (Moth)

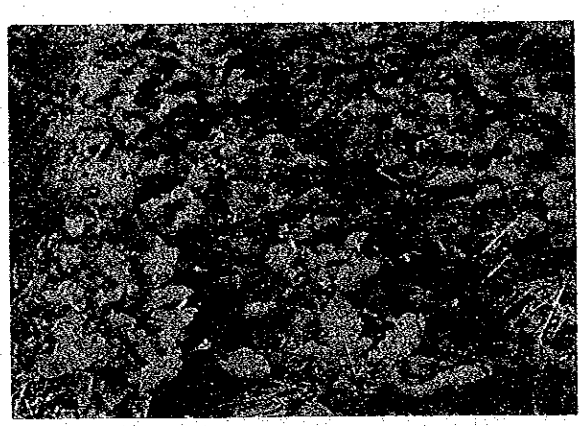


Fertilizer trial
Kisan-mal effectivity test for vegetable seedlings

Dry season culture To know the most useful rowing position in dry season. The seeds were sown in each position lidging the row east to west.

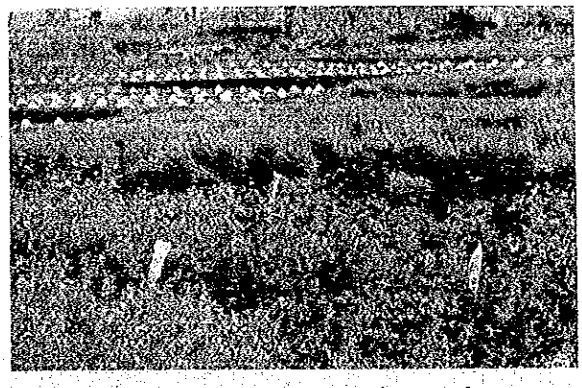


Multi-crop
Sunhemp and Dhaincha were sown in June.



Rainy season culture
Teavey rain damage is protected by using straw mulch and high lidge row is prepared for good drainage.

The net cap is introduced to the cucurbit field, it is effective way to protect the cucumber leaf beetle damage in seedling stage.



Coriander and Fenu greek seed production field.

ANNEX I

RAPTI MODEL FARM

YAGYAPURI, CHITAWAN

FINAL

PROGRESS REVIEW

PERIOD

2029-030 (1972-73)--2034-035 (1977-78)

PRESENTED BY

A.N. YADAV

FARM INCHARGE

SUBMITTED ON

2035-3-31 i.e. JULY 14, 1978

RAPTI MODEL FARM

YAGYAPURI, CHITAWAN

FINAL PROGRESS REPORT

INTRODUCTION:

Rapti Model Farm was established on January 1, 1966 under the name of Rapti Agricultural Experiment and Model Farm of Tokyo University of Agriculture, Japan. On August 17, 1972 it was handed over to HMG, Nepal and was renamed as Rapti Model Farm. By that time it was operated by the District Agriculture Development Office of HMG in this district. When Janakpur Zone Agriculture Development Project started it came under this project on November 19, 1972. Till November 6, 1974 it was working in preparatory phase under this project. On November 7, 1974 and agreement for 5 years was settled between HMG, Nepal and the Government of Japan. From that time this Farm was running in full sowing with its objective and activities under this project. In the month of Shrawan, 2035 i.e. August 1978 this farm was handed over to Horticulture farm, Yagyapuri (HMG, Nepal).

LOCATION OF THE FARM:

This Farm is located inside the fence of Horticulture Farm, Yagyapuri. Its altitude is 306-310M. from the Sea level. It is operating its activities in 5.83 hectares of land towards the south -west corner inside the fence. Total area of the Farm is 10.05 hectares. Out of which plain cultivable land is 5.83 hec., terrace land 1.45 hec. and buildings and residances in 2.77 hec. General soil condition of the surrounding area of the Farm is Sandy to Sandy-loam. pH of the soil ranges from 5.0-6.5. Textural classification of the soil of this district has been presented on page no.2 of the presenting paper.

WEATHER RECORD OF THE FARM:

The weather record of the Farm from 1973 to 1977 is attached herewith in Table No. 12, 13 and 14.

OBJECTIVE OF THE FARM:

Rapti Model Farm in Narayani Zone will contribute to the Agricultural Development Activities in the hilly area in Janakpur Zones.
(Record of discussion).

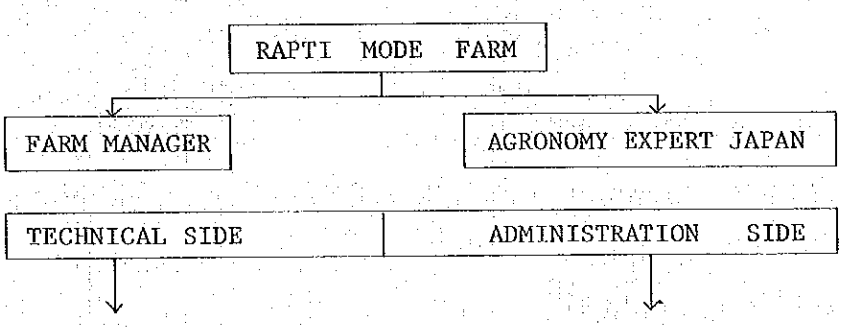
FUNCTIONS OF THE FARM:

(a) Introduction and demonstration of improved farming techniques of Paddy, Wheat and other upland crops;

(b) Multiplication and distribution of Improved seeds and seedlings of various crops for extension work;

(c) Extension of improved farming techniques in the vicinity of the Farm in cooperation with the A.D.O. of the District.

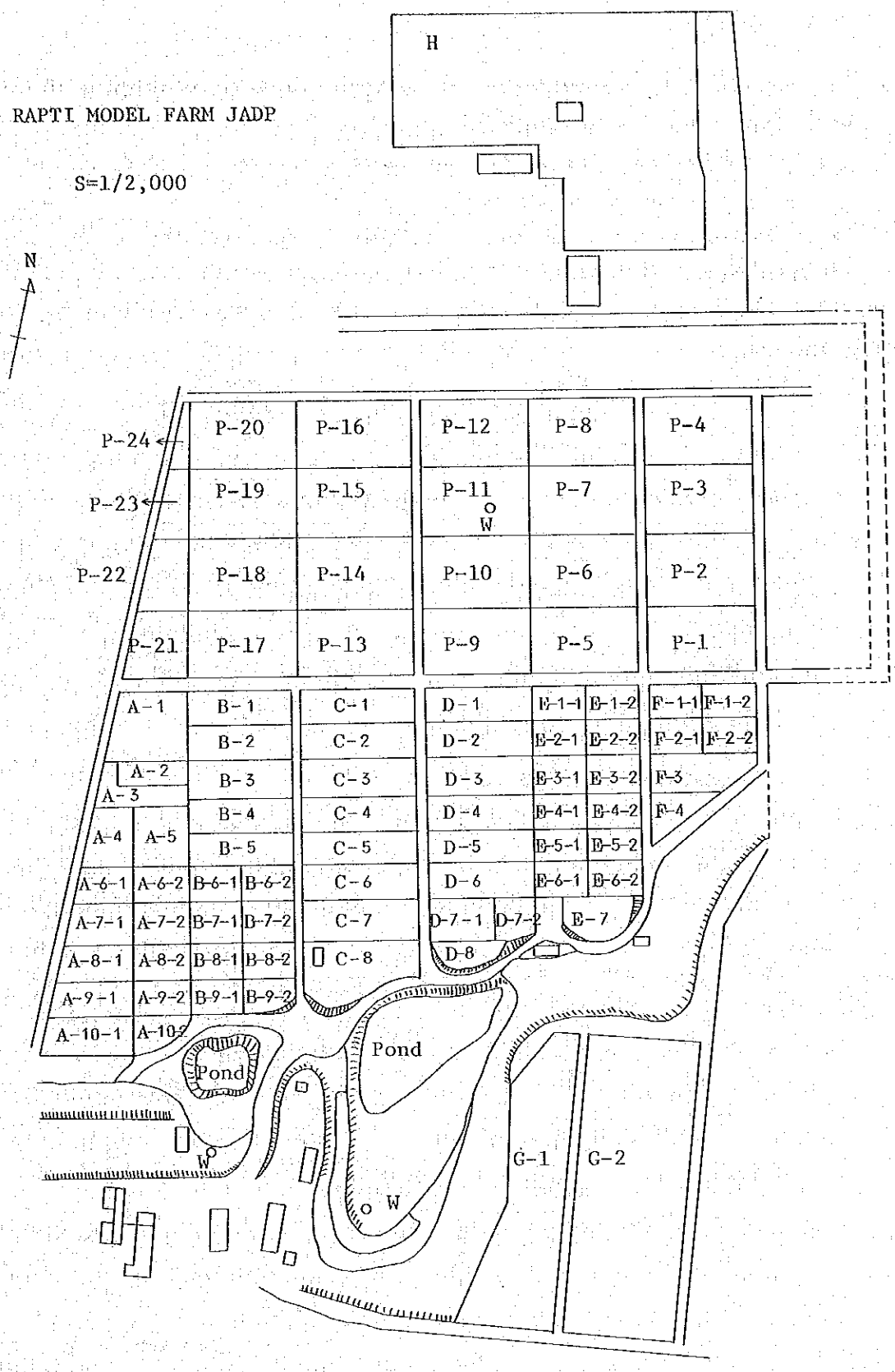
STAFF ORGANIZATION



J.T.A.	1	ACCOUNTANT (CASHIER)	--1
JOCV -- Vegetable	1	STORE KEEPER	--1
FIELD ASST.	1		
AGROMACHINE OPERATOR	1		
FIELD MAN	1		
DRIVER	1		
PEON (FIELD WORKS)	5		

RAPTI MODEL FARM JADP

S=1/2,000



Farm map with Irrigation System has been presented on page No.5 of the presenting paper

8. Farmers day 2 (number)

ACTIVITIES AND ACHIEVEMENTS AT RAPTI MODEL FARM

TABLE 1 — Fiscal year 2029 - 030 (1972-73)

S.No.	Projects	Production
1.	Wheat production	63 Muri 14 Pathi 2 Mana.
2.	Paddy production	27 Muri 10 Pathi 2 Mana.
3.	Fresh Radish production	1649 Mutha
4.	Fresh vegetable production	46.000 Kgs
5.	Hariyo Makai "	257 Jhutta
6.	Fresh Tomato "	300.700 Kgs.
7.	Fresh Sugarcane "	2,408.000 Kgs
8.	Ghnans "	12 Bhari

TABLE 2 — Fiscal year 2030 - 031 (1973-74)

S.No.	Projects	Production
1.	Fresh fruit and vegetable production	7,213.380 Kgs
2.	Cereal crops seed production	2,300.030 Kgs
3.	Vegetable seed "	4,646.300 Kgs
4.	Other crops "	3,272.000 Kgs
5.	Demonstrations	16 (number)
6.	Farmers' day	4 (number)

TABLE 3 — Fiscal year 2031 - 032 (1-74-75)

S.No.	Projects	Production
1.	Paddy seed production	2,850.000 Kgs
2.	Wheat " "	2,673.500 Kgs
3.	Maize " "	1,502.640 Kgs
4.	Other crops seed production	443.910 Kgs
5.	Vegetable " "	177.910 Kgs
6.	Fresh vegetable "	12,629.730 Kgs.
7.	Fruits vegetable seed production	8.260 Kgs
8.	Farmers day	2 (number)

ACTIVITIES AND ACHIEVEMENTS AT RAPTI MODEL FARM:

TABLE 4 — Fiscal year 2032 - 033 (1975-76)

S.No.	Projects	Production
1.	Paddy seed production	2,889.500 Kgs
2.	Wheat seed production	3,036.000 Kgs
3.	Maize seed production	1,298.800 Kgs
4.	Other crops seed production	1,398.800 Kgs
5.	Vegetable seed production	252.035 Kgs
6.	Fresh vegetable Production	15,023.925 Kgs
7.	Farmers's day	1

TABLE 5 — Fiscal Year 2033 - 034 (1976-77)

S.No.	Projects	Production
1.	Paddy seed production	3,049.000 Kgs
2.	Wheat seed production	3,581.830 Kgs
3.	Maize seed production	1,257.500 Kgs
4.	Other crops seed production	2,149.722 Kgs
5.	Vegetable seed production	532.148 Kgs
6.	Fresh vegetable production	10,818.905 Kgs
7.	Farmer's day	1

TABLE 6 — Fiscal Year 2034 - 035 (1977-78)

S.No.	Projects	Production
1.	Paddy seed production	2,280.330 Kgs
2.	Wheat seed production	6,334.550 Kgs
3.	Maize seed production	1,443.200 Kgs
4.	Pulses and Oilseed crops seed production	2,214.254 Kgs
5.	Vegetable seed production	927.139 Kgs
6.	Fresh vegetable production	32,837.619 Kgs
7.	Demonstrations	4
8.	Farmer's day	1
9.	Other crops seed production	915.100 Kgs

CROPPING PATTERN

About 25 kinds of vegetables were cultivated here for the purpose of seed production and commercial cultivation. Cereal crops like Paddy, Wheat and Maize and in Other crops Soybean, Tori, Cowpea, Ground nut, Arhar etc. were taken to have better rotation with vegetables to avoid the occurance of soil borne diseases and to maintain the soil fertility. About 2 hectares area of the farm was low land where Paddy was taken in rains and was utilized for vegetables cultivation during spring and summer. Among the vegetables being grown here were:-

Cole crops	(Cauliflower, Cabbage, Broccoli, Brussels sprout, Knolkhol)
Brassicas	(Radish, Turnip, Rayo, C.cabbage)
Cucurbits	(Cucumber, Sponge gourd, Bitter gourd, Squash, Pointed gourd, Watermelon)
Solanaceas	(Tomato, Eggplant, Pepper, Potato)

In others Carrots, Colocasia, Fenugreen, Cress, Spinach etc. were the main Production of most of the vegetables except cole crops.

In the upland area Vegetable was cultivated in rotation with Paddy, Wheat and Maize. The rotations developed at Rapti Model Farm were under study and are mentioned on page No. 7 & 8 of this report and on 9 & 10 of that of the presenting paper. Classification of blocks like A, B, C, D, E, F, G, H & P at the Farm and development of blockwise rotations found to be quite effective in controlling the soil borne diseases and nematodes. Likewise, the development of composting, manuring and farm cleaning plans were the another features to increase the productivity of the soil and to keep farm clean for better sanitation which is also one of the important measures in controlling the crops insects and diseases.

P - BLOCK

(A)	(B)
Paddy - Wheat - Moong	Paddy - Wheat - Watermelon
Paddy - Wheat - Tomato	Paddy - Wheat - Asparagus bean
Paddy - Wheat - Capsicum	Paddy - Tori - Watermelon

FIRST YEAR ROTATION:

Plot Nos.	Crops
P_1 - P_8	Radish seed production
P_9 - P_{12}	Tomato, Egg plant, capsicum (Other solanacea)
P_{13}- P_{16}	Watermelon (Other cucurbits)
P_{17}- P_{20}	Asparagus bean
P_{21}- P_{24}	Moong

SECOND YEAR ROTATION:

P_1 - P_4	Moong
P_5 - P_8	Watermelon (Other Cucurbits)
P_9 - P_{16}	Radish Seed production
P_{17}- P_{20}	Tomato, Egg plant, Capsicum (Other Solanacea)
P_{21}- P_{24}	Asparagus bean

THIRD YEAR ROTATION:

P_1 - P_4	Asparagus bean
P_5 - P_8	Moong
P_9 - P_{12}	Watermelon (Other Cucurbits)
P_{13}- P_{16}	Tomato, Egg plant, Capsicum (Other Solanacea)
P_{17}- P_{24}	Radish seed production

G AND H BLOCKS

(1) Maize - Radish - Wheat
(2) Maize - Radish - Tori
(3) Maize - Potato - Tori
(4) Maize - Potato - Wheat

CULTIVATION PATTERN

Highly intensive cultivation of vegetables and other crops was followed at Rapti Model Farm, Yagyapuri, Intensive land use and cropping scheme were the criteria of the farm activities. To maintain the soil fertility and to preserve the farm soil from being eroded during rainy season and also by strong wind and hurricane during summer season, steps were taken into account at the first place.

To check the soil erosion by rain and wind, in slopy land, cultivation of erosion checking crops (deep rooted crops) like Arhar (Cajanus cajan), Soybean (Glycine max), Clover, Alfalfa, Pineapple and others were done along the contour

of the slope leaving 1.0m. land fallow alternately. In rainy season as well as in summer season erosion of top soil by rain was very severe in cultivated plots. As the top soil is very important and valuable, attention was paid for its onservation. For this, after planting each vegetable crop before or during rainy season, grass or straw mulching was practised over the naked bed soil to cover it completely which checked the soil erosion by rain drops. It also holds the fine soil particles being washed away by the rain water and strong wind and also it checks weeds to come up. After the cultivation of the crop was over, the mulched grass or straw was ploughed in the soil if rotten which added the organic matter to the soil. Green manuré crops were also taken blockwise and schedulewise and were incorporated to improve the physical condition of the soil.

Because the farm was small and cultivation was intensive, occurance of soil borne diseases were quite natural. To overcome such problems we divided the farm area into different blocks like A, B, C, D, E, F, G, H and P blocks. And we were cultivating different families of vegetables blockwise and maintaining a nice rotation system to overcome the soil borne diseases. Besides vegetable cultivation and their seed production we were cultivating Cereal crops and Other crops also in rotation with vegetables which helped in overcoming such problems.

As the original soil of the farm was highly acidic in nature, continuous efforts were made to develop a neutral soil. Instead of applying a heavy dose of lime at a time, split doses were applied in the soil before the cultivation of each vegetable as the rest period of the land was very short. This way, there was no harmful affect of lime on the crops. The acidity at present was between 5.0 - 6.5 as compared to 4.5 - 5.0 of the initial soil.

Careful management of the crops was done against the harmful insects and diseases. Timely spray of insecticides and fungicides were done. For the control of their hazardous affect, preventive control measures were given much priority over the curative one.

SEED PRODUCTION ACTIVITIES AT THE FARM:

For the seed production, much efforts were made to make it free from insects, pests, diseases, off type plants and other crop seeds. In the seed production plot, roguing of off type plants and other technical management were practised under the direct supervision of the farm technicians.

For the seed production at commercial scale of highly cross pollinated vegetables at Rapti Model Farm like Radish and Turnip, Watermelon and other Cucurbits and also of Hot pepper, Capcioum and other Solanaceas were done under rigorous management by the farm technicians to avoid crossing with other

varieties. Particularly, in hot pepper and capsicum seed production, we cultivated only one in one season and the other in the next to avoid contamination completely. In Watermelon, we cultivated much earlier and practised artificial pollination early in the morning to avoid crossing with the varieties at Horticulture Farm, Yagyapuri. In order to get watermelon crop much early, we practised HUMIKOMI (preparing hot bed) as mentioned in page No.17 of this report for germinating the seeds in the extreme winter season. In Radish and Turnip, we practised rigorous selection of the roots based on the standard phenotypic characters of the variety after 35-40 days of seeding in the main season and transplant at another better plot after cutting the two-third roots of Radish and top of both without any injury to the crown. Whatever seeds we got that year, was kept a as our farm stock seed. Next year that seed was sown in line at 60 x 25cms spacing in the second to third week of Mansir and applied fertilizers in a half amount of that of the commercial crop. It was topdressed twice - one at 25-30 days of seeding and the second at pre blooming stage. We preffered compound fertilizers at basic application. This year we harvested a yield of 750 Kgs/hec. of Radish seed which was a very satisfactory yield.

MAJOR EMPHASIS ON COMPOST AND LIME APPLICATION IN THE FARM SOIL

As the soil of the Farm was acidic in nature, the growth of most of the vegetables was not satisfactory. Harmful affects of the acid soil can be listed as follows:-

1. Harmful affect of the acid itself.
2. Harmful affect of the al ion dissolved by neutral salts.
3. Harmful affect that causes deficiency of active lime in the soil.
4. Harmful affect by fixing the rate of Phosphoric acid through the increase of Hydrogen ion, thus causing deficiency of Phosphoric acid.

Acid soil intensifies its acid reaction during the wet season and slackens it during the dry season. Vegetables like Eggplant, Chilli pepper, Peas, Onion, Cabbage, Carrot, Spinach, Lettuce and Soybean have very less or lalmost no resistance against soil acidity. Main activity at Rapti Model Farm was Vegetables seed production and their cultivation. So, to accomplish the activities satisfactorily the farm soil was to be improved at the first place. In order to improve the acid soil of the farm, good rainage system and lime, wood ashes add abundant quantity of comoost application are the most important. For the lime application approximately 1,750 kgs of lime is necessary to improve the pH from 4.5 and 5.5 to 6.5 respectively. The above quantity of lime was being applied in two or three splitdocess in a year. Also Urea was given priority over the Ammonium sulfate in the fertilization schedule at the farm as the later has more acidic affect on such soil.

The content of humus in the fertile soil for vegetable cultivation should be upto 5%. In order to maintain this much level of humus in the soil, 15m. tons of compost per hectare per year is required. Taking these things into account the lime and compost were applied in the farm soil before every cropping i.e. twice or thrice in a year. At present here are four bullocks whose urine and dung were fully utilized for composting in a well designed compost cum bullockshed at the farm. Also, all the green wastes of the campus were fully utilized for compost making. The diseased vegetable plants were rogued and discarded at the concrete oven at the farm where they were burnt later on to avoid the disease pathogens to come to soil again through the compost media.

By adopting the above practices, the soil of this farm was much improved as compared to that of the surrounding areas. Care was taken in the application of compost to the soil. It was applied in the soil after making trenches of 30-45 cms deep in the plot by the ridger and then covered by soil. The