5.7 Seasonal Planting Tests

Purpose

The objective of this test is to determine the optimum sowing and transplantation date for both the main-season crop and the off-season crop to establish the most suitable pattern for double cropping for the project area.

Method

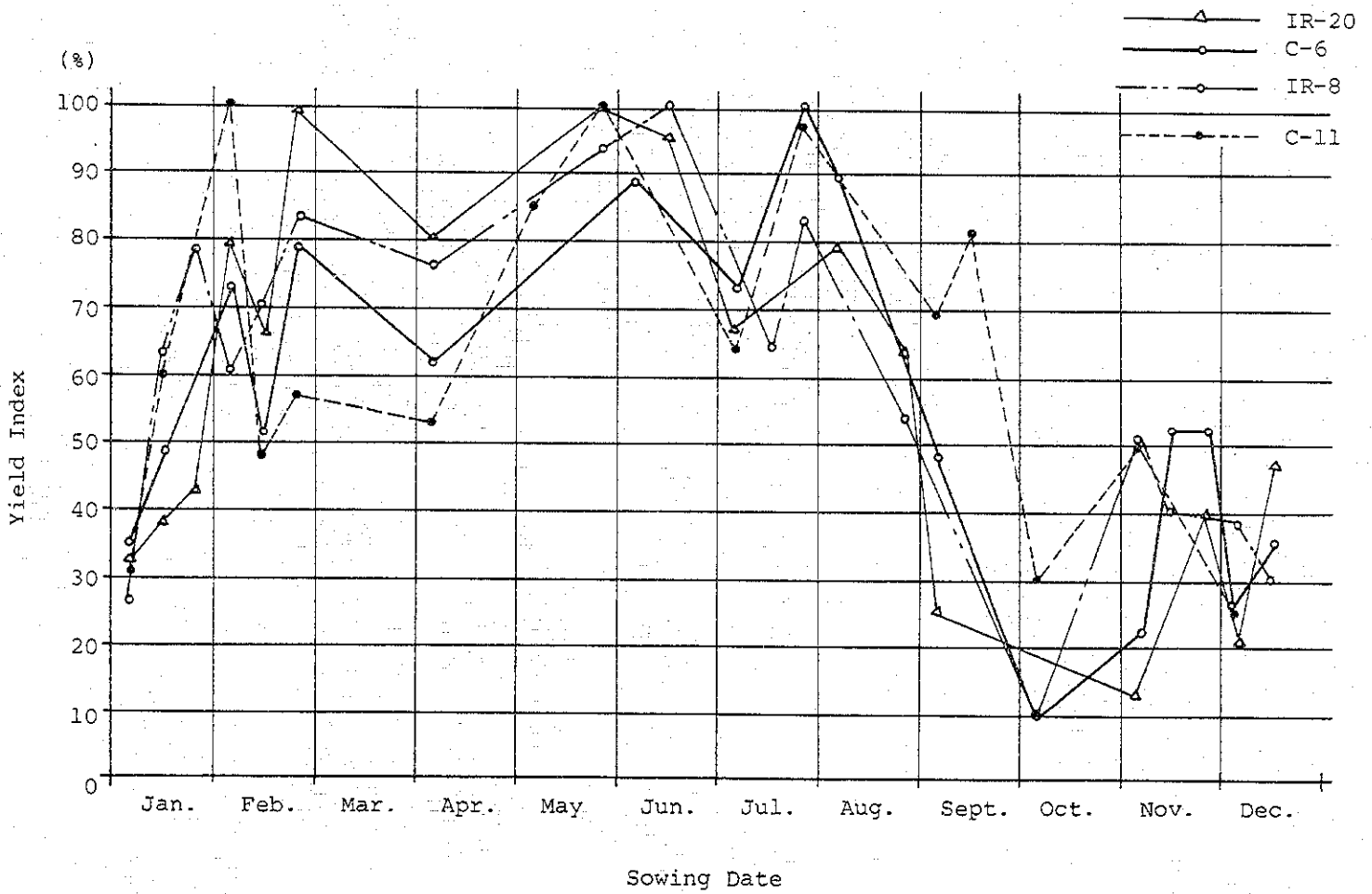
In the first testing, the 3 varieties - IR-8, C-6 as a long-term varieties, and IR-20 as a medium-term variety - were planted in the 1977 off-season. The fertilization and density of transplantation were the same as those in the variety test in the 1977 off-season. Sowing was carried out at half monthly intervals starting in November.

After the first trial of seasonal planting tests, a regular and precise seasonal planting test was started in June, 1978. In this test the following 4 varieties were sown every month all the year round from June to November; Chen-Chu-Ai (C-11) (Short-term variety), IR-20 (medium-term variety), IR-8 (long-term variety), C-6 (long-term variety). From November to February, sowing was conducted every 10 days with an additional variety, TOS-103. The area of each plot was to be at least 13 square meters. The experiment was carried out with two replications. Fertilization, planting density and the investigation items were the same as those for the variety test carried out in 1978.

Results

The overall results of the test are given in ANNEX 7, which contains several additional results of the variety tests. Yields were averaged for sowings within each 10-day period, then the average yields were converted into indexed yields taking the maximum yield of each variety as 100. The yield index of each variety was plotted against the 10-day sowing dates, as shown in Fig. 5.7-1. Fig. 5.7-1 shows a large seasonal change in yield for each variety.

Fig. 5.7-1 Relation between Sowing Dates and Yield Indexes



Generally and roughly speaking, however, it is quite evident that the rice plants sown during the period from early October to late January produce relatively low yields, while those sown in the period from early February to late August produce relatively high yields. The reason why the plants sown from early October to late January produce poor yields can surely be ascribed to the fact that these plants were seriously damaged by low temperatures during December and January when the monthly minimum temperatures were 17.7 and 15.8°C, respectively. In view of this, it may be suggested that the suitable sowing period in the project area appears to be a period from early February to late August. However, there are two minima in the indexed yield during this suitable sowing period, i.e. in mid - February and early or mid - July. Though it has not been ascertained whether the two minima are significant or not. The two minima may be ascribed to the high temperatures at the heading stage or at the active ripening stage, which will be mentioned later, because when rice plants are sown in the mid - February and early or mid - July, the heading dates occur in May and October in most cases, and the average air temperature during the 20 days after heading is highest in May and second-highest in October, as shown in Fig. 5.7-2. Thus, the suitable sowing time may be taken as the period from late February to late August, excluding early and late July, as far as this experiment indicates.

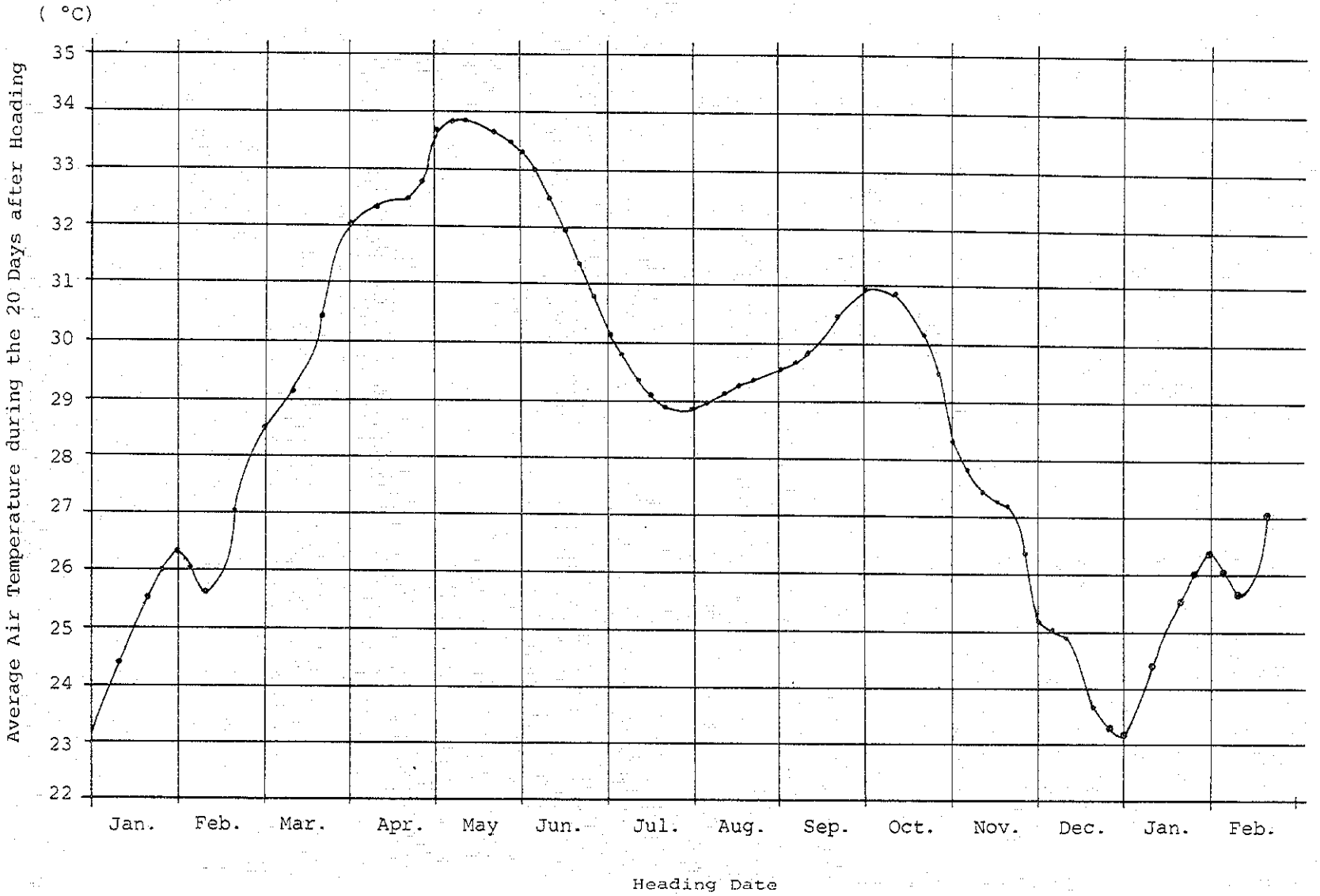
To make the relation between the sowing date and the yield clearer, the effects on the growth of rice plants of the natural environment were investigated.

The seasonal variance in yield is attributable to the variance of the natural conditions throughout the year, because nearly identical cultivation methods were used throughout the test period.

Major factors affecting rice yields are considered to be temperature, solar radiation, rainfall, soil, humidity and wind speed.

Among these factors, solar radiation in the project area seems to be sufficient for the growth of rice plants as can be inferred from the data for Wad-Medani which is 150 km west of the project area. Rainfall can not be a factor governing the yield variance, because irrigation water was available throughout the test period.

Fig. 5.7-2 Average Air Temperature during the 20 Days after Heading
(July 1975 to Jan. 1979)



Solar Radiation Recorded at Wad-Medani

(Unit: Cal/cm^2/day)

Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
487	540	574	595	578	554	517	523	550	521	493	473	534

Soils in the project area are free from salinity and chemical toxicity, and are high in cation exchange capacity. So, the soils also can not be a factor affecting the yield variance.

Therefore, it is considered that temperature, humidity and wind speed are the major factors affecting the variance in yield of rice.

The most sensitive growth stages of the rice plant to adverse conditions are the young panicle formation stage, reduction division (meiosis) stage of pollen mother cells, heading stage, and the most active ripening stage (Matsushima 1966).

In order to analyze the relationship between rice yield and meteorological conditions, the following interrelation were investigated using the results of the seasonal planting test;

1) Percentage of non-fertilized grains and the average minimum water temperature during the period from young panicle formation to the most active reduction division.

2) Yield and the average air temperature during the ripening period

3) Percentage of imperfectly ripened grains and the average daily mean air-temperature during the ripening period

4) Percentage of non-fertilized grains and the average relative humidity at 8:00 a.m. during 10 days centered on the heading date

5) Percentage of non-fertilized grains and the wind speed (maximum, mean) at 8:00 a.m. during 10 days centered on the heading date

(1) The relationship between the percentage of non-fertilized grains and the average minimum water temperature during the period from skikelet differentiation to the most active reduction division, i.e. between the 20th and 10th day before heading, is shown in Fig. 5.7-3. The regression curve shown in the figure is highly adaptable with 99% probability. The regression curve can be expressed by the following formula:

$$Y = \frac{52.9}{X-12.5}$$

Where, X is the average minimum water temperature between the 20th and 10th days before heading, and Y is the percentage of non-fertilized grains. Roughly speaking, the percentage of non-fertilized grains decreases with increasing water temperature up to 17°C, and thereafter it tails off. This phenomenon closely resembles the results of the experiments on low temperature damage by Terao et al. (1942), Kondo (1943), and many others. From this figure it can be said that more than 20 percent of non-fertilized grains are produced when the average minimum water temperature between the 20th and 10th days before heading is below 15°C. If the safety heading period is defined as the period in which the percentage of non-fertilized grains is always less than 20%, the safety heading period can be taken as the period from mid - April to late November from Fig. 5.7-4, in which the average minimum water temperature between the 20th and 10th days before heading is shown. Therefore, much more attention must be paid to water temperature than to air temperature, because, up to the reduction division stage, water temperature has much stronger effect on the growth of rice plants than air temperature, as has clearly been demonstrated by Matsushima et al. in 1964 (b) in experiments in which the combined effects of air temperatures and water temperatures at different stages of growth on the grain yield were examined.

(2) The relationship between yield and the average air temperature durint the ripening stage, i.e. during the 20 days after heading, is illustrated in Fig. 5.7-5. The regression curve, in the figure, of yield against the average air temperature during the 20 days after heading excludes samples which headed during the coldest season, November and January, because they are probably damaged by low temperatures. This regression curve is highly adaptable with 99% probability. From this curve and the conclusion reached in paragraph (1) above, it can be said that the lower the temperature at the ripening stage, the higher the yield so long as the rice plant heads emerge within the period from late March to mid - November. This relation can be confirmed by the studies of Matsushima & Manaka (1957), Matsushima & Tsunoda (1958), Aimi et al. (1959), Takana (1962), Murata (1964), and Munakata (1976), all of which proved that the optimum temperature for ripening at the active ripening stage is as low as 21 to 22°C in Japan.

Fig. 5.7-3 Relationship between Percentage of Non-fertilized Grains and Average Minimum Water Temperature between the 20th and 10th Days before Heading

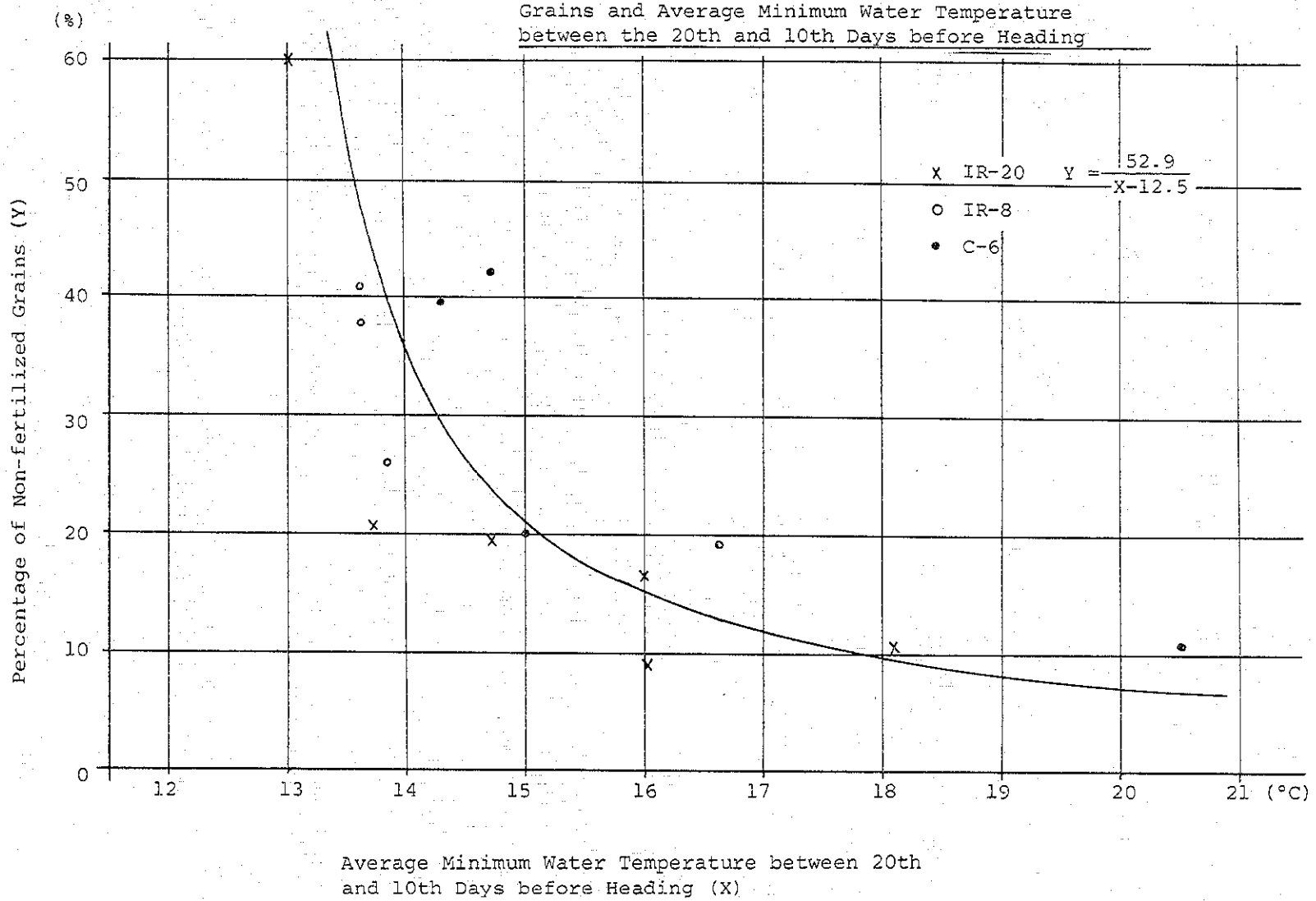


Fig. 5.7-4 Average Minimum Water Temperature between 20th and 10th Days before Heading

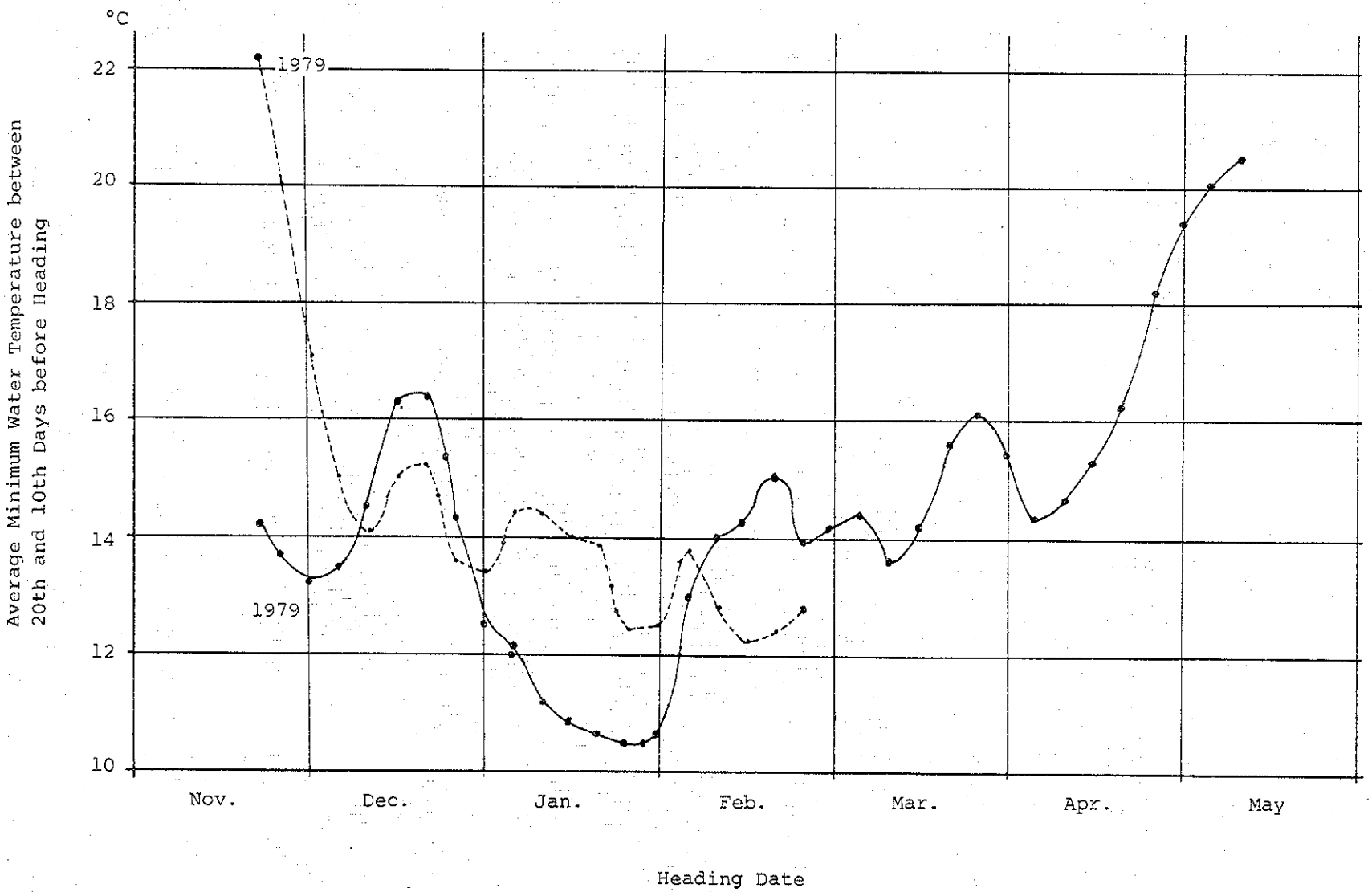
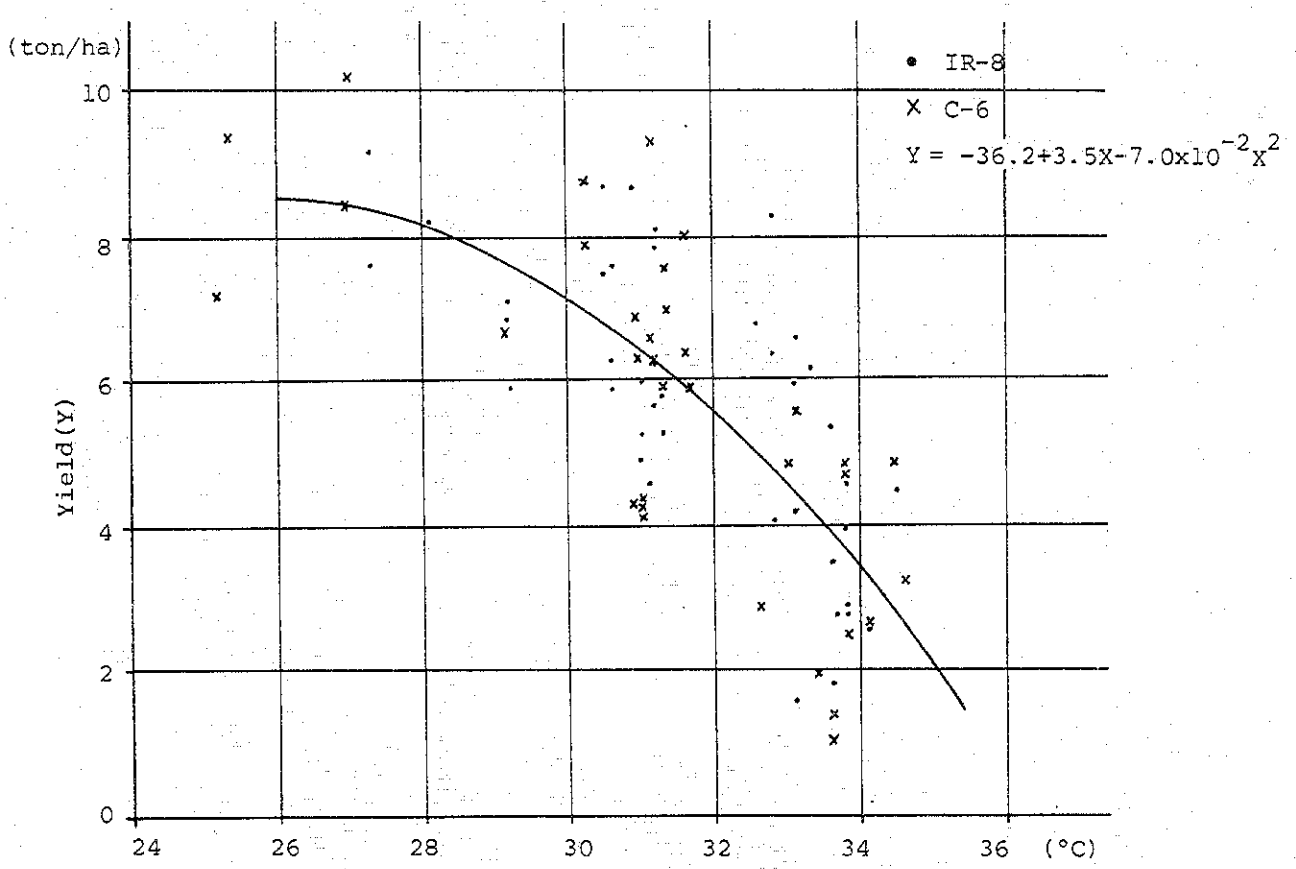


Fig. 5.7-5 Relation between the Average Daily Mean Air Temperature during the 20 Days after Heading and the Yield



Average Daily Mean Air Temperature during the 20 Days after Heading (X)

Samples assumed to have suffered cold damage are excluded.

(3) The seasonal change of average air temperature during the 20 days after heading calculated for the data recorded from July 1975 to January 1979 is shown in Fig. 5.7-2. If two croppings of rice a year are planned, the two optimum heading seasons can be identified from this figure as those from late June to mid - September and from late October to mid - November.

(4) The relationship between the percentage of imperfectly ripened grains and the average daily mean air temperature during the ripening period is shown in Fig. 5.7-6. From the figure, it may be said that in general the percentage of imperfectly ripened grains increases for higher average daily mean air temperatures during the 20 days after heading. When the average daily mean air temperature during the 20 days after heading is above 34°C, the percentage of imperfectly ripened grains seems to reach more than 20 percent. Therefore, the cropping pattern should be determined so that rice plants may ripen during a period in which the average air temperature for this 20 days is below 34°C at least.

Subjecting rice plants to higher temperatures and lower temperatures by 10°C than the average long-term mean air temperature in each period, Matsushima (1966) proved that the effects of high temperatures and low temperatures on the percentage of ripened grains are quite similar, despite the fact that treatments are quite different from each other, and the most serious ill-effects are found in two periods: (1) the 15 days from the 19th day before heading (corresponding to the period from the late spikelet differentiation stage to just before heading), and (2) the 18 days from just before heading to 14 days after heading. He reported also an optimum temperature for ripening of 26°C during the daytime and 16°C or 11°C at night at the most active ripening stage. These results strongly support the above findings.

(5) The relation between the percentage of non-fertilized grains and the average relative humidity at 8:00 a.m. during the 10 days centered on the heading date is shown in Fig. 5.7-7. From the figure, the following can be noted:

1) The variation in the percentage is larger at lower humidities than higher humidities.

2) The maximum percentages of non-fertilized grains at each average relative humidity decrease as the relative humidity increases.

This indicates that non-fertilized grains are liable to occur if there is a low relative humidity at 8:00 a.m. during the 10 days centered on the heading date. The relationship between the percentage of non-fertilized grains and the humidity could be clarified if data on the humidity during the period from 10 to 12 a.m., during which the majority of flowers open, were available. Sato (1960) observed 100% sterility in Cambodia when rice crops flowered in April. This sterility was attributed to a failure of pollination at high temperature and low humidity. Further, hot and dry air frequently causes "white heads", particularly if it comes at heading time (Hitaka . Ozawa 1979). Ikeda and Taoka (1979) found that white heads occurred under the conditions of greater wind speed than 10 m/s, higher temperature than 35°C and lower relative humidity than 45%, and also that non-discolored sterile grains occurred at greater wind speed than 5 m/s, higher temperature than 39°C and lower relative humidity than 32%. (Furthermore, they observed varietal differences in this occurrence of white reads.) Little is known about the effects of low humidity on ripening, so further studies should be carried out.

No definite relationship was observed between the percentage of non-fertilized grains and the wind speed (maximum, mean) at 8:00 a.m. during the 10 days centered on the heading date. Some clear relationships could have been determined if the wind speed had been measured during the period from 10 to 12 a.m., during which the majority of flowers opened. Tsuboi (1961) elucidated experimentally that strong winds cause sterility of grains by desiccating the plant and impairing grain development by physically damaging the grain surface.

Fig. 5.7-6 Relation between Percentage of Imperfectly Ripened Grains and Average Daily Mean Air Temperature during 20 Days after Heading

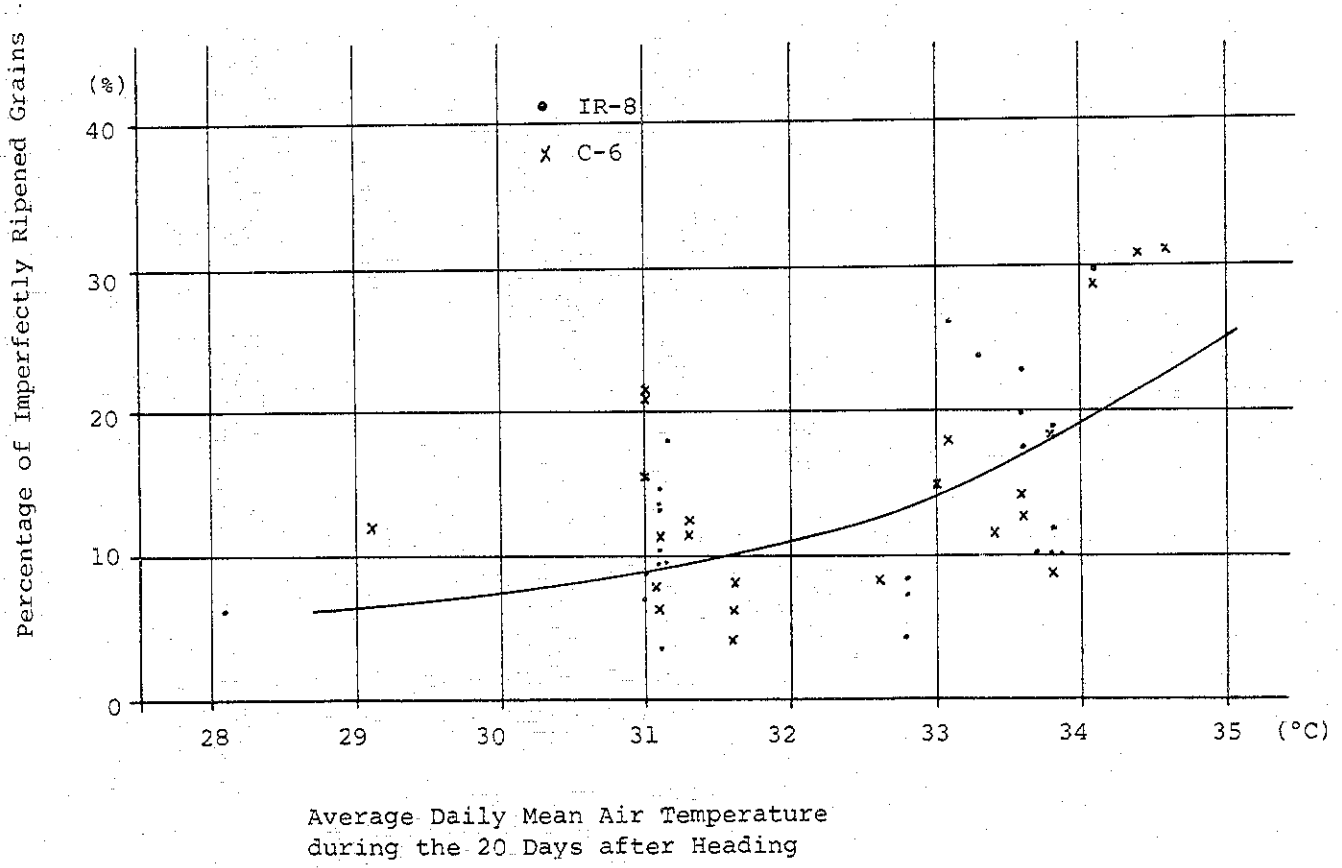
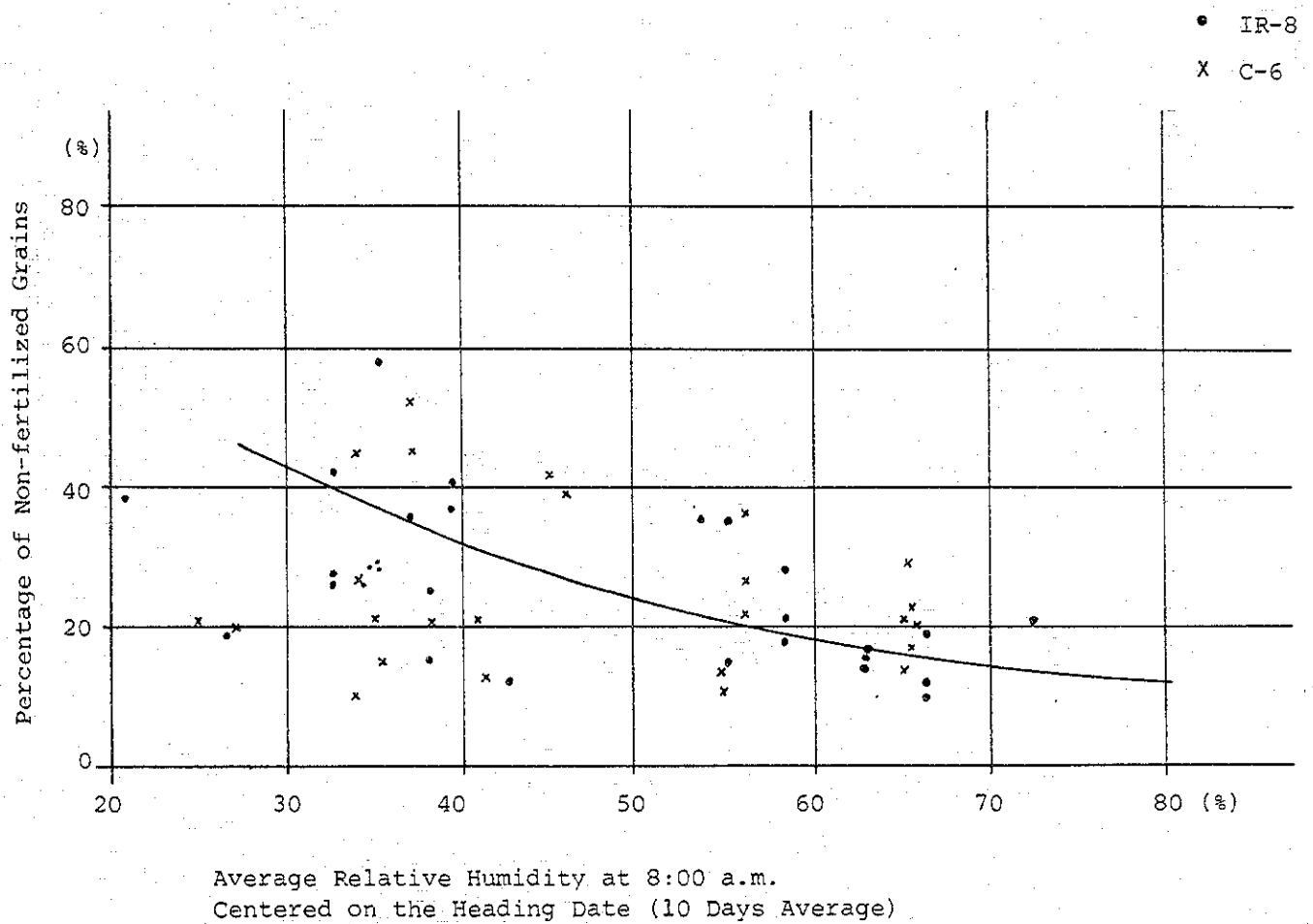


Fig. 5.7-7 Relation between Percentage of Non-fertilized Grains and Average Relative Humidity at 8:00 a.m. Centered on the Heading Date (10 Days Average)



To allow optimum sowing dates to be decided for the optimum heading dates, the relationship between sowing dates and heading dates for major varieties is shown in Figs. 5.7-7 and 8. To determine the most suitable cropping pattern for double cropping in the project area, many combinations of varieties with different growth durations for the first cropping with those for the second cropping were investigated. The investigations show that only a combination of long-term or medium-term varieties sown from late February to early April with short-term varieties sown from late February to early April with short-term Varieties sown from mid - August to mid - September is suitable.
An example of a tentative cropping pattern for the project area is shown in Fig. 7-9.

Fig. 7-8 Relation Between Sowing Date and Heading Date

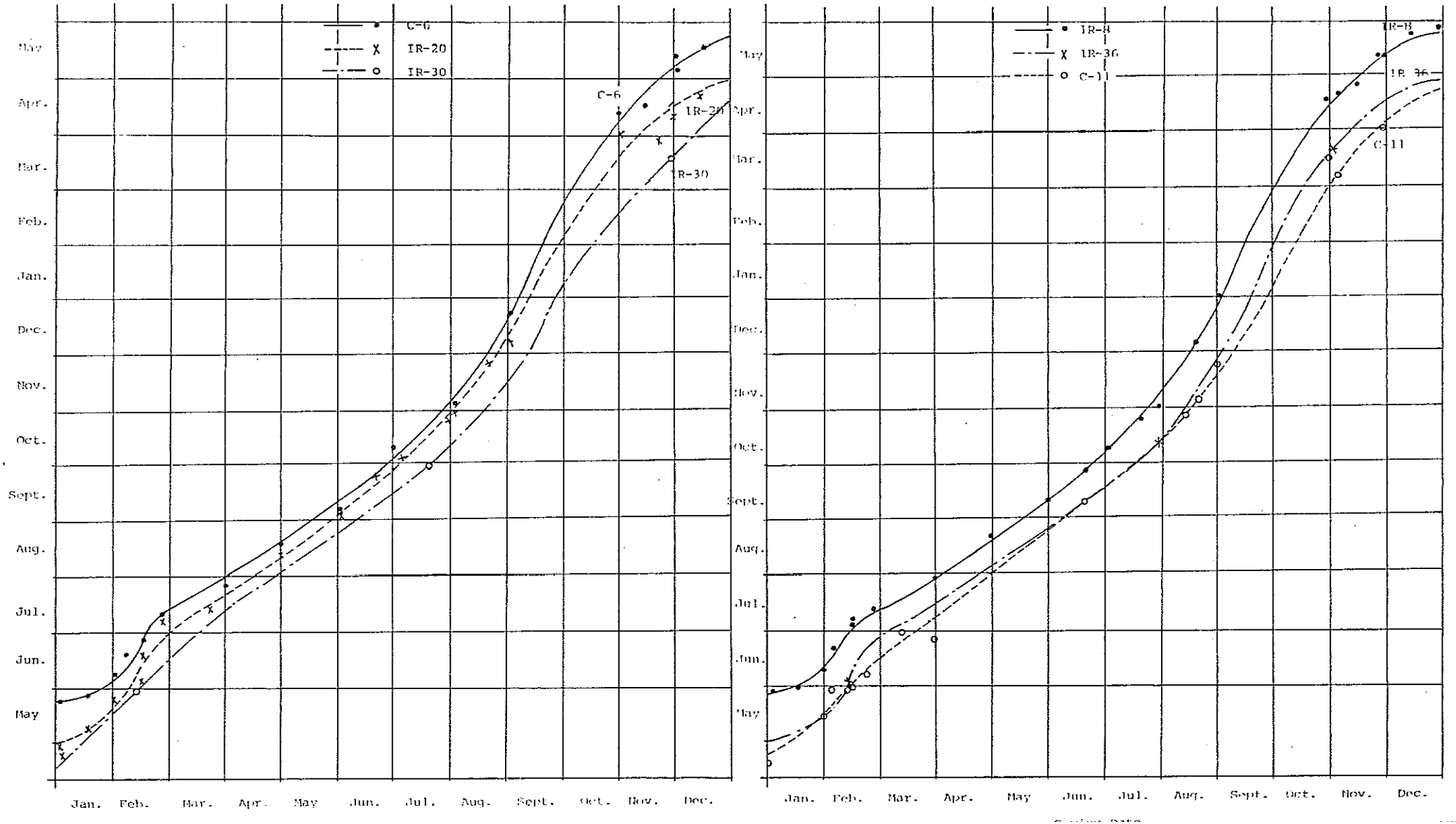


Fig. 7-8 Relation Between Sowing Date and Heading Date

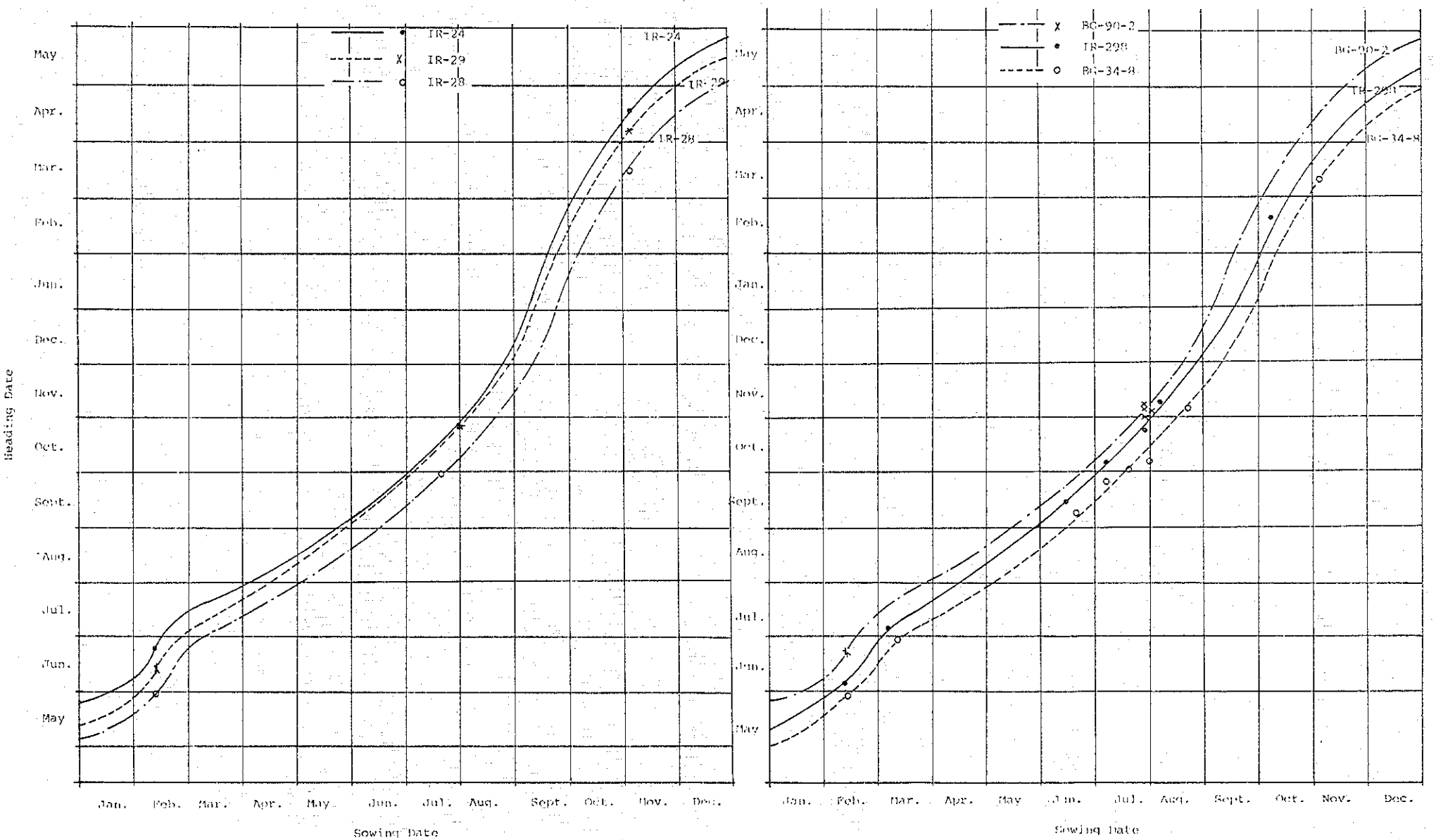
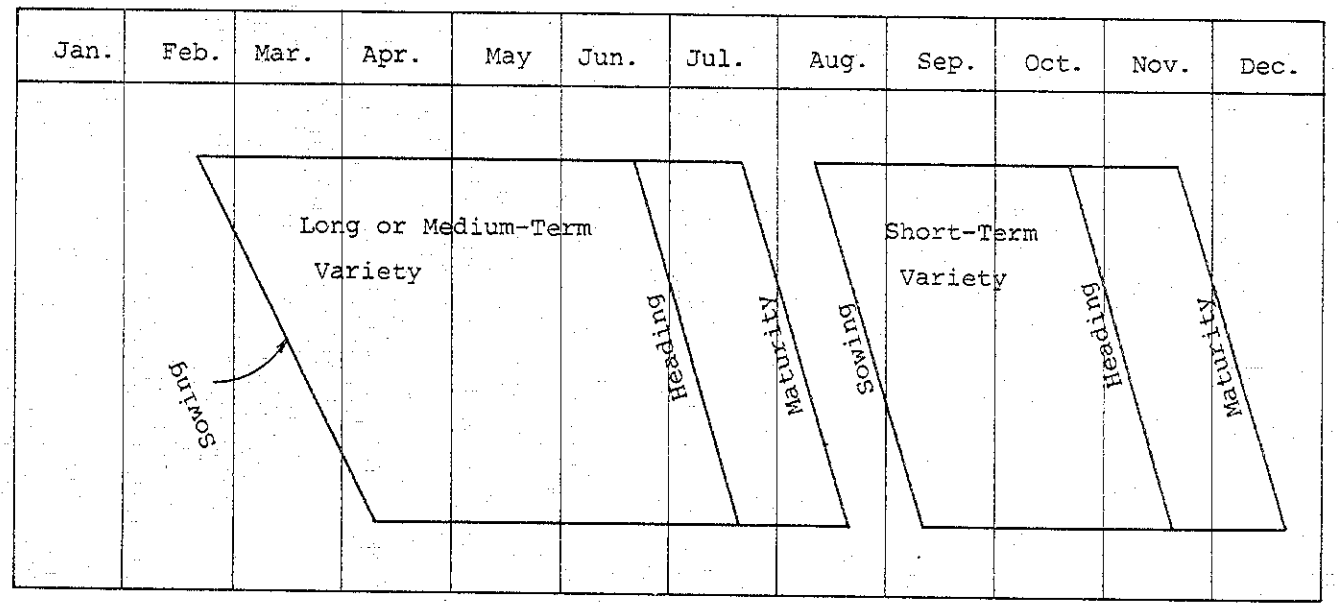


Fig. 7-9 Example of Proposed Cropping Pattern for Double Cropping



5.8 Sowing Method Tests

Purpose

Large scale rice cultivation will have to be carried out by the direct sowing method, because the number of available labourers for transplanting will be limited in the project area. The establishment of seedlings and weed control are the key to success in rice cultivation by the direct sowing method. The objective of this experiment is to find the most suitable sowing technique for direct sowing.

Method

The effects on the rate of emergence of seedlings of the depth of covering soil, an oxygen supplying chemical (calcium peroxide), forced germination, time from puddling to sowing, and duration of submergence of seeds after sowing were studied. The test was divided into two parts, as follows.

a) Test of the effects on emergence of the seedlings of the depth of covering soil, calcium peroxide and moisture conditions of the soil.

The following 12 treatments were implemented by the completely randomized method with 3 replications under dry field conditions. Under flooded field conditions, 8 treatments were implemented, omitting treatment of the 5 cm covering soil.

	Treatment with calcium peroxide	Variety	Depth of covering soil (cm)
1	Non-treated	IR-8	0 (Surface)
2	"	"	2
3	"	"	5
4	"	TOS-103	0
5	"	"	2
6	"	"	5
7	Treated	IR-8	0
8	"	"	2
9	"	"	5
10	"	TOS-103	0
11	"	"	2
12	"	"	5

Plastic seedling boxes filled with soil obtained from the experimental farm were prepared as seed beds. The seed was soaked for 48 hours in water, then coated with an amount of calcium peroxide equal to the amount of seed.
Sowing was carried out with 100 grains for each plot in mid - January 1979. The seedling boxes were kept in the shade.
For the plots under the dry field conditions, the seed beds were supplied with water only at the sowing time and not saturated with water, while in case of plots under flooded conditions, the seed beds were flooded with water at the sowing time and excess water wad drained. The percentage of seedlings that emerged within the 14th and 4th days after sowing and the average length of time from sowing to emergence of seedlings were investigated.

b) Test of the effects on the establishment of seedlings of hastening germination, the time from puddling to sowing and the duration of submergence of seeds after sowing.

The following four factors were investigated for 2 to 5 different levels each. Sixty treatments (2 x 2 x 3 x 5) with 4 replications were implemented by the randomized block method.

A. Hastening of germination
   A1. 3 days soaking only
   A2. 3 days soaking and 2 days forced germination

B. Duration from puddling to sowing
   B1. 0 (sown just after puddling)
   B2. 1 day

C. Duration of submergence of seeds after sowing
   C1. 1 day
   C2. 3 days
   C3. 7 days

D. Variety

D1. IR-8
D2. IR-20
D3. C-6
D4. C-11
D5. TOS-103

Each plot was 1 m^2 (1m x 1m). Sowing was conducted in January, 1979. Degrees of emergence of seedlings were evaluated visually, expressing them at a scale from 0 (lowest) to 5 (highest).

Results and Conclusion

a) Test on the effects on the emergence of seedlings of the depth of covering soil, calcium peroxide and the moisture conditions of the soil

The test results are given in Table 5.8-2, below.

Table 5.8-2 Effects on the Emergence of Seedlings of the Depth of Covering Soil, Calcium Peroxide and Moisture Conditions of the Soil

		Dry field conditions		Flooded field conditions	
Variety	Sowing depth	Percentage of germinated seeds	Average number of days required for germination	Percentage of germinated seeds	Average number of days required for germination
Non-treated					
IR-8	Surface	74	7.5	78	7.8
	2 cm	93	7.8	56	8.1
	5 cm	77	11.0	no test	no test
TOS-103	Surface	49	8.1	53	10.6
	2 cm	72	8.0	39	9.0
	5 cm	62	8.8	no test	no test
Treated with Calper					
IR-8	Surface	87	7.4	92	5.3
	2 cm	86	7.4	83	6.8
	5 cm	48	8.3	no test	no test
TOS-103	Surface	14	10.0	53	9.0
	2 cm	46	8.8	59	8.8
	5 cm	32	9.5	no test	no test

As shown Table 5.8-2, under dry field conditions, the most appropriate depth of covering soil was 2 cm, while in case of flooded field conditions, 0 cm (Surface) was best. The effects of calcium peroxide on the emergence of seedlings were not observed under dry field conditions, but in case of flooded field conditions, some favorable effects were observed.
In consideration of the experimental results in IRRI (Yoshida . Rirera 1978), the effects of calcium peroxide would have been much greater if the seeds had been sown in water at a higher temperature. Water temperature was low in this test.

b) Test of the effects on the establishment of seedlings of hastening germination, the time from puddling to sowing and the duration of submergence of seeds after sowing.

The test results are shown in Table 5.8-3. Statistical analysis of the results was carried out. The results of this are given in Table 5.8-4.

The hastening of germination has a significiant effect on the degrees of emergence of seedlings of each variety. The average degree of emergence of seedlings subjected to hastened germination is significantly higher than for those without hastening germination with 99% probability, while the effect of one day from puddling to sowing in the case of seeds treated with hastening germination, is significantly clear for varieties, IR-8, C-6 and C-11 with more than 95% probability. The duration of submergence after sowing seems to have no effect on the degree of emergence of seedlings, that is, no difference was found in the average degree of emergence of seedlings for the different treatments, when seeds were subjected to hastening germination. It can be said from these results that seeds should be subjected to hastening germination and should be sown one day after puddling. There is much room for further study on the improvement of sowing technique, because the highest performance in this test is found at a value of 3, which is much lower than the highest scale value of 5.

Table 5.8-3 Sowing Method Test Results

Variety	Treatment	Degree of Emergence of Seedlings (See Note 2) Block Number 1	2	3	4	Average
IR-8	A1B1C1 (See Note 1)	0	0	0	0	0.00
	" C2	1	1	1	0	0.75
	" C3	1	0	0	0	0.25
	A1B2C1	1	1	1	0	0.75
	" C2	0	0	1	2	0.75
	" C3	2	2	2	1	1.75
	A2B1C1	2	1	2	2	1.75
	" C2	2	2	2	2	2.00
	" C3	2	2	2	2	2.00
	A2B2C1	2	3	3	2	2.50
	" C2	2	3	3	3	2.75
	" C3	2	2	3	1	2.00
IR-20	A1B1C1	0	0	0	0	0.00
	" C2	0	0	0	0	0.00
	" C3	0	0	0	1	0.25
	A1B2C1	0	0	0	1	0.25
	" C2	0	1	0	0	0.25
	" C3	0	0	1	2	0.75
	A2B1C1	1	1	1	2	1.25
	" C2	1	2	2	2	1.75
	" C3	1	1	1	2	1.25
1.75	A2B2C1	2	2	2	2	2.00
	" C2	2	3	0	2	1.75
	" C3	0	0	1	1	0.50
C-6	A1B1C1	1	0	0	0	0.25
	" C2	0	0	0	0	0.00
	" C3	1	1	0	0	0.50
	A1B2C1	0	1	1	1	0.75
	" C2	0	1	1	1	0.75
	" C3	2	1	2	1	1.50
	A2B1C1	1	0	1	1	0.75
	" C2	1	2	1	2	1.50
	" C3	1	2	2	2	1.75
	A2B2C1	2	1	2	2	1.75
	" C2	2	2	2	2	2.00
	" C3	2	2	2	2	2.00

Variety	Treatment	Degree of Emergence of Seedlings (See Note 2) Block Number 1	2	3	4	Average
C-11	A1B1C1	0	0	0	0	0.00
	" C2	0	1	0	0	0.25
	" C3	0	0	1	0	0.25
	A1B2C1	1	0	0	0	0.25
	" C2	0	0	1	1	0.50
	" C3	1	2	1	2	1.50
	A2B1C1	2	2	1	2	1.75
	" C2	3	2	2	3	2.50
	" C3	3	3	2	3	2.75
	A2B2C1	1	2	1	2	1.50
	" C2	2	2	2	2	2.00
	" C3	2	2	2	2	2.00
TOS-103	A1B1C1	0	0	0	0	0.00
	" C2	1	0	0	0	0.25
	" C3	0	1	0	1	0.50
	A1B2C1	1	1	0	1	0.75
	" C2	1	1	0	1	0.75
	" C3	1	1	2	1	1.25
	A2B1C1	2	2	2	1	1.75
	" C2	2	2	2	1	1.75
	" C3	2	1	2	2	1.75
	A2B2C1	1	2	2	2	1.75
	" C2	2	2	2	2	2.00
	" C3	2	2	2	1	1.75

Remarks

Note 1:
- A1, 3 days soaking
- A2, 3 days soaking and 2 days forced germination
- B1, Sown just after puddling
- B2, 1 day from puddling to sowing
- C1, 1 day submergence of seeds after sowing
- C2, 3 days submergence of seeds after sowing
- C3, 7 days submergence of seeds after sowing

Note 2: Degrees of emergence were evaluated visually on a scale of values 0 to 5, 5 representing highest emergence.

Table 5.8-4 Mutual Comparison of Sowing Methods

Variety	Source of Comparison	"t" value
IR-8	A1* VS. A2	7.62**
	S2B1 VS. A2B2	2.38*
IR-20	A1 VS. A2	6.10**
	A2B1 VS. A2B2	0
C-6	A1 VS. A2	5.66**
	A2B1 VS. A2B2	2.89**
C-11	A1 VS. A2	9.02**
	A2B1 VS. A2B2	2.28*
TOS-103	A1 VS. A2	8.28**
	A2B1 VS. A2B2	0.46

Variety	Source of Comparison	"F" Value
IR-8	A2B1C1, A2B1C2, A2B1C3	1.02
	A2B2C1, A2B2C1, A2B2C3	2.36
IR-20	A2B1C1, A2B1C2, A2B1C3	3.05
	A2B2C1, A2B2C2, A2B2C3	3.21
C-6	A2B1C1, A2B1C2, A2B1C3	3.56
	A2B2C1, A2B2C2, A2B2C3	0.38
C-11	A2B1C1, A2B1C2, A2B1C3	13.02*
	A2B2C1, A2B2C2, A2B2C3	3.0
TOS-103	A2B1C1, A2B1C2, A2B1C3	0.0
	A2B2C1, A2B2C2, A2B2C3	0.44

Remarks:
A1: 3 days soaking only
A2: 3 days soaking and 2 days forced germination
B1: Sown just after puddling
B2: Sown 1 day after puddling
C1: 1 day's submergence of seed after sowing
C2: 3 days' submergence of seed after sowing
C3: 7 days' submergence of seed after sowing

5.9 Measurement of Evapotranspiration by Rice Plants

Purpose and Method

Evapotranspiration by rice plants is a very important factor for the design of irrigation facilities, for water management and for the water balance study.

In the rice experiment, evapotranspiration was measured through two cropping seasons.

In the project area rice plants will generally be cultivated under submerged field conditions. Therefore, evapotranspiration was measured using a tank filled with water. The tank was a cube of 1 m side (1x1x1m) with a bottom. Measurements were made with a hook gage. The varieties used for the experiment were Reimei sown on January 16, 1978 for the 1st test and IR-20 sown on December 1, 1978 for the 2nd test.

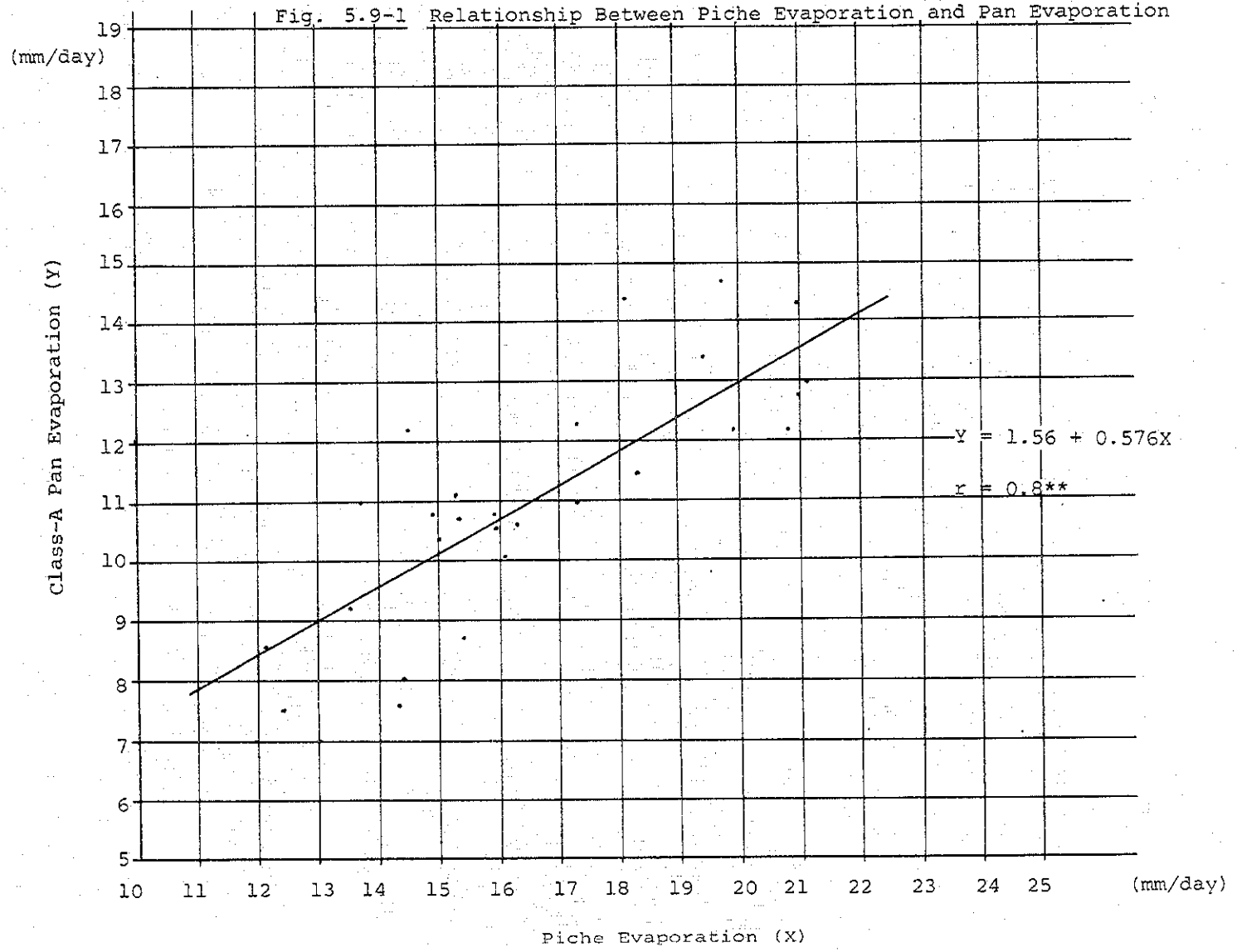
Besides the measurement of evapotranspiration of the plants, measurements of evaporation were carried out concurrently for IR-20 using a Class-A pan, evaporation from which is said to be almost equal to the potential evapotranspiration. There is a long-term record of evaporation values taken with a Piche Atmometer at the Duiem Weather Observatory, thus if a definite relation is determined between the values from the Piche Atmometer and those from the Class-A pan, the long-term Piche Atmometer records can be effectively used to find a long-term record of the evapotranspiration values.

Results

Data obtained are presented in Table ANNEX 8 with mean values for every 5-day period.

The relation between Piche evaporation and pan evaporation was investigated using mean values for 5-day periods obtained from January 1978 to May 1979, and is shown in Fig. 5.9-1.

Fig. 5.9-1 Relationship Between Piche Evaporation and Pan Evaporation



The regression line derived by the least squares method is

$$Y = 1.56 + 0.576\ X$$

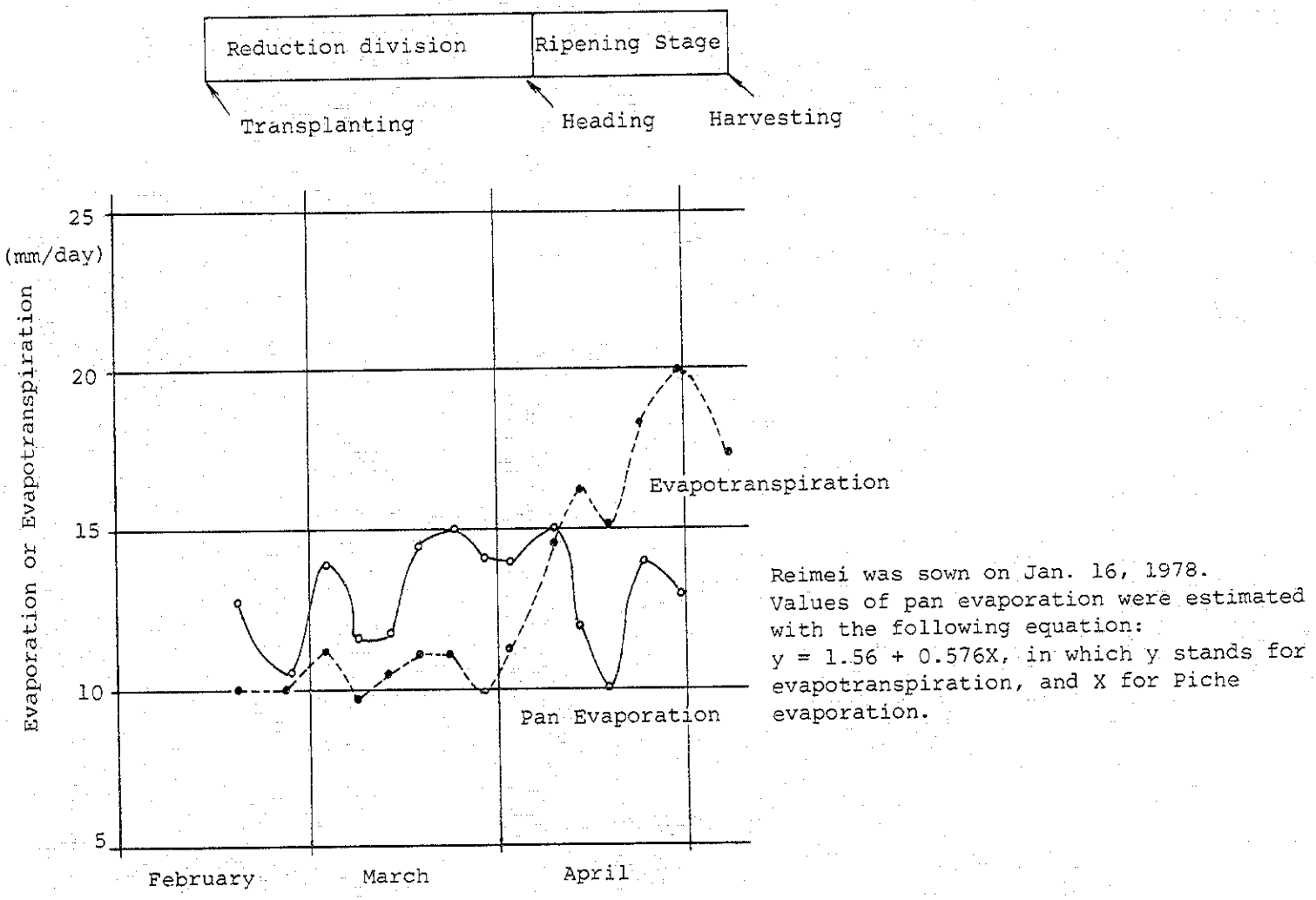
where, Y is the Class-A pan evaporation, and X is the Piche evaporation. Judging from the results of variance analysis, the regression line is highly adaptable with a more than 99% probability of confidence. From the equation, the Class-A pan evaporation can easily be calculated, and consequently evapotranspiration can be approximated.

Seasonal changes in evapotranspiration and pan evaporation are given in Figs. 5.9-2 and 3. As shown, evapotranspiration varies widely from period to period in both the two seasons, with fluctuations those are much heavier than usual. And, maximum evapotranspiration occurs at the late ripening state in the main-season and at the most active ripening stage in the off-season. Data for the past shows that maximum evapotranspiration occurs at the early ripening stage in most cases (Sugimote 1971). However, the maximum evapotranspiration from the present measurements occurred a little later than usual, which may partly be ascribed to the fact that the varieties used had a long heading duration (between initial and terminal heading dates).

Maximum evapotranspiration by a Reimei variety was found to be 20 mm/day, while it was 22 mm/day for IR-20. Daily mean evapotranspiration through the whole growth period of Reimei was 13 mm/day, while that of IR-20 was 12 mm/day.

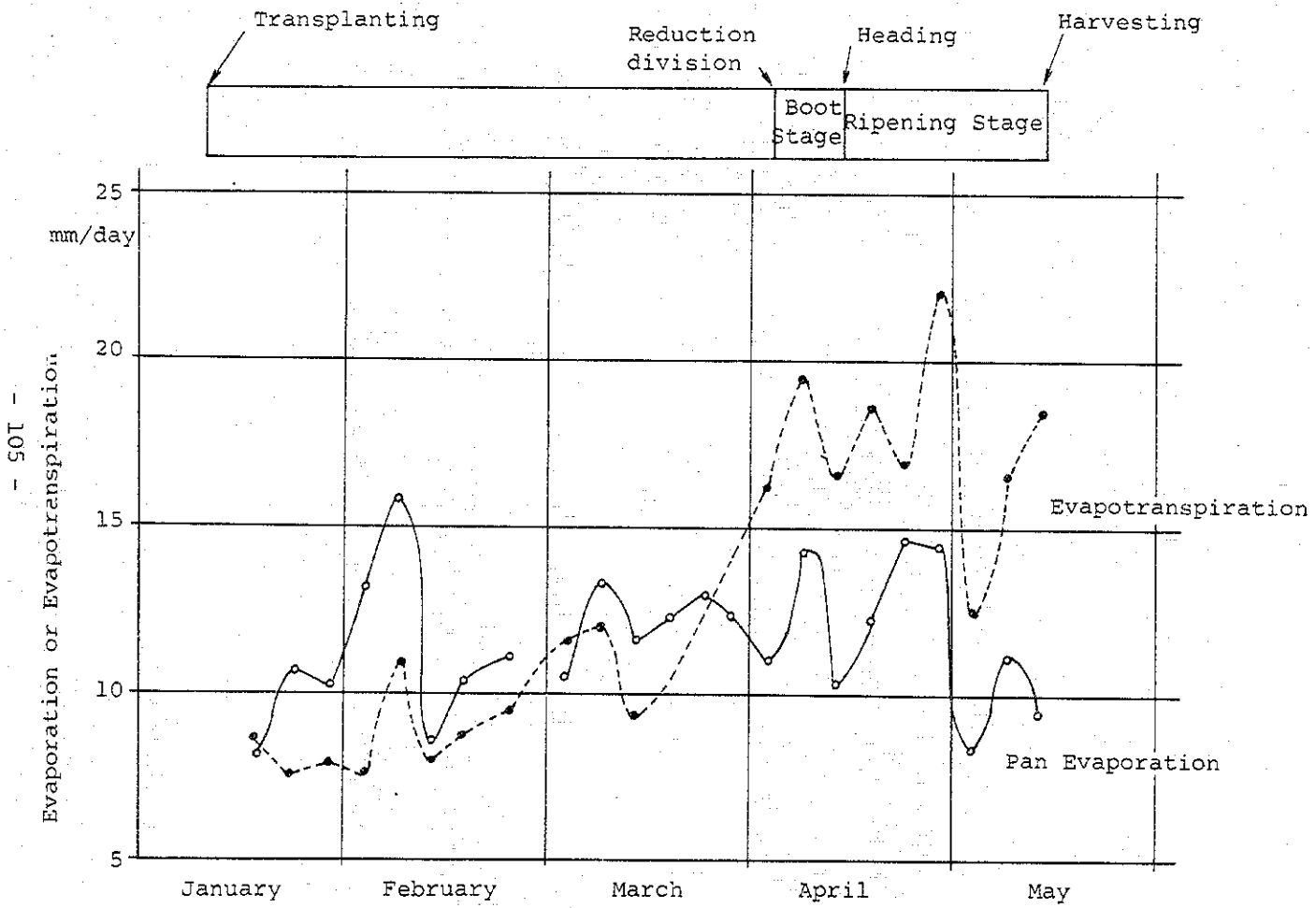
Reviewing past data of evapotranspiration, the highest value is found to be 16 mm/day measured by Buringh (1960) in Iraq, followed by 14.3 mm/day measured by Kung et al. (1965) in East Pakistan. These values are extraordinarily large compared with values so far measured in other temperate and tropical countries. For instance, the values obtained in Thailand (Kung et al. 1965), Cambodia (Hatta), Laos (Kotter), East Pakistan (Kung et al. 1965), Ceylon (Murakami 1966), India (Vamadevan et al.), Malaysia (Matsushima 1962, Sugimoto 1971, Nishio 1972), Philippines (IRRI), Taiwan (Maki), Korea (Tsubouchi), and Japan (Ishikawa and Nishio; Nakagawa 1966-67; Iwakiri)range from 4.0 mm to 6.5 mm/day.

Fig. 5.9-2 Consumption of Water by Rice Plants (Reimei)



Reimei was sown on Jan. 16, 1978.
Values of pan evaporation were estimated with the following equation:
$y = 1.56 + 0.576X$, in which y stands for evapotranspiration, and X for Piche evaporation.

Fig. 59-3 Consumption of Water by Rice Plants (IR-20)



IR-20 was sown on Dec. 1, 1978

Pan diameter, 120 cm.

Compared with data obtained in the past, the values in the present measurement appear to be abnormally large and by far the largest in the world. Such large values may presumably be ascribed to the extremely hot and dry conditions in the small, isolated paddy field in the middle of a vast desert. If measurement had been conducted in the middle of a large area of paddy fields, much smaller values than these would have been obtained. Further precise measurements are definitely required.

5.10 Investigation of the Growth Patterns of Rice

The growth patterns of rice were traced using Taichung 65 (medium-term variety) sown in June 7, 1977 for the main-season crop, and IR-8 (long-term variety) sown on November 6, 1977 for the off-season. The results are shown in Figs. 5.10-1 and 5.10-2.

For Taichung 65 (Fig. 5.10-1) the following points are noted.

(1) The panicle initiation stage occurred just before the maximum tiller number stage, which is consistent with normal cases of rice cultivation of short-term varieties in Japan (Matsushima 1966).

(2) The final emergence of bearing tillers occurred on the 54th day after sowing and on the 38th day after transplanting, which meant that only tillers which emerged within 54 days after sowing could bear panicles and any tillers emerging after that time could not really bear panicles. This suggests that fertilizers should be applied as early as possible if the number of panicles is expected to be insufficient.

(3) The final emergence of bearing tillers occurred on the 11th day before the maximum tiller number stage. This occurs in Japan on the 15th day before the maximum tiller number stage in most cases, so there is little difference between the two countries in this respect, as far as the results of this investigation indicate (Matsushima 1966).

From IR-8 (Fig. 5.10-2) the following points may be observed.

(1) Panicle initiation occurred around the 8th day after the maximum tiller number stage. This is also in good agreement with most cases of rice cultivation of long-term varieties in Japan (Matsushima 1966).

(2) The final emergence of bearing tillers occurred around the 100th day after the sowing. The number of days required for the final emergence of bearing tillers is almost twice as many as in the previous case of the main-season crop. This is mainly due to the low temperature in the vegetative growth period in December and January.

(3) The final emergence of bearing tillers occurred on the 37th day before heading. The number of days before heading in this case is more than twice as many as in normal cases in Japan (Matsushima 1966). This is presumably due to the development of too many non-bearing tillers.

(4) The maximum number of tillers attained as many as 37 per hill which was the most noticeable point, as shown in Fig. 5.10-2. This is mainly due to the low temperature (especially during the night) at the active tillering stage in December and January, because the low temperature at the active tillering stage causes rice plants to promote tillering (Matsushima 1976).

Besides the above investigations, the relation of the panicle initiation stage and the reduction division (meiosis) stage to the leaf-number index (Matsushima 1966) was investigated for IR-20. The results showed that no big difference was found between the relation obtained in this investigation and that in Japan.

5.11 Relation between Water Temperature and Air Temperature

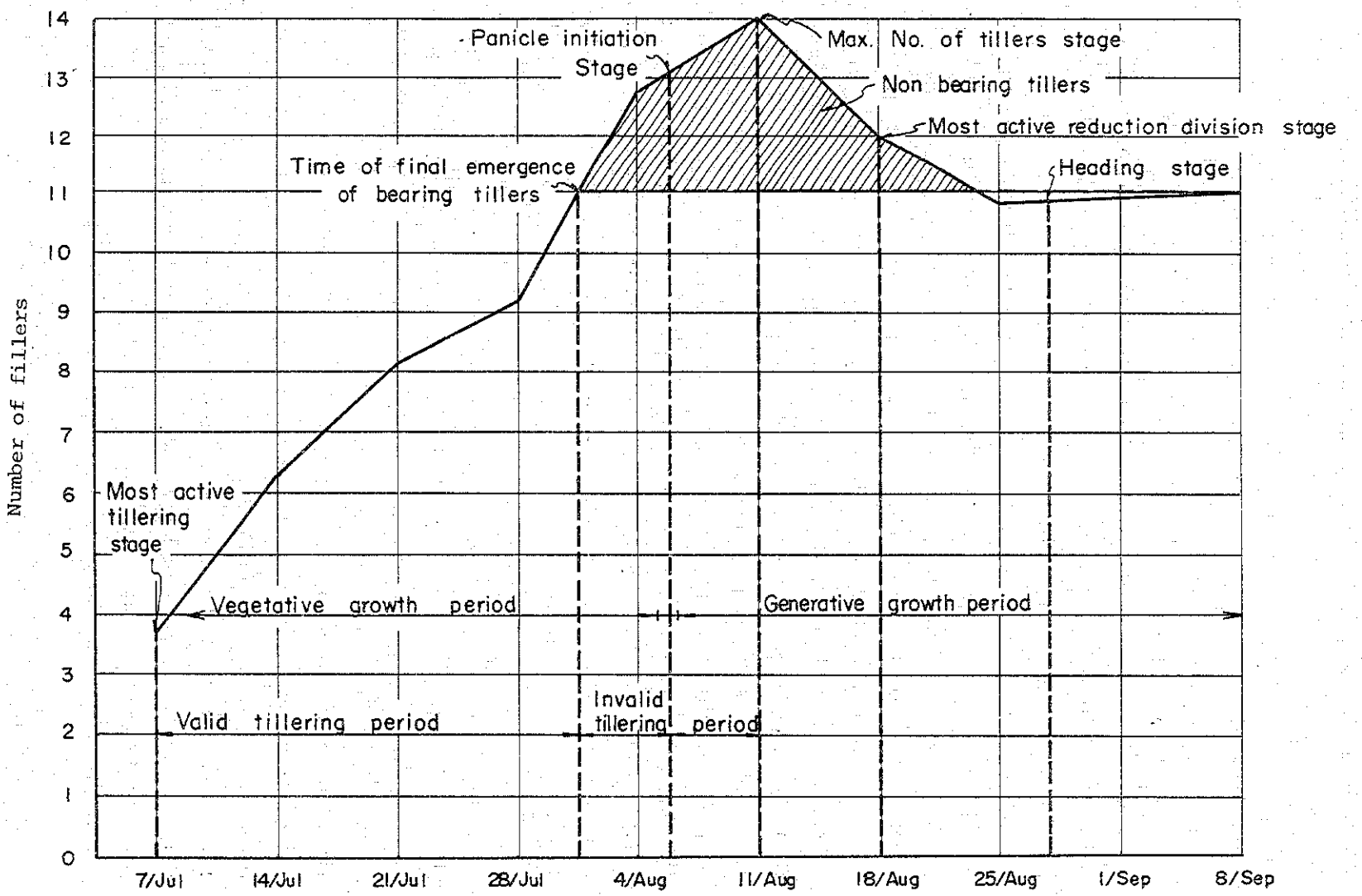
Water temperature investigations were carried out in June 1977 and January 1978 to clarify the micro-meteorological conditions of the paddy field for the growth of rice.

Investigation in June

One of the most important factors affecting the growth of rice under water-logged conditions is the water temperature in the paddy field. In the project area, air temperature rose very often to more than 40°C during the day, therefore, judging from the actual situations in Japan and Malaysia, the water temperature also be assumed to have risen above 40°C. Because, it has long been well known that during the vegetative growth period of rice in Japan the water temperature in ordinary paddy fields is always higher than the air temperature (Nakanishi . Yamada 1957). The same has also been observed in Malaysia (Matsushima 1962 b). When rice plants are subjected to water temperatures above 37°C, root activity is easily damaged and plants are very liable to be attacked by root-rot diseases, resulting in a marked decrease in yield (Kondo and Okamura 1930 and 1931, Baba 1958, Matsushima et al. 1964, Tsunoda 1964). Based on these earlier results, an actual observation of water temperature in the paddy fields was carried out during the period from June 14 to 22 in Dueim.

An example of the observation results is shown in Fig. 5.11-1, which indicates the diurnal change of water temperature together with air temperature. In the figure the most noteworthy point is that the water temperature does not rise above 36°C, even in the case of the air temperature being above 40°C. This was also noted in all other observations conducted on different days, which was quite strange in comparison with the Japanese and Malaysian situations. To clarify the reason for this, further observations were carried out as follows. (The water temperature, however, was not always found to be lower than air temperature all the year round, sometimes is was higher than air temperature, especially when humidity was high.)

Fig. 5. 10-1 Growth Pattern of a Medium Term Variety (Taichung-65)



Note : Sowing date ----- Jun. 7 Transplantation date ----- Jun. 23

Fig.5.10-2 Growth pattern of IR-8 in Off-season

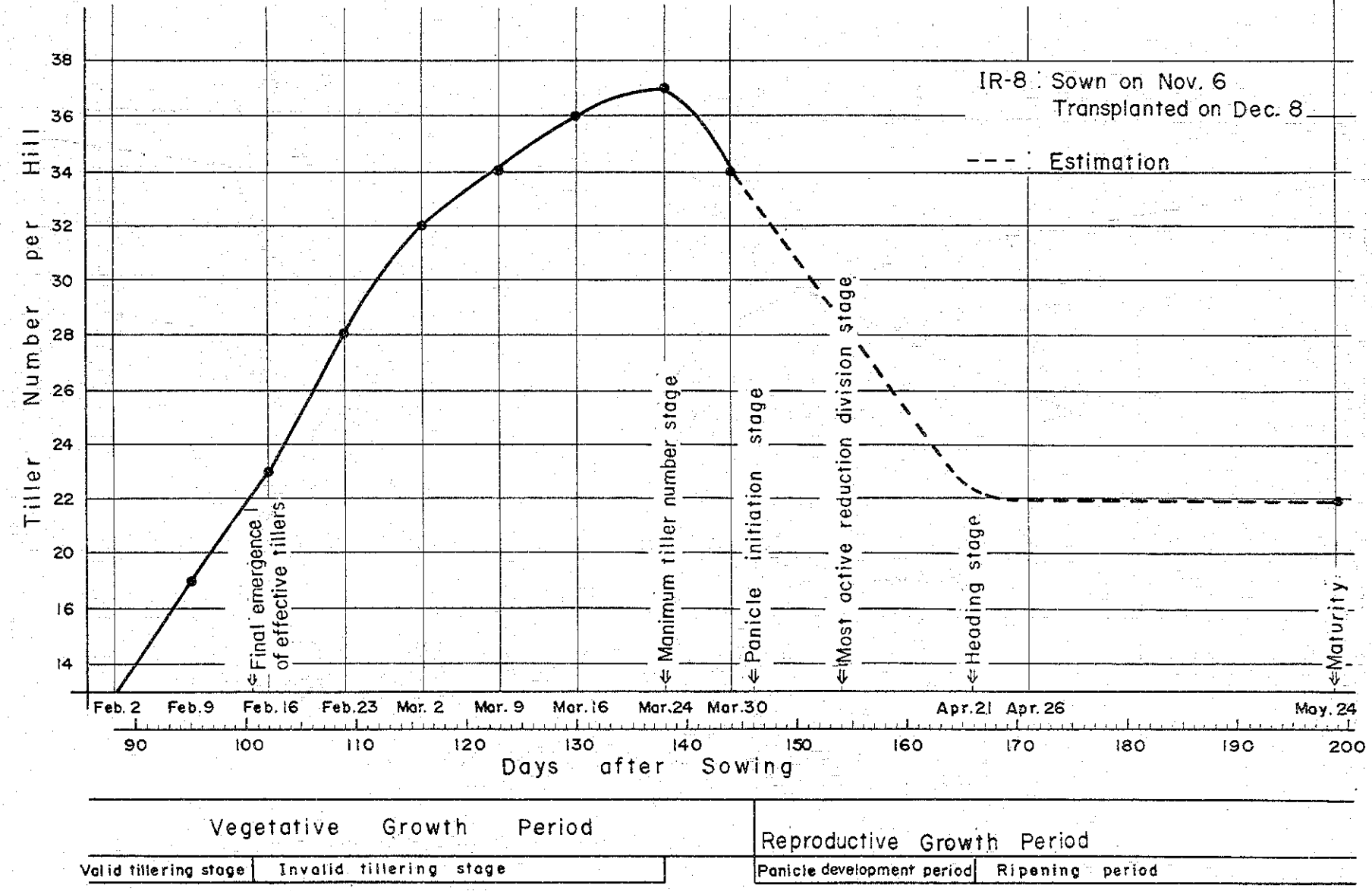
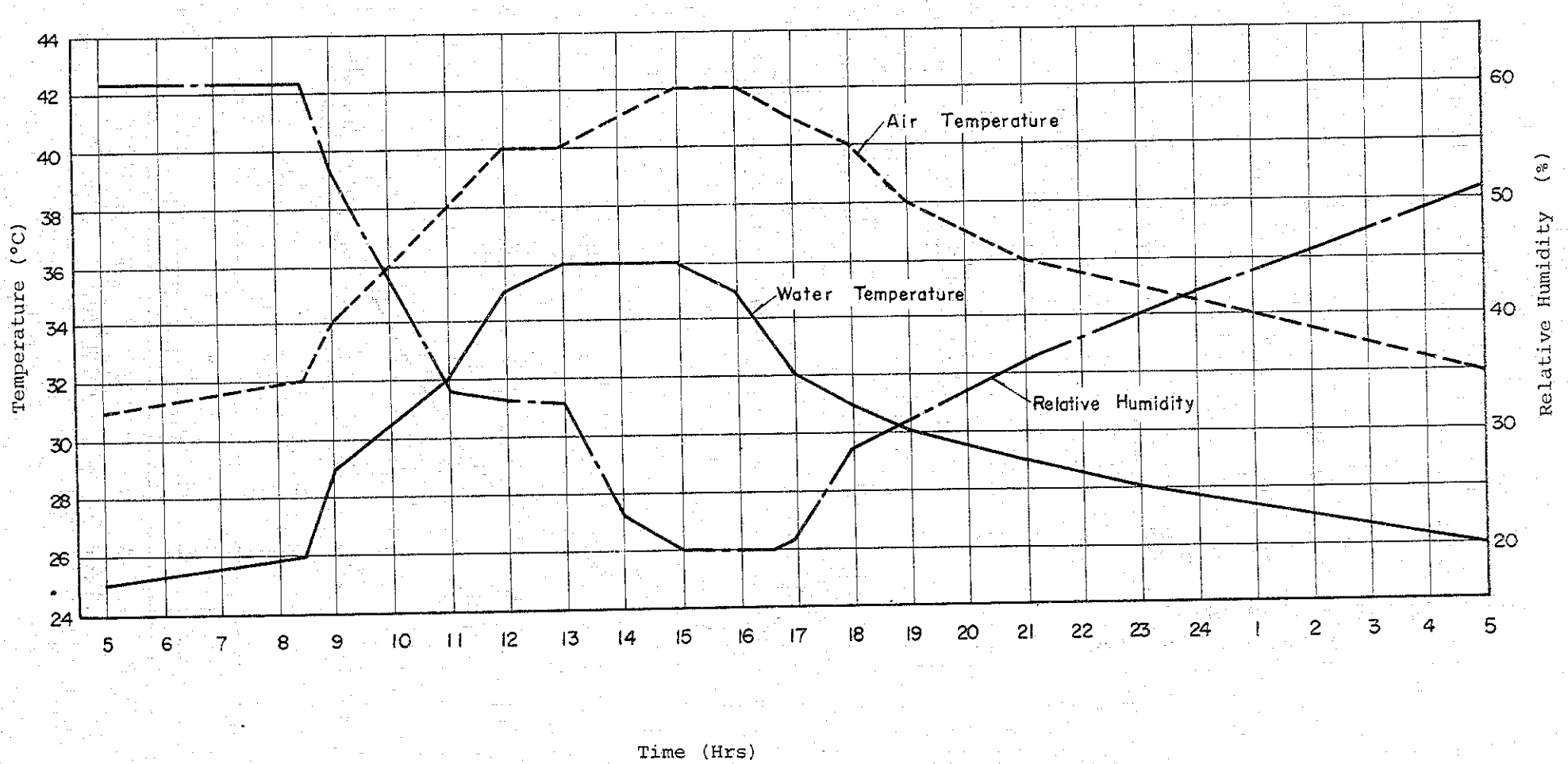


Fig. 5.11-1 Diurnal Changes in Water Temperature in a Paddy Field, Air Temperature and Relative Humidity
(Dueim, June 17, 1977)



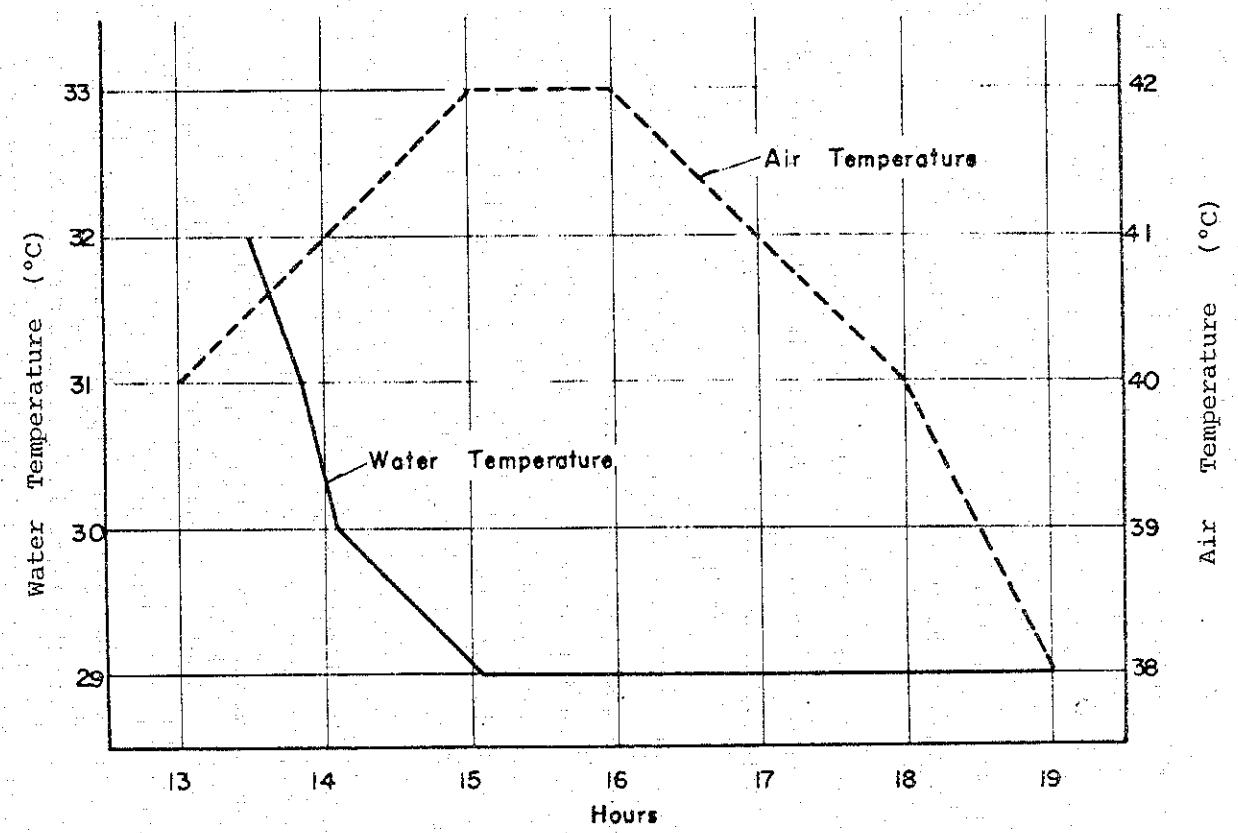
City water was collected in a tinned vessel at 1:30 in the afternoon on July 17, and it was kept indoors thereafter. The changes of water temperature as well as air temperature were followed, and are shown in Fig. 5-11-2. The figure clearly shows that water temperature decreases rapidly irrespective of air temperature being over 40°C until 3 o'clock (one and a half hours after taking the water from the water pipe), thereafter remaining constant. According to Fig. 5.11-2 the relative humidity from 1:30 to 3:00 p.m. was very low (25 - 20%). These facts clearly suggest that water temperature is lowered by the latent heat of vaporization of water evaporating from the water surface.

On the basis of the above reasoning, the note worthy fact that the water temperature in the paddy field did not exceed 36°C even when the air temperature was more than 40°C can be well understood.

This is quite advantageous for rice cultivation in the dry season, because higher water temperatures than 37°C not only seriously damage the germination of seeds, but also definitely depress root activity and increase root-rot disease, which are closely connected with reduction of rice yield.

In respect of these facts, Ito (1963) observed under the extremely hot and dry climate in Iraq that the temperature of the rice plant itself did not exceed 34°C even when the air temperature was 39°C, but did go down with air temperature until as low as 22°C. Consequently, he reported that rice plants have the ability to protect themselves against rises in temperature, but can not protect themselves against falls in temperature. Anyway, the decrease of temperature by latent heat losses must be utilized to the best advantage for developing rice cultivation under the hot and dry climate of the project area.

Fig. 5.11-2 The Fall of Water Temperature inside a Room



Note: For the test, city water was collected in a tinned vessel at 1:30 in the afternoon on July 17, and it was kept indoors thereafter.

Investigation in January

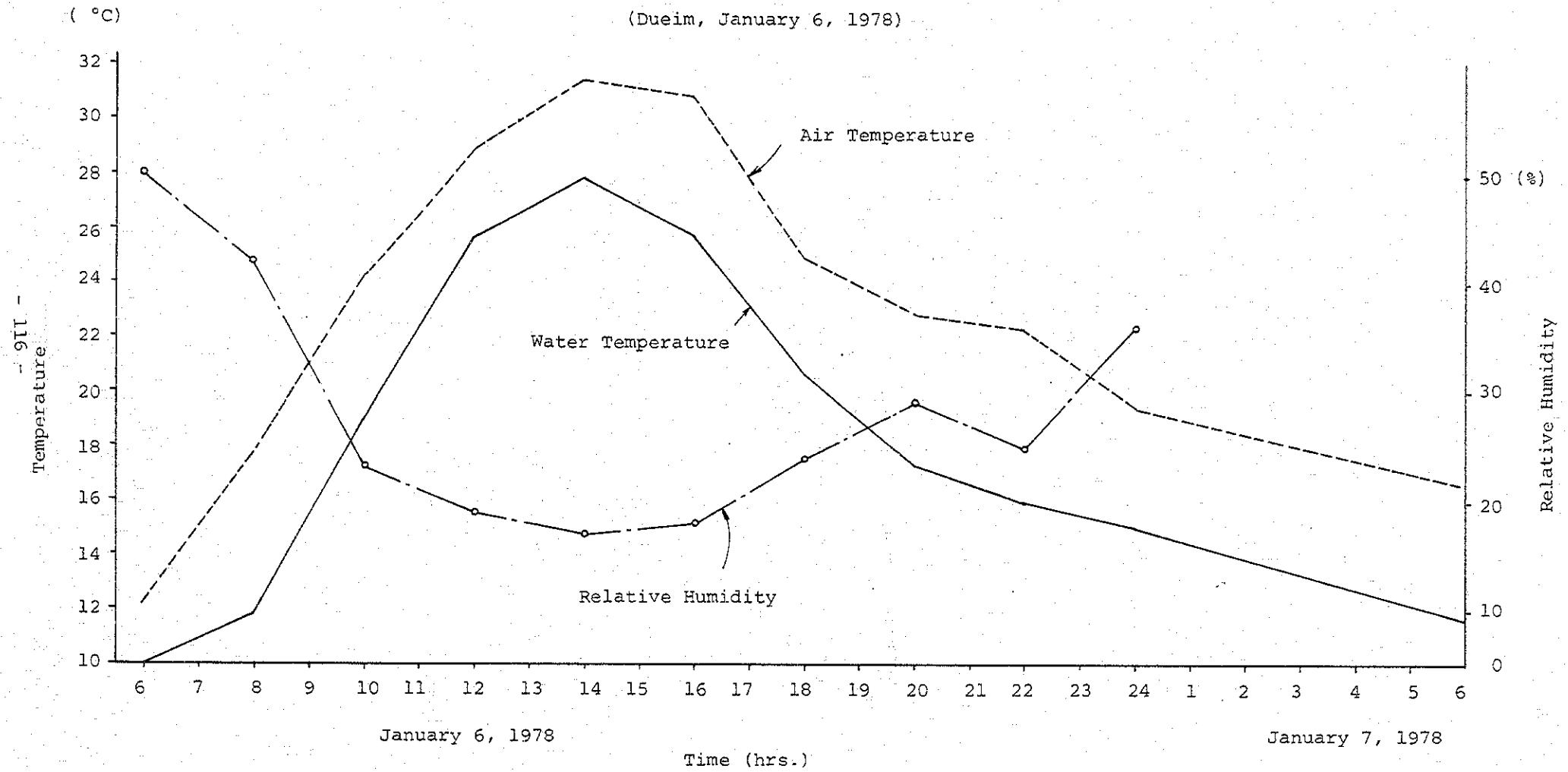
High sterility of grains was often observed on rice plants which had been grown in the cold season from November to February. In this case, however, air temperature in the cold season was not so low, i.e. the mean (maximum and minimum) temperatures ranged from 23.5°C to 28.5°C on the average monthly values. To clarity the causes of high sterility of grains and the micro-climatic conditions in the paddy field during winter as well, the diurnal changes of water temperature in a paddy field, air temperature and humidity were measured on January 6 1978. The results are shown in Fig. 5.11-3.

As shown the Figure, water temperatures was lower by 2 to 6°C than the air temperature. The lowest water temperature was as low as 10°C. Water temperatures lower than 18°C always have clear ill-effects on the percentage of ripened grains, as shown in Fig. 5.7-3.
And, young panicles are always below the water surface until the most active reduction division, and consequently it can be well understood that spikelets are easily damaged by low water temperatures during the cold season.

Based on these facts, it may be considered that drainage of water in the paddy field from 18:00 to 10:00, during which time temperatures are always low, will sometimes have favorable effects on panicle development as well as ripening, when rice plants have already differentiated young panicles during the cold season.

Fig. 511-3 Diurnal Charges of Water Temperature in Paddy Field,
Air Temperature and Relative Humidity

(Dueim, January 6, 1978)



6. SUMMARY AND CONCLUSION

With a view to obtaining supplementary data for the feasibility study on rice development in the Gasaba Basin, White Nile Province, Sudan, where irrigated rice cultivation has never been practiced, and further to determining a method for growing rice twice a year which was proposed in the feasibility study, some preliminary rice cultivation experiments have been carried out for two years under the extremely hot and dry climate.

On account of the insufficiency of facilities, materials and personnel, complete and satisfactory results were difficult to obtain, but the results achieved still come up to our expectations, and they might be worthy of reference by rice workers who are interested in rice cultivation under hot and dry climates.

6.1. In the variety tests, ten varieties yielded more than 8.0 ton/ha on average in three main (rainy) seasons, and the highest yield of 10.2 ton/ha was obtained by C-6. Eleven varieties produced more than 6.0 ton/ha on average in two off - seasons (dry), and IR-20 produced the highest yield of 9.7 ton/ha. Taking the yielding ability as well as the quality of rice kernels into account, the following varieties could be recommended tentatively for each cropping season.

For the main-season (wet) : BR-4, BG-33-2, IR-36, BG-34-12, TOS-103, BG-90-2, IR-29, BG-34-6, IR-2053, IR-298-12-1-1-1.

For the off - season (dry): BG-90-2, IR-24, IR-22, IR-2053, IR-2153, IR-1561, Dawn.

Further, varietal differences in ripening under the hot and dry conditions were observed.

6.2. In the fertilizer element test, sulphur was used instead of lime to decrease the high pH of the soil. An outstanding favorable effect of nitrogen was clearly observed on yield, while other elements had no or little effect on it. This suggests that rice plants maybe nicely be grown by applying only nitrogen, not applying any other fertilizer elements.

6.3. The optimum dosage of nitrogen to be applied was found to be 150 kg/ha, but optimum application times could not be clarified.

6.4. In general, the grain yield increased with an increase in spacing in the transplanted field. However, in view of results of significant difference test and labor saving, a planting density of 22 hills to 27 hills per m^2 might be taken as the optimum for transplanted plants. In the directly sown field, any level of seeding density between 50 kg and 100 kg of seeds per ha could be taken as optimum. Analyzing the yield into yield-components and studying the correlation between them elucidated the importance of an increase in the number of grains or panicles to increase yield in the project area.

6.5. The ordinary transplantation method, the broadcast transplantation method and the direct sowing method were compared with one another. Generally speaking, the transplantation method was safer and gave more stable yield and also a higher yield than the direct sowing method. Comparison of the ordinary transplantation method with the broadcast transplantation method showed that the latter was much more advantageous than the former, because the yields of the latter were by no means inferior to the former, and moreover the latter took only 1/10 to 1/15 of the transplanting labor of the former. The direct sowing method, however, ranked with the transplanting method in yield when the paddy field was nicely levelled, drained and weeded. In the experiment a yield of 11.4 ton/ha was obtained by the broadcast transplantation method.

6.6. In the herbicide test Saturn, X-52 and MO were found to be effective against weeds. They gave rise to no phytotoxicity either on transplanted plants or directly sown plants. While, Ronster caused considerable phytotoxicity in both transplanted plants and directly sown plants.

6.7. From seasonal planting tests, an optimum sowing period for growing rice twice a year was identified as the period from late February to early August, except for early and mid - July. Rice plants sown from early October to late January produced low yields, which was attributable to damage due to the low temperatures in winter especially in December and January. On the other hand, rice plants sown in middle February and in early or middle July also produced low yields, which was ascribed to the high temperature at the heading stage and the active ripening stage. Further, two optimum heading periods for producing high yields were also identified, i.e. one from late June to mid - July and the other from late October to mid - November.

The above conclusion are based an investigation of the correlations between (1) the percentage of non-fertilized grains and the average daily minimum water-temperature, (2) the grain yield and the average air-temperature during the ripening period, (3) the percentage of imperfectly ripened grains and the average daily mean air-temperature and (4) the percentage of non-fertilized grains and the average relative humidity at 8:00 a.m. during the 10 days centered on the heading date.

On the basis of the these findings the double-cropping pattern of rice that has been tentatively proposed for the project area in the feasibility study is further confirmed as feasible.

6.8. The sowing method tests clarified that a 2 cm-depth of covering soil encouraged the emergence of seedlings under non-flooded conditions, while no-covering of soil was found to be best under flooded conditions, and that seeds should be subjected to hastening germination treatment and be sown one day after puddling.

6.9. Seasonal changes of evapotranspiration were traced through the entire growth period for two seasons. The values of evapotranspiration per day were very large indeed. The maximum values of 20 mm attained in 1978 and 22 mm in 1979, appeare to be the largest so far recorded in the world.

6.10. The growth pattern during the main-season was not much different from that in Japan, while a considerably different pattern was observed in the off-season, especially for rice plants sown in the autumn and ripened in the spring.

6.11. As a result of investigation of the dirunal changes in air-temperature and water-temperature in a paddy field at the tillering stage of rice, the water-temperature was found to be lower than the air-temperature, and it did not attain temperatures higher than 36°C even when the air-temperature was as high as 42°C while relative humidity was low. This was considered quite different from the situations in Japan and in Malaysia, in which the water temperature is always higher than the air-temperature in the vegetative growth period. This noteworthy fact was clearly due to the great latent heat of vaporization of water evaporating from the surface due to the extremely low humidity which was found to decrease the water temperature. This phenomenon was considered to be decidedly advantageous for rice cultivation in the project area, because water-temperatures higher than 36°C often have serious ill-effects on the growth and the yield of rice.

7. LITERATURE CITED

Aimi, R. Sawamura, H. & Konno, S. (1959):
Physiological studies on the mechanism of crop plants. The effect of the temperature upon the behaviour of carbohydrates and some related enzymes during the ripening of rice plant. Proc. Crop Sci, Soc. Japan 27; 4 (405-407).

Alluri, K (1978):
Tranditional and broadcastable seedlings in relation to methods of fertilizer application. Rice in Africa. Edited by Budeenhagen and Persley. Academic Press, London, New York, San Francisco.

Baba, I. (1958):
Nutritional study on the occurrence of Helminthoporium Leaf Spot and "Akiochi" of the rice plant. Bull. Natio. Inst. Agric. Sci. Ser. D,7

Bringh, P. (1960) Soils and soil conditions in Iraq.: 322p.
Directorage General of Agric. Research & Project, Ministry of Agric., Iraq.

Chao, Lieng-Frang (1959):
Report to the Government of Iraq on Rice. No. 1081 FAO.

Enomote, N. Yamada, I. & Kozumi, K. (1956):
On the artificial germination of pollen in rice plants. Proc. Crop Sci. Soc. Jap. 25; 2.

Hitaka, N. & Ozawa, Y. (1970):
Handbook of agriculture meteorology: Division of Research Co-ordination, Ministry of Agriculture, Yokendo Publishing Co., Tokyo.

Ikeda, S. & Taoka, A. (1976):
Field experiments on "foehn" treatments on rice plants at flowering stages. Abstracts of Papers Read at the Meeting of Society of Agrometeorology.

Ito, H. (1963):
The necessity, the possibility and the means of rapidly increeasing rice production in Iraq. Field Crop Division Directorate General of Agric. Research & Project, Ministry of Agric., Iraq.

Kondo, M. & Okamura, T. (1930-1931):
Relation between water temperature and the growth of rice. Agriculture Research 15 & 17.

Kondo, Y. (1943):
Experimental study of chill injury of rice plants.
4. Fertility damage due to low light and low temperature.
Agric & Horic. 18: 7 (710-714). (In Japanese)

Kung, P., Atthayodhin, C. & Kruthabandhu, S. (1965):
Determining water requirements of rice by field measurements in Thailand. IRC Newsletter 14; 4 (5-18).

Matsushima, S. & Manaka, T. (1957):
Analysis of development factors determining yeild, and yield prediction in lowland rice. 39. On the mechanism of ripening (5) Proc. Crop Sci. Soc. Japan 25; 4 (203-206).

Matsushima, S. & Tsunoda, K. (1958):
Analysis of developmental factors determining yield, and yield prediction for lowland rice. 45. Effects of temperature and its daily range in different growth stages upon the growth, grain yield and constitutional factors in rice plants. Proc. Crop Sci. Soc. Japan 26; 4 (243-244).

Matsushima, S. & Tsunoda, K. (1959):
Effects of irrigation-water temperatures and its daily range in different growth-stages upon the growth, grain yield and constitutional factors in rice plants. Proc. Crop Sci. Soc. 27; 3 (357-358).

Matsushima, S. & Tanaka, T. (1960):
Early discrimination of non-fertilized grains. Crop Sic Soc Jap. 28: 4 (365-366).

Matsushima, S. (1962 a):
Some experiments on soil water plant relationship in rice. Ministry Agric. & Co-operat. Agric. Bull. 112. (1-38).

Matsushima, S. (1962 b):
Research on rice physiology in relation to irrigation practices. Expanded Program of Technical Assistance. FAO No. 1516 (1-30).

Matsushima, S. (1964a):
Nitrogen requirements at different stages of growth. Mineral nutrition of the rice plant. The Johns Hopkins Press, Baltimore, Maryland. (219-242).

Matsushima, S. Tanaka, T. & Hoshino, T. (1964b):
Combined effects of air-temperatures and water-temperatures at different stages of growth on the grain yield and yield-components for lowland rice. Proc. Crop Sci. Soc. Jap. 33; 1.

Matsushima, S. (1966):
Crop science in rice. Fuji Publishing Co., Tokyo.

Matsushima, S. (1976):
High yielding rice cultivation. University of Tokyo press, Tokyo.

Matsushima, S. (1980):
Rice Cultigation for the Million. Japan Scientific Societies Press. Tokyo.

Munakata, K. (1976):
Effects of temperature and light on the reproductive growth and ripening of rice. Proc. Symposium on climate and rice. IRRI.

Murakami, T. (1966):
Report of the experimental results of a rice water relation study. Dept. of Agric. Ceylon 1 - 145.

Murata, Y. (1964):
On the influence of solar radiation and air temperatures upon local differences in productivity of paddy rice in Japan Proc. Crop Sci. Soc. Japan 33; 1 (59-63).

Nakagawa, S. (1966-67):
Methods for measuring and planning water requirements in paddy fields. Jour. JSIDRE 34; p.85-90, 571-577.

Nakanishi, S. & Yamada, M (1957):
Study on characteristics of water temperatures in paddy fields in Japan nation-wide. Water Temperature Research 1:1 (21-30).

Nishio, T. (1972):
Report on irrigation and paddy cultivation studies in the Muda Irrigation Scheme area, West Malaysia.

Osada, A (1972):
Physiological and agronomic characteristics of rice varieties in Thailand with reference to some cultivation factors. Technical Division, Rice Department, Ministry of Agriculture, Thailand.

Osada, A., Sasipra. V., Rahong, M., Dhammanuvong. S. & Chakrabandhu (1973):

Abnormal occurrence of empty grains of Indica rice plants in the dry, hot season in Thailand. Proc. Crop Sci. Soc. Jap. 42; 1. (103 - 109).

Satake, T. & Yoshida, S. (1978):

High temperature-induced sterility in Indica Rices at flowering. Jap. Jour. Crop Sci. 47; 1 (6-17).

Sato, K. (1960):

Accelerating generation of rice varieties by short-day treatment. 38 p. Papers submitted to Minister Secretariate, Ministry of Agriculture and Forestry. (In Japanese)

Sugimoto, K. (1971):

Plant-water relationship of indica rice in Malaysia. TARC Tech. Bull. 1: 1-80.

Tanaka, M. (1962):

Studies on the growth of lowland rice damaged by cool water irrigation and delayed heading. Bull. Aomori Agric. Exp. Stn. 7: 1-107.

Terao. H., Otani, Y., Doi, Y. and Izumi, S. (1942):

Physiological studies of the rice plant with special reference to crop failure caused by the occurrence of unseasonal low temperatures. VIII. The effect of various low temperatures on panicle differentiation, heading and ripening in the different stages from transplanting to heading. Proc. Crop Sci. Soc. Jap. 13: 3 - 4 (317-336).

Tsuboi, Y (1961):

Ecological studies on rice plants with regard to damage caused by wind. Bull Natl. Inst. Agric. Sci. Ser. A, 8 (1-156).

Tsunoda, K. (1964):
Studies on the effects of water-temperatures on growth and yield of rice plants. Bull. Natio. Inst. Agric. Sci. Ser. A, 11.

Tukey J. W. (1949):
Comparing individual means in the variance analysis. Biometrics 5; 2.

Villegas, L. M. & Feuer, R. (1970):
Response of lowland rice to fertilization in the Philippines. Rice Production Manual. University of Philippines & IRRI.

Yoshida, S. & Rivera, C.T. (1978):
Effect of calcium peroxide on seedling emergence of IR36 from puddled soil at different temperatures. IRRI, IRRN 3; 6 (December 1978).

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1977

June

Day	Maximum Air Temperature (c)	Minimum Air Temperature (c)	Relative Humidity at 8:00 a.m (%)	Rainfall (mm)
1	42.4	24.6	51	-
2	40.2	26.0	46	-
3	41.4	26.5	47	-
4	39.6	24.5	61	-
5	41.5	26.0	54	-
6	43.6	27.7	38	trace
7	42.0	27.5	42	-
8	40.6	27.7	47	-
9	40.8	26.8	55	-
10	39.0	23.8	54	-
11	34.7	24.6	63	-
12	39.0	23.7	61	-
13	40.0	26.8	47	-
14	40.4	23.8	67	-
15	39.2	25.5	51	-
16	39.8	26.2	45	-
17	40.3	27.0	51	-
18	39.5	26.5	56	-
19	39.0	26.0	62	-
20	41.6	26.5	43	-
21	41.2	26.0	50	-
22	39.0	24.0	59	-
23	36.2	27.0	65	5.4
24	38.7	25.2	61	5.4
25	40.0	26.4	49	-
26	39.6	28.5	43	-
27	33.2	25.3	73	-
28	38.7	25.7	62	-
29	40.0	27.4	50	-
30	35.0	24.7	43	trace
Mean	39.5	25.9	63	
(Total)				10.8

Source: Meteorological Station in Ed Dueim

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1977

Day	Maximum Air Temperature (c)	Minimum Air Temperature (c)	Relative Humidity at 8:00 a.m (%)	Rainfall (mm)
1	35.6	25.6	75	trace
2	39.6	24.5	44	trace
3	38.0	24.0	67	-
4	38.6	26.2	54	-
5	39.5	26.7	50	-
6	36.4	25.3	73	-
7	38.2	25.7	64	-
8	36.5	26.0	59	-
9	38.0	25.5	57	-
10	36.0	22.7	80	4.9
11	35.6	23.6	71	3.5
12	35.4	26.2	64	-
13	38.0	26.0	62	trace
14	37.8	26.2	65	-
15	33.2	22.6	81	4.0
16	35.7	24.3	76	trace
17	38.3	25.6	56	-
18	38.3	24.2	57	trace
19	33.5	24.4	80	trace
20	35.7	25.0	62	trace
21	37.7	25.7	56	-
22	29.5	22.0	92	18.5
23	35.0	23.3	75	-
24	35.2	24.4	64	-
25	34.0	20.0	83	16.3
26	34.3	24.4	77	-
27	34.8	26.0	74	-
28	37.0	26.2	67	-
29	31.9	25.8	67	-
30	33.3	24.0	79	trace
31	35.5	22.7	61	trace
Mean (Total)	36.0	24.7	67	47.2

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1977 August

Day	Maximum Air Temperature (c)	Minimum Air Temperature (c)	Relative Humidity at 8:00 a.m (%)	Rainfall (mm)
1	34.5	24.7	71	-
2	34.4	24.1	79	trace
3	31.5	23.0	88	3.5
4	34.6	24.2	73	-
5	33.0	23.4	82	0.3
6	29.8	23.9	71	2.5
7	33.0	22.9	81	trace
8	35.5	24.1	78	-
9	26.4	25.5	84	trace
10	33.0	21.0	80	-
11	35.0	24.3	84	-
12	31.8	24.2	88	1.8
13	36.2	24.1	72	-
14	34.4	23.9	76	-
15	35.4	24.7	65	-
16	33.7	24.5	77	0.1
17	31.3	23.3	67	trace
18	35.8	25.2	75	-
19	35.5	24.8	49	-
20	35.6	23.3	81	7.8
21	31.6	24.1	78	6.3
22	35.5	23.3	63	-
23	37.3	26.0	63	-
24	34.0	22.7	73	0.6
25	36.1	25.0	72	-
26	37.2	26.0	65	-
27	33.6	23.5	69	trace
28	30.2	21.8	85	6.0
29	35.0	24.3	75	-
30	36.3	25.0	68	-
31	34.5	24.8	71	-
Mean (Total)	33.9	24.1	74.3	28.9

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1977 September

Day	Maximum Air Temperature (c)	Minimum Air Temperature (c)	Relative Humidity at 8:00 a.m. (%)	Rainfall (mm)
1	37.3	25.0	66	-
2	38.5	25.0	66	-
3	38.0	24.8	54	trace
4	38.6	25.5	57	-
5	40.0	25.5	69	-
6	33.5	22.8	84	1.8
7	37.6	22.5	65	-
8	36.6	24.6	66	-
9	39.0	24.7	56	-
10	36.5	25.0	55	-
11	36.8	25.5	61	-
12	39.0	24.5	52	-
13	39.7	24.5	40	-
14	40.5	24.0	34	-
15	38.0	27.0	52	trace
16	36.0	25.7	67	trace
17	32.0	21.0	79	11.5
18	34.2	24.0	84	-
19	34.6	24.0	73	trace
20	37.6	24.5	67	-
21	36.0	24.4	76	-
22	36.0	24.4	69	-
23	37.1	24.7	45	-
24	38.9	25.8	49	-
25	35.2	22.3	69	5.5
26	36.7	23.0	70	-
27	39.6	24.7	62	-
28	37.2	25.7	53	-
29	36.5	25.4	65	-
30	38.0	25.5	65	-
Mean (Total)	37.2	24.5	62	18.8

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1977 October

Day	Maximum Air Temperature (c)	Minimum Air Temperature (c)	Relative Humidity at 8:00 a.m (%)	Rainfall (mm)
1	32.6	24.0	50	-
2	36.4	18.6	33	-
3	38.5	25.8	58	-
4	40.2	25.7	44	-
5	37.0	25.2	62	-
6	36.6	25.5	65	-
7	38.2	27.0	68	-
8	38.6	25.5	51	-
9	38.8	24.7	53	-
10	36.5	24.7	56	trace
11	36.5	24.4	53	-
12	39.0	26.0	49	trace
13	37.5	28.1	36	trace
14	36.3	25.5	61	-
15	36.5	26.5	53	-
16	33.1	22.2	93	4.6
17	37.9	21.3	59	0.5
18	39.5	24.7	78	-
19	37.1	25.4	67	-
20	36.5	26.5	27	-
21	35.3	23.8	28	-
22	32.3	22.5	30	-
23	32.6	23.0	31	-
24	32.9	18.6	33	-
25	34.1	18.8	29	-
26	33.0	20.7	35	-
27	32.5	19.8	30	-
28	33.2	18.4	35	-
29	32.4	20.0	30	-
30	32.1	19.5	21	-
31	32.7	17.2	38	-
Mean (Total)	35.7	23.2	47	5.1

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1977 November

Day	Air Temperature Maximum (c)	Air Temperature Minimum (c)	Water Temperature Maximum (c)	Water Temperature Minimum (c)	Relative Humidity at 8:00 a.m (%)	Rainfall (mm)
1	35.0	19.6	33.1	12.2	36	-
2	35.7	21.1	32.5	15.3	37	-
3	34.0	22.2	29.5	14.0	30	-
4	33.6	21.6	27.1	14.6	24	-
5	35.0	20.6	31.2	14.5	27	-
6	34.5	21.4	31.0	13.2	31	-
7	35.6	20.0	30.9	14.2	39	-
8	36.6	22.8	31.9	14.8	28	-
9	31.1	22.9	30.9	14.9	31	-
10	34.5	22.0	29.5	14.1	34	-
11	32.6	21.0	28.9	14.5	33	-
12	29.7	20.1	29.0	13.0	38	-
13	32.0	19.5	29.1	11.9	17	-
14	34.6	17.0	30.8	12.0	35	-
15	34.0	20.5	30.5	13.8	41	-
16	34.6	20.3	29.0	13.5	31	-
17	33.2	19.8	28.0	13.2	28	-
18	33.0	14.6	29.0	13.0	32	-
19	33.2	16.4	30.0	12.6	34	-
20	32.8	19.5	30.0	12.3	35	-
21	33.2	17.7	28.2	11.9	34	-
22	33.4	18.8	29.0	13.2	37	-
23	34.3	17.4	29.8	14.6	41	-
24	35.2	20.0		15.5	37	-
25	36.2	20.2			38	-
26	37.2	21.0			42	-
27	36.6	22.7			45	-
28	36.5	22.8	33.0		53	-
29	35.5	23.0	30.5	17.5	48	-
30	33.7	22.7	30.0	17.5	52	-
Mean	34.4	20.3	30.1	13.4	36	

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1977 December

Day	Air Temperature Maximum (c)	Air Temperature Minimum (c)	Water Temperature Maximum (c)	Water Temperature Minimum (c)	Relative Humidity at 8:00 a.m. (%)	Rainfall (mm)
1	35.1	21.8	30.0	17.3	49	-
2	35.7	19.0	30.8	17.1	47	-
3	35.6	21.2		17.1	48	-
4	36.7	23.1			43	-
5	35.5	21.5			34	-
6	35.3	20.7	30.3	15.5	35	-
7	34.2	21.0	30.5	16.1	37	-
8	31.9	20.3		14.5	33	-
9	31.2	18.0			64	-
10	33.8	18.1			37	-
11	34.0	19.4			40	-
12	34.5	20.3			33	-
13	29.4	20.5	25.6		25	-
14	27.0	17.7	23.8	12.0	33	-
15	26.0	15.1	24.5	11.2	37	-
16	26.4	14.8	24.8	11.2	34	-
17	31.2	16.0	27.0	11.0	42	-
18	33.6	17.5	28.0	12.3	41	-
19	34.4	18.8	27.5	14.2	37	-
20	33.2	19.4	30.0	14.3	41	-
21	29.9	18.4	26.6	12.5	31	-
22	26.6	16.3	23.5	11.6	35	-
23	24.5	14.5	23.2	11.7	30	-
24	24.5	14.5	23.0	11.3	31	-
25	25.8	14.2	22.3	11.0	34	-
26	25.4	14.2	23.6	11.2	31	-
27	27.0	14.7	25.5	10.0	31	-
28	28.2	14.7	24.6	10.5	34	-
29	28.5	15.5	24.5	10.4	29	-
30	27.5	13.7	25.7	10.8	28	-
31	28.5	14.4	26.1	9.8	28	-
Mean	30.7	17.7	26.2	12.7	37	

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1978 January

Day	Air Temperature Maximum (c)	Air Temperature Minimum (c)	Water Temperature Maximum (c)	Water Temperature Minimum (c)	Relative Humidity at 8:00 a.m (%)	Rainfall (mm)
1	31.0	14.8	27.0	11.3	36	-
2	31.4	13.4	27.8	12.7	49	-
3	29.6	13.6	24.3	11.9	47	-
4	25.5	14.0	25.3	10.5	42	-
5	27.2	13.2	25.6	8.4	41	-
6	31.2	13.4	27.9	10.0	30	-
7	32.0	16.7	27.8	11.7	34	-
8	28.2	14.4	23.4	11.3	38	-
9	26.2	14.3	22.5	10.0	32	-
10	23.5	13.7		9.3	33	-
11	23.2	13.4			43	-
12	28.3	12.0			31	-
13	30.2	14.1	24.5		38	-
14	30.2	15.8	26.5	11.0	44	-
15	30.1	12.1	25.0	10.2	41	-
16	29.0	14.3	24.0	9.3	28	-
17	30.6	14.9	28.0	10.5	33	-
18	31.7	15.2	28.1	10.4	41	-
19	33.2	16.5	28.8	12.0	43	-
20	34.9	17.8	29.8	14.3	53	-
21	35.8	18.8	31.3	14.7	50	-
22	34.5	18.5	30.6	14.0	37	-
23	36.0	18.5	29.7	15.3	40	-
24	34.4	19.8		15.3	33	-
25	31.6	18.6			25	-
26	31.2	16.6			28	-
27	30.8	17.0	28.2		34	-
28	31.5	18.0	27.9	11.3	25	-
29	33.5	17.6		13.7	38	-
30	33.6	18.9			50	-
31	28.5	19.6			14	-
Mean	30.6	15.8	27.0	11.7	37	

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1978

February

Day	Air Temperature Maximum (°c)	Air Temperature Minimum (°c)	Water Temperature Maximum (°c)	Water Temperature Minimum (°c)	Relative Humidity at 8:00 a.m (%)	Rainfall (mm)
1	31.6	14.8	30.7		36	-
2	36.6	13.4	30.0	15.8	49	-
3	34.5	20.3	30.5	13.2	30	-
4	36.0	21.3	31.8	17.0	37	-
5	39.7	20.4	31.8	16.3	55	-
6	39.6	19.5	34.9	16.1	44	-
7	31.3	18.8		13.5	34	-
8	30.2	19.0			27	-
9	30.9	17.0	28.2		27	-
10	31.7	18.8	26.9	12.8	27	-
11	32.7	18.0	31.9	12.5	27	-
12	32.7	18.4	30.8	12.8	30	-
13	33.0	18.8	31.0	12.8	33	-
14	34.1	16.3	32.5	12.6	41	-
15	36.6	18.0	33.1	15.2	46	-
16	37.1	18.6	33.6	17.0	46	-
17	33.8	18.4	29.7	16.0	34	-
18	34.7	18.0	31.5	13.9	29	-
19	37.8	19.8	34.7	15.0	33	-
20	33.1	20.2		15.2	30	-
21	32.4	18.1			33	-
22	33.9	17.0			34	-
23	34.0	17.6	30.0	13.2	33	-
24	32.5	17.8	28.8	12.9	35	-
25	31.8	16.5	27.5	12.6	34	-
26	32.1	16.5	29.8	13.0	34	-
27	33.6	16.9	31.8	14.0	34	-
28	35.6	17.5	32.9	13.5	31	-
Mean	34.1	18.1	31.1	14.2	35	

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1978

March

Date	Air Temperature Maximum (°C)	Air Temperature Minimim (°C)	Water Temperature Maximum (°C)	Water Temperature Minimum (°C)	Relative Humidity at 8:00 A.M. (%)	Rainfall (mm)
1	37.4	19.3	32.5	15.0	31	-
2	38.0	20.4	34.6	15.4	30	-
3	39.6	21.6	34.0	17.0	38	-
4	40.5	22.4	34.2	16.3	25	-
5	39.7	21.0	32.8	16.2	21	-
6	40.1	20.9	33.8	15.9	20	-
7	38.9	21.2	33.3	15.5	22	-
8	37.7	21.6	33.5	15.9	31	-
9	37.2	21.2	33.5	15.3	26	-
10	38.3	19.5	34.6	15.4	42	-
11	37.0	21.0	34.5	17.3	19	-
12	35.2	25.0	28.9	19.0	31	-
13	28.2	17.0		15.2	37	2.6
14	32.0	20.5			25	-
15	34.1	22.0	29.8		21	-
16	33.7	19.4	28.6	13.5	27	-
17	34.6	15.8	31.2	14.0	23	-
18	36.1	20.0	30.0	13.9	23	-
19	36.6	20.4	31.0	15.0	24	-
20	36.1	21.4	29.0	14.9	26	-
21	37.2	18.5	30.9	13.5	27	-
22	37.8	22.0	31.8	15.5	25	-
23	37.1	21.0	31.0	14.2	23	-
24	36.6	20.5	31.5	15.2	25	-
25	34.5	20.2	29.3	13.8	19	-
26	36.0	19.9		15.4	21	-
27	36.0	21.2			26	-
28	36.6	21.0			23	-
29	36.9	20.4			29	-
30	36.5	20.5	30.0		26	-
31	35.9	20.3	29.1	15.0	25	-
Mean	36.5	20.6	31.7	15.3	26	2.6

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1978

April

Date	Air Temperature Maximum (°C)	Air Temperature Minimum (°C)	Water Temperature Maximum (°C)	Water Temperature Minimum (°C)	Relative Humidity at 8:00A.M. (%)	Rainfall (mm)
1	38.8	20.4	34.0	15.7	30	-
2	41.3	21.8		14.9	28	-
3	41.0	22.6			27	-
4	41.0	23.7			30	-
5	41.4	25.5			26	-
6	41.1	23.4			30	-
7	41.0	24.8	35.9		31	-
8	42.0	25.4	38.5	17.0	24	-
9	42.6	28.0	37.5	17.0	15	-
10	43.0	27.5	39.5	18.2	23	-
11	41.7	27.6	38.8	22.2	41	-
12	43.7	28.0	38.9	23.4	34	-
13	43.0	27.0	36.8	18.0	27	-
14	39.5	25.0	37.8	16.3	20	-
15	40.0	21.0	37.5	16.0	12	-
16	40.6	21.4	39.9	17.5	27	-
17	44.6	24.0	41.0	18.2	15	-
18	43.2	30.5	40.8	22.0	35	-
19	41.0	29.0		23.0	38	1.1
20	37.7	26.8	39.6	23.5	31	-
21	40.0	27.6	41.4	23.5	47	-
22	40.8	26.5	36.6	21.0	26	-
23	39.7	27.0	36.0	21.3	25	-
24	39.1	25.5	34.6	19.0	15	-
25	39.4	23.7	29.8	18.0	18	-
26	41.3	24.0			17	-
27	39.0	27.3			24	-
28	42.5	26.8	38.6	20.0	21	-
29	41.9	25.8	37.0	19.0	23	-
30	39.7	24.0			22	-
Mean	41.1	26.4	37.6	19.3	26	1.1

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1978

May

Date	Air Temperature* Maximum (°C)	Minimum (°C)	Water Temperature Maximum (°C)	Minimum (°C)	Relative Humidity at 8:00A.M.* (%)	Rainfall* (mm)
1	39.3	23.2			17	-
2	39.7	24.4			19	-
3	42.3	23.9			24	-
4	42.7	24.4			37	-
5	43.0	25.5			19	-
6	43.5	26.2	42.2	21.5	48	-
7	43.2	27.6	41.5	21.2	22	-
8	39.5	27.8	37.4	22.9	47	-
9	40.7	28.0	40.8	23.4	52	-
10	40.1	27.3	40.9	23.9	55	-
11	40.9	26.6	40.5	24.0	53	0.6
12	41.3	26.0	40.0	23.5	59	TR
13	40.6	27.0	40.0	24.3	48	-
14	41.2	26.6	39.9	24.1	47	-
15	40.1	26.8	39.0	23.2	57	-
16	41.2	27.5	38.0	24.0	45	-
17	40.1	26.3	38.0	22.7	40	-
18	43.2	27.2	39.0	23.4	37	-
19	43.0	25.7	38.9	20.5	32	-
20	42.5	29.0	38.5	21.3	37	-
21	41.9	29.2			38	-
22	41.2	29.0			26	-
23	39.8	26.4			44	-
24	43.7	27.2			19	-
25	41.7	26.0			49	-
26	-	25.2			12	-
27	-	27.7			44	-
28	-	28.4			49	-
29	-	30.1			42	-
30	-	27.0			51	TR
31	-	26.2			47	-
Mean	41.5	26.8	39.6	22.9	39	0.6

Note *: The data on air temperature relative humidity and rainfall are from the meteorological station at Ed-Dueim.

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED DUEIM

June, 1978

Date	Air Temperature Maximum (C)	Air Temperature Minimum (C)	Water Temperature Maximum (C)	Water Temperature Minimum (C)	Relative Humidity at 8:00 a.m. (%)	Rainfall (mm/day)
1	-*	29.5			38	
2	-	27.2			49	
3	-	27.0			47	
4	-	28.2			41	1.4
5	-	28.0			39	
6	-	29.0			17	
7	-	25.7			37	
8	-	25.6			19	
9	-	24.4			22	
10	-	25.2			19	
11	-	25.0			50	
12	-	23.2			49	
13	-	24.6			16	
14	-	25.5	39		17	
15	-	31.7		17	31	
16	-	25.7	39		31	
17	-	24.9	32	17	51	
18	-	25.6		21	45	
19	-	27.6			37	
20	-	26.5			43	
21	-	27.0	34		57	
22	-	28.0	34	21	51	TR
23	39.5	25.8	34	22	55	
24	37.4	28.2	31	23	61	
25	38.6	26.2		23	61	1.5
26	38.6	25.7	32		62	
27	38.0	23.5	33	22	57	
28	38.7	26.7	33	22	55	72.1
29	36.9	27.0		24	54	
30	34.9	18.0	32		82	29.7
Mean	37.8	26.2	34.0	21.0	43	104.7

Note *: No data on account of a accident at the meteorological station at Dueim.

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM

July, 1978

Date	Air Temperature Maximum (C)	Air Temperature Minimum (C)	Water Temperature Maximum (C)	Water Temperature Minimum (C)	Relative Humidity at 8:00 a.m. %	Rainfall (mm/day)
1	36.6	24.4	33	22	73	-
2	32.5	21.6	31	23	75	3.2
3	35.6	23.4	32	23	72	-
4	31.6	21.7	31	21	75	0.8
5	33.4	23.4	31	23	73	0.8
6	35.6	24.7	31	24	70	2.7
7	37.2	25.8	28	25	67	0.5
8	30.2	21.4	28	23	83	-
9	36.0	21.7	33	23	77	-
10	34.2	24.7	-	23	64	7.5
11	35.0	22.8	31	-	79	-
12	36.1	25.4	31	21	67	35.5
13	30.5	20.6	36	23	83	-
14	34.6	23.2	35	23	77	-
15	36.0	24.7	32	25	67	56.2
16	31.1	24.6	31	23	72	-
17	30.7	20.2	33	22	83	-
18	35.4	22.7	32	24	73	75.5
19	35.2	25.7	-	23	70	34.0
20	24.2	19.8	-	-	100	TR
21	31.4	20.0	37	-	92	TR
22	30.4	21.8	35	22	71	-
23	34.5	23.8	35	26	78	12.0
24	32.5	22.3	35	25	92	6.3
25	26.5	24.2	34	25	90	2.0
26	29.7	22.2	34	21	93	-
27	31.1	25.8	36	24	81	-
28	31.6	23.4	37	23	76	-
29	32.5	25.0	36	23	69	-
30	35.3	25.4	-	24	73	-
31	35.4	23.2	-	-	75	-
Mean (Total)	33.0	23.2	33.0	23.0	77	237.0

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1978

August

Date	Air Temperature Maximum (C)	Air Temperature Minimum (C)	Water Temperature Maximum (C)	Water Temperature Minimum (C)	Relative Humidity at 8:00 a.m. %	Rainfall (mm)
1	34.1	25.4	36.0	24.1	73	-
2	35.1	24.6	34.3	25.0	65	-
3	32.5	20.8	37.0	22.6	84	25.5
4	32.5	25.4	37.3	25.6	75	-
5	34.8	25.4	36.4	25.1	75	-
6	30.6	18.9	34.0	25.3	89	25.5
7	38.6	23.7	38.0	24.0	83	-
8	33.7	22.1	37.2	25.3	78	-
9	28.5	25.2	31.9	25.9	79	-
10	33.1	24.4	37.9	24.8	84	-
11	32.7	23.5	37.0	24.8	89	0.95
12	33.4	24.0	37.5	24.6	79	-
13	33.0	24.4	38.6	24.9	73	-
14	34.5	25.8	36.9	24.3	73	-
15	30.2	22.8	32.6	23.5	87	TR
16	34.0	21.8	38.0	21.8	80	4.0
17	31.2	22.5	37.0	24.1	87	6.5
18	34.0	23.7	36.8	23.9	77	-
19	38.1	22.2	30.5	24.7	82	45.0
20	31.8	22.8	37.1	23.4	87	49.4
21	32.2	23.7	37.6	25.5	81	TR
22	33.2	23.8	38.3	24.9	81	TR
23	32.5	24.8	38.5	25.1	77	-
24	34.6	25.6	39.6	25.1	67	-
25	35.2	24.0	39.5	24.3	64	-
26	33.8	23.2	36.0	24.5	64	-
27	35.1	24.4	39.6	26.3	72	-
28	37.5	25.2	39.8	24.5	65	-
29	33.6	23.5	35.1	23.8	71	TR
30	36.5	23.8	35.6	24.2	77	-
31	38.7	22.6	39.8	24.2	50	-
Mean (Total)	33.7	23.7	36.8	24.5	76	156.85

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM IN 1978

September

Date	Air Temperature Maximum (C)	Air Temperature Minimum (C)	Water Temperature Maximum (C)	Water Temperature Minimum (C)	Relative Humidity at 8:00 a.m. %	Rainfall (mm)
1	38.1	23.0	39.5	23.8	55	-
2	36.6	25.0	38.3	23.0	73	-
3	32.1	25.3	37.0	24.1	65	-
4	34.0	25.4	36.8	23.9	67	-
5	35.4	25.4	37.8	23.3	64	TR
6	33.1	24.5	32.2	24.5	68	TR
7	33.2	23.8	34.5	23.5	75	-
8	34.6	23.6		23.4	63	-
9	38.6	25.0			61	-
10	32.0	21.4			83	8.0
11	34.0	23.9			74	-
12	36.0	23.9	37.0		68	-
13	38.4	25.3	34.0	23.9	58	-
14	34.5	23.2	35.1	23.5	68	-
15	34.5	24.2	34.0	23.8	75	-
16	35.2	25.5	33.9	23.5	71	-
17	34.0	24.8	32.0	24.3	62	-
18	36.0	24.4	34.0	23.5	73	-
19	37.8	24.7	33.5	25.0	64	-
20	37.4	24.2	34.0	24.5	57	2.7
21	38.4	24.2	34.2	24.0	58	-
22	38.4	23.8	34.3	23.5	70	-
23	40.0	25.3	34.0	23.1	56	-
24	37.3	23.2	33.0	24.0	24	-
25	36.4	25.5	34.5	23.5	69	-
26	35.5	26.5		23.0	66	-
27	37.2	24.4			62	3.5
28	38.3	25.2	34.0		59	-
29	38.2	26.4	34.1	25.3	62	-
30	35.2	24.1	33.7	24.0	64	TR
Mean (Total)	36.2	24.5	34.8	23.8	65	13.9

ANNEX 1. METEOROLOGICAL CONDITIONS AT ED-DUEIM IN OCTOBER, 1978

Date	Air Temperature Maximum (°C)	Air Temperature Minimum (°C)	Water Temperature Maximum (°C)	Water Temperature Minimum (°C)	Relative Humidity at 8: C a.m. (%)	Rainfall (mm)
1	36.6	24.5	35.3	23.4	59	-
2	35.6	24.6	35.4	23.5	65	-
3	36.9	25.1	34.5	23.0	65	-
4	38.4	25.4	33.5	23.6	56	-
5	38.0	25.5	34.8	23.5	56	-
6	38.2	24.5	35.3	23.3	65	-
7	38.5	24.6	35.9	23.4	53	-
8	39.0	26.6	36.0	22.8	51	-
9	38.3	21.3	31.0	21.0	38	-
10	38.0	22.7	30.0	23.0	52	-
11	34.0	20.6	32.7	22.5	67	12.8
12	35.8	24.0	34.2	23.0	61	-
13	37.2	23.4	36.0	23.4	59	-
14	37.7	26.3	37.0	24.0	54	-
15	36.4	23.0	38.5	23.5	71	-
16	37.9	22.7	36.2	22.3	49	-
17	37.3	25.3	36.1	23.0	74	-
18	40.0	26.5	38.5	24.2	56	-
19	40.5	25.0	35.8	22.5	43	-
20	39.5	25.2	34.0	21.0	44	-
21	39.0	25.2	35.8	22.5	60	-
22	39.3	25.2	35.0	22.5	63	-
23	38.8	24.2	36.2	22.5	54	-
24	39.5	22.8	36.5	22.0	58	-
25	39.0	22.8	33.5	19.3	36	-
26	39.0	26.4	32.0	20.2	64	-
27	39.2	26.4	35.2	21.4	41	-
28	39.0	23.6	33.5	23.3	35	-
29	37.6	26.4	33.4	21.6	41	4.9
30	37.0	25.4	32.4	21.4	28	-
31	37.0	24.9	32.9	21.2	40	-
Mean	(38.1)	(24.5)	(34.7)	(22.5)	(54)	(17.7)

ANNEX 1. METEOROLOGICAL CONDITIONS AT ED-DUEIM November, 1978

Date	Air Temperature		Water Temperature		Relative Humidity	Rainfall
	Max. (°C)	Min. (°C)	Max. (°C)	Min. (°C)	(%)	(mm)
1	36.4	24.6	33.0	20.5	42	0
2	37.5	24.3	32.5	21.7	37	0
3	37.7	24.4	32.5	22.0	40	0
4	37.6	23.9	32.0	22.3	39	0
5	36.3	24.0	32.5	21.5	40	0
6	35.0	23.4	31.5	21.5	39	0
7	32.5	21.4	27.5	23.8	31	0
8	33.5	20.4	26.3	22.9	39	0
9	33.5	20.4	27.0	23.0	33	0
10	32.2	20.2	29.0	23.0	33	0
11	30.5	19.6	30.0	21.0	38	0
12	30.5	18.3	31.5	20.0	36	0
13	29.5	18.2	27.5	14.0	36	0
14	29.5	18.0	27.0	15.0	36	0
15	32.0	17.8	27.5	14.8	36	0
16	30.5	18.2	29.0	16.0	38	0
17	30.0	17.8	28.5	17.0	34	0
18	32.7	15.0	27.0	15.0	34	0
19	32.5	15.2	26.0	16.0	31	0
20	32.8	18.9	26.5	14.0	36	0
21	32.4	19.2	27.0	15.5	37	0
22	32.0	18.4	26.0	14.5	44	0
23	31.6	18.4	27.0	13.0	31	0
24	31.6	18.0	26.5	14.0	30	0
25	32.2	18.2	29.5	13.0	35	0
26	32.4	18.2	25.0	14.0	32	0
27	32.8	17.8	26.0	14.5	31	0
28	35.0	19.4	23.5	12.5	42	0
29	37.0	20.6	27.0	15.5	51	0
30	36.4	20.4	29.0	17.0	48	0
31						
Mean	33.2	19.8	28.4	17.6	37.0	0

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM December, 1978

Date	Air Temperature		Water Temperature		Relative Humidity	Rainfall
	Max. (°C)	Min. (°C)	Max. (°C)	Min. (°C)	(%)	(mm)
1	36.4	20.3	28.0	17.0	46	0
2	36.0	20.4	30.0	17.0	45	0
3	33.5	20.3	30.0	15.5	33	0
4	33.2	19.8	27.5	15.0	36	0
5	33.8	18.6	29.0	14.0	33	0
6	34.5	19.6	28.5	14.0	26	0
7	35.5	21.0	29.5	14.0	53	0
8	35.7	21.4	26.0	13.5	55	0
9	33.5	21.0	24.0	15.0	45	0
10	31.6	20.4	25.0	14.8	35	0
11	27.6	18.2	25.0	14.6	40	0
12	26.5	16.4	24.0	13.0	34	0
13	25.1	14.0	21.0	12.0	39	0
14	27.2	14.4	22.0	11.0	40	0
15	29.6	15.7	25.0	12.0	40	0
16	31.6	14.4	23.0	13.0	40	0
17	32.6	18.2	23.0	14.5	35	0
18	33.0	18.2	24.0	14.5	41	0
19	34.0	18.3	25.0	15.0	51	0
20	34.2	18.2	24.0	14.8	45	0
21	33.8	21.1	25.0	14.5	50	0
22	32.9	18.2	30.0	15.0	53	0
23	33.1	17.0	25.0	15.0	52	0
24	36.0	17.7	25.5	14.5	50	0
25	33.6	22.0	25.0	14.5	49	0
26	32.0	20.0	24.8	14.7	30	0
27	32.1	19.5	25.5	15.0	28	0
28	31.0	19.3	24.0	15.0	51	0
29	32.3	18.2	27.0	14.0	33	0
30	30.6	17.7	26.0	12.0	37	0
31	30.6	18.0	26.0	13.5	40	0
Mean	32.4	18.6	25.7	14.3	41.5	0

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM January, 1979

Date	Air Temperature		Water Temperature		Relative Humidity	Rainfall
	Max. (°C)	Min. (°C)	Max. (°C)	Min. (°C)	(%)	(mm)
1	31.0	17.9	25.0	14.0	38	0
2	30.9	18.0	24.0	14.0	40	0
3	32.1	18.0	24.5	14.0	44	0
4	32.0	18.0	28.0	14.0	42	0
5	31.0	18.6	26.0	15.0	25	0
6	32.2	19.6	25.5	14.0	47	0
7	32.2	19.4	24.5	13.5	51	0
8	32.2	19.5	23.5	13.5	51	0
9	29.0	18.5	22.0	13.5	32	0
10	24.5	13.0	23.0	10.0	43	0
11	28.6	13.2	24.5	11.0	43	0
12	31.5	14.2	27.0	8.5	41	0
13	32.6	17.3	28.0	12.5	47	0
14	34.5	18.0	28.5	13.0	41	0
15	35.5	17.5	30.0	13.5	36	0
16	34.6	18.5	30.5	13.5	30	0
17	33.6	17.3	28.0	13.5	43	0
18	34.2	19.2	31.0	15.0	44	0
19	32.1	19.5	27.0	15.0	52	0
20	31.6	17.7	31.0	15.0	61	0
21	33.4	19.8	32.0	15.0	51	0
22	32.6	20.2	31.0	14.0	51	0
23	30.4	17.8	31.0	15.0	32	0
24	31.0	17.0	28.0	11.0	32	0
25	31.4	17.5	29.0	15.0	32	0
26	32.0	17.0	31.0	15.0	34	0
27	31.6	17.2	29.5	11.5	34	0
28	31.2	14.8	30.0	14.0	34	0
29	31.8	18.0	26.5	10.5	32	0
30	32.5	17.5	27.5	11.0	34	0
31	33.5	17.8	30.5	10.5	34	0
Mean	30.8	17.7	27.8	13.0	40.4	

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM February, 1979

Date	Air Temperature		Water Temperature		Relative Humidity*	Rainfall
	Max. (°C)	Min. (°C)	Max. (°C)	Min. (°C)	(%)	(mm)
1	33.2	17.9	30.5	11.0	41	0
2	33.7	17.8	32.6	14.0	37	0
3	34.4	17.8	32.0	12.5	41	0
4	33.5	17.8	31.5	12.0	43	0
5	33.6	18.0	30.6	12.5	36	0
6	33.4	18.4	30.8	12.5	25	0
7	33.5	17.8	30.6	13.5	31	0
8	33.0	17.2	30.0	13.5	33	0
9	33.4	18.4	28.5	12.5	31	0
10	33.6	18.5	28.5	11.8	32	0
11	31.2	17.8	29.5	12.5	31	0
12	34.0	16.8	32.0	13.0	30	0
13	35.0	19.2	31.0	13.5	43	0
14	35.6	19.5	32.0	13.0	37	0
15	37.3	18.4	32.0	14.0	33	0
16	38.0	21.3	32.5	15.5	38	0
17	38.3	28.8	34.0	16.0	44	0
18	38.9	21.3	34.5	15.5	40	0
19	39.3	22.5	33.0	17.5	40	0
20	38.6	24.0	34.5	18.6	38	0
21	39.6	24.0	33.5	17.5	36	0
22	39.5	24.0	36.0	16.5	26	0
23	39.4	24.1	36.5	17.5	31	0
24	40.5	23.8	35.5	16.6	39	0
25	39.0	24.5	35.5	18.0	39	0
26	40.0	26.0	35.5	19.5	44	0
27	41.0	26.4	39.0	20.5	42	0
28	40.4	25.4	36.5	18.5	40	0
29						
30						
31						
Mean	36.4	21.0	35.7	15.0	36.3	

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM March, 1979

Date	Air Temperature		Water Temperature		Relative Humidity*	Rainfall
	Max. (°C)	Min. (°C)	Max. (°C)	Min. (°C)	(%)	(mm)
1	39.6	25.4	35.0	18.0	53	0
2	41.3	25.4	36.9	19.3	29	0
3	40.0	25.2	35.3	17.8	39	0
4	39.0	25.0	35.3	19.3	33	0
5	38.0	22.0	32.8	16.3	26	0
6	39.5	20.4	34.6	15.9	33	0
7	40.5	25.5	35.0	16.5	31	0
8	34.0	22.4	32.0	15.3	24	0
9	30.0	18.8	26.5	13.0	34	0
10	30.0	17.0	27.9	13.5	32	0
11	31.5	16.5	30.1	13.1	32	0
12	32.0	17.6	29.0	12.0	25	0
13	31.6	17.8	27.3	12.3	22	0
14	33.0	17.4	27.0	12.3	25	0
15	34.5	33.0	28.8	12.5	17	0
16	25.0	20.2	29.0	14.0	33	0
17	36.0	19.4	29.5	14.3	25	0
18	37.0	20.4	31.3	14.0	22	0
19	37.8	20.0	30.9	15.1	24	0
20	38.3	20.8	31.0	16.0	26	0
21	38.4	21.5	32.9	16.0	31	0
22	40.5	22.5	32.4	16.4	43	0
23	41.6	23.6	34.9	17.7	31	0
24	42.4	27.3	37.6	18.6	29	0
25	40.0	26.0	37.6	18.7	31	0
26	36.0	24.6	37.3	16.5	24	0
27	37.6	20.4	29.9	14.7	24	0
28	36.4	19.0	29.5	13.1	24	0
29	37.5	22.1	35.3	16.3	44	0
30	40.7	22.8	35.0	16.3	22	0
31	41.5	22.5	34.8	17.0	19	0
Mean	36.8	22.0	32.3	15.5	29	

Note *: Observed value at 8.00 a.m.

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM April, 1979

Date	Air Temperature		Water Temperature		Relative Humidity	Rainfall
	Max. (°C)	Min. (°C)	Max. (°C)	Min. (°C)	(%)	(mm)
1	40.5	22.4	32.2	18.0	26	0
2	41.5	23.5	34.5	16.8	28	0
3	43.5	22.6	35.5	17.6	27	0
4	44.0	25.6	36.3	16.6	31	0
5	43.6	26.7	36.5	20.3	24	0
6	43.0	27.3	37.0	19.8	29	0
7	40.0	26.5	36.0	18.8	29	0
8	35.5	25.0	32.5	18.0	26	0
9	36.4	22.5	30.5	16.0	20	0
10	37.5	20.7	29.5	14.5	27	0
11	39.5	21.0	29.0	15.0	21	0
12	39.6	21.4	28.0	14.5	25	0
13	41.8	23.5	31.0	15.8	21	0
14	xx	23.4	32.5	18.5	27	0
15	xx	24.2	31.5	17.5	24	0
16	xx	26.4	29.5	18.5	36	0
17	xx	27.4	30.5	20.5	36	0
18	xx	27.5	32.0	21.0	48	0
19	xx	27.3	30.0	18.0	39	0
20	xx	29.8	36.3	23.0	28	0
21	xx	27.6	38.0	25.0	32	0
22	xx	26.0	34.0	23.0	34	0
23	xx	26.1	31.0	23.0	58	0
24	xx	23.5	30.0	22.5	21	0
25	xx	29.0	29.5	19.5	21	0
26	xx	27.7	29.5	20.0	30	0
27	xx	28.7	28.0	19.0	29	0
28	xx	27.5	30.0	20.0	36	0
29	xx	31.3	31.5	24.0	36	0
30	xx	25.8	32.5	23.0	68	0
31						
Mean	40.5	25.6	32.2	19.3	31.2	

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM May 1979

Date	Air Temperature		Water Temperature		Relative Humidity	Rainfall
	Max. (°C)	Min. (°C)	Max. (°C)	Min. (°C)	(%)	(mm)
1	xx	27.0	36.5	21.5	57	0
2	xx	25.1	29.5	24.5	63	0
3	xx	26.3	32.0	23.0	59	0
4	xx	26.4	33.5	23.5	64	0
5	41.0	27.5	34.5	24.0	48	0
6	37.5	23.5	33.5	23.5	77	2.5
7	37.8	25.4	28.0	17.0	22	0
8	38.5	23.8	28.0	18.0	20	0
9	39.2	22.5	30.5	19.5	65	0
10	41.5	20.0	31.0	16.5	21	0
11	41.5	23.2	30.0	18.0	24	0
12	41.5	23.6	31.5	20.0	47	0
13	42.5	25.8	31.0	22.0	28	0
14	41.5	25.6	33.0	22.5	49	0
15	44.5	24.8	34.5	22.5	29	0
16	40.5	26.0	32.0	22.0	36	0
17	41.5	29.0	31.0	24.0	23	0
18	41.5	27.0	32.0	24.5	46	11.0
19	41.7	27.0	31.5	20.5	37	0
20	41.5	27.8	30.0	23.5	58	0
21	36.5	28.4	30.0	22.0	53	0
22	39.4	27.2	29.5	21.0	21	0
23	41.2	27.0	30.5	22.0	17	0
24	40.7	25.5	29.5	20.5	49	0
25	41.6	27.5	29.0	19.0	31	0
26	42.4	27.0	30.0	22.0	19	TR
27	39.3	26.5	32.0	22.5	45	TR
28	40.7	28.5	29.5	22.0	43	TR
29		25.6	29.5	22.0	48	0
30						
31						
Mean						13.5

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM June, 1979

Date	Air Temperature		Water Temperature		Relative Humidity	Reinfall
	Max. (°C)	Min. (°C)	Max. (°C)	Min. (°C)	(%)	(mm)
1	39.2	28.0	31.5	23.0	46	0
2	39.6	26.5	30.5	23.0	49	0
3	42.6	26.8	33.0	23.0	42	TR
4	39.3	24.8	41.0	23.0	70	TR
5	41.6	27.0	35.5	22.0	45	TR
6	39.5	29.0	38.0	23.0	43	TR
7	37.8	26.8	34.5	22.0	63	0.4
8	38.5	27.0	34.0	22.0	50	0
9	34.2	25.0	35.0	23.0	77	TR
10	36.5	21.4	33.5	21.5	67	5.2
11	40.2	24.5	35.0	23.0	46	0
12	41.6	26.7	35.5	24.5	47	0
13	36.0	26.4	34.0	23.0	52	0
14	34.5	25.7	30.0	22.5	71	0
15	38.2	25.5	30.0	23.0	61	0
16	38.7	24.9	34.5	23.5	54	TR
17	37.3	24.5	35.0	22.5	55	0
18	38.8	26.0	34.5	22.0	50	0
19	39.6	26.4	34.0	23.0	50	0
20	38.9	25.1	34.0	22.0	58	0
21	39.7	25.5	36.0	23.0	55	0
22	40.4	21.0	35.0	23.0	52	0
23	40.3	27.6	35.0	23.0	51	0
24	37.8	24.0	36.5	22.0	75	TR
25	38.7	25.5	36.5	23.0	53	0
26	37.3	24.8	37.0	23.5	65	1.6
27	38.5	26.0	34.0	23.0	74	TR
28	35.3	23.4	36.0	23.0	80	6.1
29	38.6	23.5	34.0	23.5	79	0
30		25.0	36.0	23.0	61	0
31						
Mean	38.6	25.5	34.6	22.8	58	13.3

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM

July, 1979

Date	Air Temperature Max. (C)	Air Temperature Min. (C)	Water Temperature Max. (C)	Water Temperature Min. (C)	Relative Humidity (%)	Rainfall (mm)
1	38.0	27.0	35.0	24.5	63	0
2	33.3	29.0	35.5	25.5	55	1.7
3	27.3	23.6	32.5	24.0	72	0
4	37.7	24.5	34.0	24.0	74	0
5	38.3	26.3	35.0	24.0	60	8.6
6	35.0	23.5	36.5	24.5	83	0
7	35.8	23.8	33.5	24.5	70	0
8	37.0	35.0	33.0	24.0	68	0
9	36.8	27.2	33.0	24.5	67	TR
10	35.7	23.6	33.5	24.0	52	0
11	34.6	25.6	33.5	24.0	65	17.7
12	36.8	22.3	36.0	23.5	87	0
13	38.3	24.4	36.5	24.0	59	TR
14	40.3	26.6	36.5	23.0	53	0
15	37.4	26.0	36.0	23.5	54	0
16	36.3	25.8	36.0	23.0	58	0
17	40.0	25.4	36.5	23.5	58	0
18	37.8	25.5	36.0	22.5	55	0
19	37.7	23.3	36.0	24.0	69	0
20	37.0	24.6	37.0	24.0	65	0
21	39.3	22.8	36.5	22.0	65	0
22	37.0	25.0	36.0	22.0	58	0
23	38.4	25.4	36.0	23.0	71	0
24	37.3	26.0	35.5	23.5	47	TR
25	36.4	23.2	35.5	22.5	67	0
26	37.3	25.4	36.0	22.0	71	0
27	36.7	26.7	35.5	22.5	67	0
28	35.4	27.4	31.0	22.0	55	4.0
29	35.8	23.4	30.0	23.0	70	0
30	36.2	25.3	31.0	24.0	74	5.0
31	36.2	23.4	30.0	24.0	66	0
Mean	36.7	25.4	33.8	23.5	64	37.0

ANNEX 1 METEOROLOGICAL CONDITIONS AT ED-DUEIM

August, 1979

Date	Air Temperature Max. (°C)	Air Temperature Min. (°C)	Water Temperature Max. (°C)	Water Temperature Min. (°C)	Relative Humidity (%)	Rainfall (mm)
1	39.0	22.0	30.0	24.0	51	0
2	37.0	25.7	28.5	22.5	73	0
3	36.0	25.5	29.5	23.0	63	0
4	35.0	25.6	28.5	23.5	78	0.1
5	37.0	25.8	30.5	24.0	75	0
6	39.0	27.0	30.0	24.0	60	TR
7	38.0	22.8	29.0	23.0	66	0
8	34.0	25.6	27.5	23.5	59	TR
9	37.0	26.4	29.0	23.5	61	0
10	39.0	26.0	30.0	24.0	61	0.2
11	36.0	26.6	28.0	24.0	66	TR
12	36.5	26.5	28.5	24.0	63	TR
13	32.3	24.5	27.5	23.0	75	TR
14	34.0	25.6	28.5	24.0	82	0
15	33.0	23.6	28.0	24.5	80	0
16	33.0	25.4	27.5	24.0	79	2.3
17	35.0	25.9	27.5	24.5	75	0
18	30.9	22.4	27.0	23.0	84	TR
19	35.0	23.7	30.0	24.0	83	63.8
20	32.0	25.0	27.5	24.5	72	0
21	36.0	23.0	28.0	23.5	80	1.4
22	32.0	23.6	30.5	24.5	80	3.9
23	35.0	23.8	31.0	24.0	84	0
24	37.0	23.7	40.0	23.5	63	1.8
25	35.0	22.7	38.5	23.5	70	0
26	36.0	25.5	29.0	25.0	71	0
27	27.0	22.4	33.0	23.0	92	0
28	33.4	22.2	38.0	22.0	84	7.5
29	34.1	23.9	35.5	25.0	76	TR
30		25.7	38.5	25.0	66	0
31				23.5		
Mean						

ANNEX 2 OVERALL RESULTS OF VARIETY TEST

Variety	Block number	Sowing date	Heading date 5 %	Heading date 50 %	Heading date 95 %	Maturity date	Culm length (cm)	Panicle length (cm)	No. of panicles per hill	No. of panicles per m²	No. of grains per panicle	No. of grains per m² (x1,000)	Percentage of ripened grains (%)	Percentage of non-fertilized grains (%)	1,000 grain weight (g)	Yield (t/ha)
1. Main-season in 1977																
Fujiminori		Jun. 7		Aug. 15		Sep. 9	73	21	14.5	322	78	25.1	78		24.5	4.8
Reimei		Jun. 7		Aug. 22		Sep. 9	60	20	15.1	335	75	25.1	82		25.7	5.3
Toyonishiki		Jun. 7		Aug. 22		Sep. 9	65	18	16.1	353	66	23.3	92		26.1	5.6
Koganenishiki		Jun. 7		Aug. 3		Sep. 1	53	16	12.2	267	30	8.0	73		20.6	1.2
Asominori		Jun. 7		Aug. 1		Sep. 1	52	16	12.6	278	46	12.8	73		23.6	2.2
Toitsu		Jun. 7		Sep. 4		Oct. 8	55	21	14.5	325	114	37.0	83		24.4	7.5
Taichung-65		Jun. 7		Aug. 28		Oct. 3	85	21	10.7	237	98	23.2	86		25.6	5.1
Taichurikukyu		Jun. 7		Aug. 27		Oct. 15	71	20	12.5	277	159	44.1	69		23.0	7.0
Dawn		Jun. 7		Aug. 28		Oct. 11	69	27	5.2	115	298	34.3	63		20.8	4.5
Blue Bonnet		Jun. 7		Sep. 12		Oct. 17	87	26	4.6	102	199	20.3	79		22.4	3.6
Basmati-370		Jun. 20		Sep. 15		Oct. 11	109	27	12.2	272	103	28.0	75		20.0	4.2
Gawad Mali		Jun. 20		Oct. 14		Nov. 8	114	27	10.3	230	122	28.0	74		22.6	4.7
IR-127		Jun. 7		Sep. 4		Oct. 15	68	24	6.6	147	355	52.2	70		18.6	6.8
IR-298-12-1.1.1. (Broadcast transplanting)		Jun. 15		Sep. 15		Oct. 17	74	22	14.1	374	120	44.9	88		20.0	7.9
IR-5 (Broadcast transplanting)		Jun. 15		Sep. 4		Oct. 12	60	23	18.1	360	99	35.6	87		23.6	7.3
IR-2053		Jun. 15		Sep. 21		Oct. 20	66	24	14.8	328	117	38.4	77		23.0	6.8
IR-22		Jun. 15		Sep. 21		Oct. 18	59	21	17.3	386	90	34.7	88		22.3	6.8
IR-2153		Jun. 15		Sep. 17		Oct. 18	62	21	20.0	444	75	33.3	86		22.0	6.3
IR-1514		Jun. 15		Sep. 24		Oct. 22	62	24	20	444	126	56.0	71		18.1	7.5
IR-1561		Jun. 15		Sep. 9		Oct. 12	53	22	22	488	91	44.4	90		19.3	7.7
IR-298-12-1.1.1.		Jun. 15		Sep. 21		Oct. 20	69	22	12.6	279	150	41.9	90		19.9	7.5
IR-20		Jun. 20		Sep. 27		Oct. 29	61	26	16	356	153	54.4	79		18.7	8.1
IR-8		Jun. 20		Sep. 28		Oct. 31	58	23	14.5	322	117	37.7	86		26.8	8.7
C-11		Jun. 15		Aug. 27		Oct. 2	56	22	15.7	342	88	30.1	91		24.8	6.8
C-15		Jun. 15		Sep. 13		Oct. 15	68	23	16.0	348	128	44.6	90		22.4	9.0
BG-34-8		Jun. 20		Sep. 9		Oct. 8	66	23	10.2	228	189	43.1	77		19.9	6.6
BG-34-8		Jul. 7		Sep. 25		Oct. 30	79	24	12.0	266	170	45.3	81		21.7	8.0
SML-18		Jun. 7		Sep. 4		Oct. 11	77	25	11.6	342	55	18.8	83		35.2	5.5
Native Variety		Jul. 7		Oct. 8		Nov. 9	118	25	16.3	363	93	33.8	63		22.0	4.7
IR-298-12-1.1.1.		Jul. 7		Oct. 4		Nov. 8	68	22	12.0	268	140	37.5	91		19.4	6.6
TOS-103		Jul. 28		Oct. 17		Nov. 18	53	25	19.8	439	118	51.8	83		22.8	9.8
BG-90-2		Jul. 28		Nov. 1		Nov. 28	54	29	19.1	424	169	71.6	41		25.4	8.0

Variety	Block Number	Sowing date	Heading date 5 %	Heading date 50 %	Heading date 95 %	Maturity date	Culm length (cm)	Panicle length (cm)	No. of panicles per hill	No. of panicles per m^2	No. of grains per panicle	No. of grains per m^2 (x1,000)	Percentage of ripened grains (%)	Percentage of non-fertilized grains (%)	1,000 grain weight (g)	Yield (t/ha)
IR-298-12-1-1-1		Aug. 7		Nov. 8		Dec. 11	62	24	19.7	282	111	31.3	77		17.0	4.1
BG-34-8		Aug. 22		Nov. 5		Dec. 13	49	21	14.4	319	138	44.0	63		20.9	5.8
IR-20		Aug. 22		Nov. 27		Dec. 22	49	22	18.4	409	119	48.7	66		16.8	5.4
IR-8		Aug. 22		Dec. 8		Jan. 9	40	22	19.3	426	91	38.8	49		24.7	4.7
Cawad Mali		Aug. 22		Nov. 2		Dec. 6	74	22	13.7	305	76	23.2	58		20.8	2.8
C-11		Sept. 11		Dec. 3		Jan. 14	45	19	20.1	447	92	41.1	70		21.2	6.1
IR-298-12-1-1-1 (Direct Sowing in Stripe)		Jun. 23		Sept. 21		Oct. 19	75	23	-	226	122	43.6	83		19.6	7.9
IR-298-12-1-1-1 (Broadcasting)		Jun. 23		Sept. 21		Oct. 19	69	22	-	-	99	34.9	84		19.8	5.8

ANNEX 2 OVERALL RESULTS OF VARIETY TEST

Variety	Block Number	Sowing date	Heading date 5 %	Heading date 50 %	Heading date 95 %	Maturity date	Culm length (cm)	Panicle length (cm)	No. of panicles per hill	No. of panicles per m²	No. of grains per penicle	No. of grains per m² (x1,000)	Percentage of ripened grains (%)	Percentage of non-fertilized grains (%)	1,000 grain weight (g)	Yield (t/ha)
2. Off-season in 1977-1978																
IR-298-12-1-1-1		Oct. 9		Feb. 19		Apr. 11	52	20	13.6	364	92	33.5	66.6	25.2	16.6	3.7
C-11		Oct. 10		Feb. 5		Apr. 16	82	17	34.2	912	77	70.5	21.7	60.9	19.6	3.0
Fujiminori		Nov. 3		Mar. 3		Apr. 29	66	18	32.1	857	26	22.2	5.3	90.0	25.0	0.3
Reimei		Nov. 3		Feb. 25		Apr. 26	57	17	41.7	1113	31	34.8	16.2	96.3	22.0	1.1
Taichung native 1		Nov. 3		Mar. 15		Apr. 15	40	21	24.5	654	76	49.6	66.6	17.8	20.0	6.6
Toyonishiki		Nov. 3		Feb. 24		Apr. 13	59	17	18.2	487	51	25.0	18.9	78.7	16.9	0.8
Norin 17		Nov. 3		Feb. 19		Apr. 11	49	14	12.3	328	82	26.8	0.5	97.5	24.0	-
Dewa chikara		Nov. 3		Feb. 1		Apr. 13	55	16	19.7	526	80	42.1	1.3	79.0	17.5	0.1
Matsunishiki		Nov. 3		Feb. 24		Apr. 12	57	16	16.3	435	54	23.6	4.2	91.4	20.2	0.2
Ishin		Nov. 3		Mar. 15		Apr. 26	412	20	29.9	798	52	41.1	66.3	19.9	20.2	5.5
Chen-chi-ai-11(C-11)		Nov. 3		Mar. 18		Apr. 16	40	18	19.9	531	76	40.1	64.0	20.0	19.5	5.0
C-13		Nov. 3		Mar. 24		May 10	42	20	22.2	593	65	38.4	83.4	9.2	18.1	5.8
Waikyakunatoku		Nov. 3		Apr. 2		May 11	39	20	37.4	999	41	41.2	52.6	39.3	16.5	3.5
IR-22		Nov. 3		Mar. 4		Apr. 25	33	17	27.9	744	45	33.4	52.8	36.8	16.3	2.9
SML-18		Nov. 3		Mar. 6		Apr. 25	49	19	20.5	547	26	14.3	7.9	92.0	28.1	0.3
IR-36		Nov. 3		Mar. 21		Apr. 19	27	17	13.1	349	51	17.8	58.0	16.5	33.0	1.8
IR-38		Nov. 3		Apr. 2		May 10	44	22	15.0	400	51	20.5	65.8	31.5	19.6	2.6
IR-30		Nov. 3		Mar. 15		Apr. 24	41	20	28.2	753	70	52.4	71.3	25.0	16.6	6.2
Sasanishiki		Nov. 3		Jan. 28		Apr. 26	53	14	61.1	1631	23	37.1	3.7	95.3	23.6	0.1
Matsumai		Nov. 3		Feb. 2		Apr. 27	44	13	28.8	769	14	10.9	47.9	27.6	14.4	1.1
Chuemon		Nov. 3		Jan. 28		Apr. 29	55	15	26.1	697	27	18.6	6.9	90.3	20.5	0.3
Toitsu		Nov. 4		Apr. 2		May 9	37	18	19.2	513	57	29.4	56.4	22.2	21.1	3.5
Taiching 65		Nov. 4		Mar. 11		Apr. 19	70	18	14.7	392	45	17.7	48.4	14.0	23.3	2.0
Taichung ikukyu		Nov. 4		Mar. 9		Apr. 18	66	19	13.8	368	64	23.7	17.9	17.2	16.5	0.7
IR-5		Nov. 4		Mar. 31		May 13	41	19	31.1	830	63	52.3	56.3	31.0	18.3	5.4
IR-28		Nov. 4		Mar. 15		Apr. 25	39	19	28.3	756	36	27.3	21.1	75.7	20.0	1.1
IR-24		Nov. 4		Apr. 17		May 16	40	20	18.3	489	76	37.3	70.0	23.7	19.2	4.9
IR-29		Nov. 4		Apr. 7		May 21	39	18	46.4	1239	33	40.6	13.9	69.7	16.1	0.9
HINO		Nov. 4		Mar. 15		Apr. 18	34	18	16.7	445	67	29.9	58.7	24.2	16.5	2.9
Kiyonishiki		Nov. 4		Feb. 24		Apr. 27	58	16	36.6	977	22	21.8	6.3	80.5	25.3	0.4
C-6		Nov. 5		Mar. 15		Apr. 12	70	20	21.3	569	62	35.0	29.4	16.6	20.4	2.1
BG-34-8		Nov. 5		Mar. 10		Apr. 15	46	18	16.9	451	103	46.5	66.8	27.4	19.0	5.9

Variety	Block number	Sowing date	Heading date 5 %	Heading date 50 %	Heading date 95 %	Maturity date	Culm length (cm)	Panicle length (cm)	No. of Panicles per hill	No. of panicles per m^2	No. of grains per panicle	No. of grains per m^2 (x1,000)	Percentage of ripened grains (%)	Percentage of non-fertilized grains (%)	1,000 grain weight (g)	Yield (t/ha)
IR-40		Nov. 5		Mar. 15		Apr. 15	37	18	25.1	670	47	31.5	63.9	23.6	15.9	3.2
IR-8		Nov. 6		Apr. 21		May 21	41	22	23.3	622	74	46.0	57.1	18.9	23.9	6.2
Reimei		Nov. 15		Mar. 3		Apr. 27	58	17	31.0	828	36	29.7	39.1	45.5	21.5	2.5
C-6		Nov. 15		Apr. 12		May 14	46	21	18.8	502	63	31.8	65.3	20.0	23.6	4.9
IR-8		Nov. 16		Apr. 26		May 24	42	22	17.9	478	65	31.3	51.8	30.8	21.5	3.5
IR-20		Nov. 22		Mar. 26		May 9	44	20	17.2	459	74	33.9	73.0	20.2	22.4	3.5
IR-20		Dec. 1		Apr. 9		May 13	38	19	11.9	318	96	30.4	72.4	19.6	15.0	3.3
C-6		Dec. 1		May 5		Jun. 5	46	23	18.0	481	76	36.4	58.5	10.4	23.0	4.9
IR-8		Dec. 1		May 13		Jun. 6	64	20	18.9	505			Sample missing			4.5
IR-20		Dec. 15		Apr. 19		May 20	45	20	19.0	507	74	37.6	76.6	9.1	13.9	4.0
IR-8		Dec. 15		May 23		Jun. 15	62	21	16.4	438	64	28.0	41.0	28.9	23.0	2.6
C-6		Dec. 15		May 17		Jun. 8	66	21	17.5	467	66	30.7	47.3	21.0	23.0	3.3
IR-8		Jan. 2		May 26		Jun. 27	63	21	15.4	411	59	24.3	65.7	15.4	24.9	4.0
Reimei		Jan. 2		Mar. 31		May 16	53	16	21.0	561	32	17.8	3.2	37.7	17.6	0.1
IR-20		Jan. 2		Apr. 23		May 24	42	20	16.9	451	63	28.4	74.9	11.0	15.8	3.4
C-6		Jan. 2		May 23		Jun. 15	65	21	14.3	382	74	28.4	49.3	21.8	22.5	2.7
IR-8		Jan. 16		May 29		Jul. 9	48	20	17.7	473	65	30.8	68.2	12.0	25.4	5.4
Reimei		Jan. 16		Apr. 7		May 20	41	15	29.7	793	29	22.8	8.2	20.2	22.5	0.4
IR-20		Jan. 16		May 8		Apr. 30	45	22	19.1	510	94	48.1	51.4	18.0	15.7	3.9
C-6		Jan. 16		May 26		Jun. 27	70	22	17.0	454	72	32.7	61.0	20.6	25.0	4.9
Reimei		Feb. 1		Apr. 18		Jun. 1	53	16	23.6	630	32	20.3	46.0	32.4	21.9	2.0
IR-8		Feb. 1		Jun. 10		Jul. 24	49	23	17.1	457	66	30.2	88.7	2.2	25.3	6.8
IR-20		Feb. 1		May 23		Jun. 15	73	24	15.6	417	78	32.5	68.5	8.5	16.4	3.6
C-6		Feb. 1		Jun. 4		Jul. 18	51	22	15.9	424	80	34.1	66.4	15.5	24.9	5.6
BG-90-2		Feb. 13		Jun. 22		Aug. 2	55	25	21.9	584	80	46.6	76.5	16.6	26.0	9.3
TOS-103		Feb. 13		Jun. 4		Jul. 18	42	21	16.3	435	76	33.2	83.2	10.2	23.7	6.5
C-11		Feb. 13		May 29		Jul. 29	46	20	34.0	908	54	49.3	42.2	46.9	20.5	4.3
C-15		Feb. 13		Jun. 25		Aug. 2	56	22	19.4	518	75	39.1	82.8	10.9	19.8	6.4
IR-36		Feb. 13		Jun. 4		Jul. 9	45	20	24.9	665	68	45.3	81.1	10.2	19.1	7.0
IR-38		Feb. 13		Jun. 4		Jul. 24	44	18	18.9	505	56	28.3	69.9	17.1	21.1	4.2
IR-30		Feb. 13		May 29		Jul. 29	47	21	56.5	1509	30	45.9	65.0	31.5	19.0	5.7
IR-22		Feb. 13		Jun. 4		Jul. 24	50	19	24.2	646	53	34.3	78.8	16.9	20.3	5.5
SML-18		Feb. 13		Jun. 3		Jul. 29	61	22	28.4	758	27	20.6	15.9	77.7	31.8	1.0
Toitsu		Feb. 13		Jun. 4		Jul. 15	46	21	16.2	433	74	31.9	59.5	20.9	22.3	4.2

Variety	Block number	Sowing date	Heading date 5 %	Heading date 50 %	Heading date 95 %	Maturity date	Culm length (cm)	Panicle length (cm)	No. of Panicles per hill	No. of panicles per m^2	No. of grains per panicle	No. of grains per m^2 (x1000)	Percentage of ripened grains (%)	Percentage of non-fertilized grains (%)	1,000 grain weight (g)	Yield (ton/ha)
Taichung 65		Feb. 13		May 29		Jul. 29	58	18	22.7	606	28	16.8	26.0	58.8	25.9	1.1
IR-28		Feb. 13		May 28		Jul. 24	51	20	35.4	945	20	19.2	76.3	18.1	21.3	3.1
IR-24		Feb. 13		Jun. 23		Aug. 2	49	21	17.6	470	74	34.8	84.4	10.7	22.7	6.6
IR-29		Feb. 13		Jun. 12		Jul. 28	50	20	55.0	1469	33	48.4	50.7	48.3	20.2	5.0
BINO		Feb. 13		May 31		Jul. 24	50	19	28.3	756	47	35.7	65.1	28.7	20.0	4.6
BG-34-8		Feb. 13		May 28		Jun. 22	54	21	17.0	454	91	41.3	61.4	28.8	19.0	4.8
IR-40		Feb. 13		Jun. 3		Jul. 10	50	22	23.9	638	60	38.3	66.7	23.2	18.3	4.7
IR-298-12-1-1-1		Feb. 13		Jun. 4		Jul. 18	44	21	17.7	473	68	32.1	87.9	7.6	20.7	5.9
Ishin		Feb. 13		Jun. 6		Jul. 15	50	21	16.5	441	88	39.0	61.1	21.7	21.0	5.0
Reimei		Feb. 15		May 4		Jun. 3	47	17	21.1	563	36	20.1	65.5	27.6	22.8	3.0
C-6		Feb. 15		Jun. 27		Jul. 29	54	22	16.5	441	78	34.2	74.4	13.4	26.5	6.7
IR-8		Feb. 15		Jul. 3		Aug. 9	51	21	18.8	502	85	42.7	73.4	20.4	26.1	8.2
IR-20		Feb. 15		Jun. 4		Jul. 10	46	22	16.9	451	93	42.1	80.6	5.2	17.4	5.9
BG-34-8		Mar. 11		Jun. 30		Aug. 5	52	22	11.9	318	103	32.7	65.1	26.9	21.4	4.6
IR-22		Mar. 25		Jul. 13		Aug. 21	50	20	17.3	462	58	26.9	92.1	5.9	21.2	5.3

ANNEX 2 OVERALL RESULTS OF VARIETY TEST

3. Main-season in 1978	Block Number	Sowing date	Heading date 5 %	Heading date 50 %	Heading date 95 %	Maturity date	Culm length (cm)	Panicle length (cm)	No. of Panicles per hill	No. of panicles per m^2	No. of grains per panicle	No. of grains per m^2 (x1000)	Percentage of ripened grains (%)	Percentage of non-fertilized grains (%)	1,000 grain weight (g)	Yield (ton/ha)
Taichung Native 1	I	Jul.18	Sep.25	Sep.26	Sep.27	Oct.26	65	24	12.2	326	88	28.8	80.2	-	24.0	5.5
	II	Jul.18	"	Sep.26	"	Oct.26	63	23	12.4	331	104	34.3	83.8	-	24.2	7.0
	III	Jul.18	"	Sep.26	"	Oct.26			12.9	344	95	32.6	85.2	-	23.6	6.5
	Mean						64	24	12.5	334	96	31.9	83.1	-	23.9	6.3
IR-5	I	Jul.18	Oct. 4	Oct. 5	Oct. 8	Nov. 7	56	24	14.2	379	98	37.2	84.2	-	23.0	7.2
	II	Jul.18	"	Oct. 5	"	Nov. 7	56	24	15.3	409	83	33.8	86.3	-	23.8	6.9
	III	Jul.18	"	Oct. 5	"	Nov. 7			15.1	403	97	39.1	85.2	-	23.0	7.7
	Mean						56	24	14.9	397	92	36.7	85.2	-	23.3	7.3
IR-30	I	Jul.19	Sep.25	Sep.29	Oct. 3	Oct.28	60	23	12.9	344	104	35.9	78.9	-	20.7	5.9
	II	Jul.19	"	Sep.29	"	Oct.28	60	23	13.2	352	91	32.1	95.4	-	20.7	6.3
	III	Jul.19	"	Sep.29	"	Oct.28			14.7	392	99	39.0	77.0	-	19.6	5.9
	Mean						60	23	13.6	363	98	35.7	83.8	-	20.3	6.0
Ishin	I	Jul.21	Sep.29	Oct. 3	Oct. 5	Nov. 7	66	24	12.2	326	102	33.4	85.5	-	24.0	6.9
	II	Jul.21	"	Oct. 3	"	Nov. 7	63	24	12.9	344	95	32.8	90.7	-	24.3	7.2
	III	Jul.21	"	Oct. 3	"	Nov. 7	57	24	11.5	307	98	30.1	85.1	-	24.0	6.2
	Mean						62	24	12.2	326	98	32.1	87.1	-	24.1	6.8
IR-24	I	Jul.21	Oct.11	Oct.15	Oct.18	Nov.16	54	22	10.0	267	150	40.0	83.0	-	22.5	7.5
	II	Jul.21	"	Oct.15	"	Nov.16	55	23	11.5	307	145	44.6	77.8	-	23.0	8.0
	III	Jul.21	"	Oct.15	"	Nov.16			10.7	286	140	39.9	74.9	-	22.0	6.6
	Mean						55	23	10.7	287	145	41.5	78.6	-	22.5	7.1
IR-8	I	Jul.21	Oct.22	Oct.25	Oct.27	Dec.12	51	22	9.8	262	94	24.6	83.7	-	28.5	5.9
	II	Jul.21	"	Oct.25	"	Dec.12	51	22	10.7	286	105	30.1	83.6	-	28.3	7.1
	III	Jul.21	"	Oct.25	"	Dec.12	48	22	11.0	294	100	29.4	82.3	-	28.7	6.9
	Mean						50	22	10.5	281	100	28.0	83.2	-	28.5	6.6
C-11	I	Jul.21	Sep.18	Sep.26	Sep.29	Oct.26	66	21	12.7	339	96	32.5	79.9	-	23.5	6.1
	II	Jul.21	"	Sep.25	"	Oct.26	64	22	12.8	342	101	34.6	86.5	-	24.0	7.2
	III	Jul.21	"	Sep.25	"	Oct.26	58	22	12.2	326	77	25.0	91.4	-	22.8	5.2
	Mean						63	22	12.6	336	91	30.7	85.9	-	23.4	6.2
BG-34-8	I	Jul.19	Sep.29	Oct. 1	Oct. 3	Nov. 6	69	25	10.5	280	140	39.3	84.1	-	22.9	7.6
	II	Jul.19	"	Oct. 1	"	Nov. 6	70	25	14.0	375	117	44.0	82.6	-	22.7	8.3
	III	Jul.19	"	Oct. 1	"	Nov. 6	61	23	11.3	301	129	38.9	76.1	-	22.4	6.6
	Mean						67	24	11.9	319	126	40.7	80.9	-	22.7	7.5

Variety	Block Number	Sowing date	Heading date 5 %	Heading date 50 %	Heading date 95 %	Maturity date	Culm length (cm)	Panicle length (cm)	No. of panicles per hill	No. of panicles per m²	No. of grains per penicle	No. of grains per m² (x1000)	Percentage of ripened grains (%)	Percentage of non-partilized grains (%)	1,000 grain weight (g)	Yield (ton/ha)
IR-28	I	Jul.19	Sep.21	Sep.29	Oct. 2	Oct.28	70	23	13.8	368	71	26.2	91.6	-	23.1	5.6
	II	Jul.19	"	Sep.29	"	Oct.28	65	22	16.6	443	73	32.4	90.3	-	22.7	6.7
	III	Jul.19	"	Sep.29	"	Oct.28	58	21	14.9	398	84	33.6	74.8	-	22.2	5.6
	Mean						64	22	15.1	403	76	30.7	85.6	-	22.7	6.0
IR-298-12-1-1-1	I	Jul.29	Oct.15	Oct.23	Oct.25	Dec.19			11.1	296	111	32.8	89.2	-	19.5	5.7
	II	Jul.29	"	Oct.23	"	Dec.20			12.4	331	150	49.7	83.4	-	19.5	8.1
	III	Jul.29	"	Oct.23	"	Dec.21			11.2	299	102	30.6	88.3	-	26.0	7.0
	Mean								11.6	309	122	37.7	87.0	-	21.8	6.9
TOS-103	I	Jul.29	Oct.12	Oct.18	Oct.21	Dec.19			13.5	360	88	31.6	88.5	-	21.8	6.9
	II	Jul.29	"	Oct.18	"	Dec.20			12.7	339	123	41.7	85.7	-	23.4	8.4
	III	Jul.29	"	Oct.18	"	Dec.21			12.3	328	98	32.0	92.5	-	25.5	7.6
	Mean								12.8	342	103	35.1	88.9	-	24.6	7.6
IR-20	I	Jul.29	Oct.23	Oct.27	Oct.30	Dec.13			15.5	414	102	42.2	49.4	-	17.8	3.7
	II	Jul.29	"	Oct.27	"	Dec.13			14.2	378	151	57.0	52.7	-	18.3	5.5
	III	Jul.29	"	Oct.27	"	Dec.12			15.5	414	153	63.2	56.2	-	18.8	6.7
	Mean								15.1	402	135	54.1	52.8	-	18.3	5.3
IR-2053	I	Jul.29	Oct.23	Oct.30	Nov. 6	Dec.19			14.7	392	93	36.4	82.0	-	25.0	7.5
	II	Jul.29	"	Oct.30	Nov. 7	Dec.20			13.2	352	122	42.9	82.6	-	22.3	7.9
	III	Jul.29	"	Oct.30	Nov. 6	Dec.21			14.4	385	128	49.1	80.2	-	22.2	8.7
	Mean								14.1	376	114	42.8	81.6	-	23.2	8.0
C-6	I	Jul.29	Oct.23	Oct.31	Nov. 7	Dec.19			12.7	339	142	48.1	65.1	-	26.7	8.4
	II	Jul.29	Oct.23	Oct.31	Nov. 7	Dec.20			11.1	296	154	45.6	82.7	-	27.1	10.2
	Mean								11.9	318	147	46.9	73.9	-	26.9	9.3
Taichung 65	I	Jul.29	Oct. 5	Oct.10	Oct.15	Dec.19			11.2	299	149	44.7	63.4	-	26.4	7.5
	II	Jul.29	Oct. 5	Oct.10	Oct.15	Dec.20			12.1	323	73	23.5	87.6	-	29.8	6.1
	Mean								11.6	311	110	34.1	75.5	-	28.1	6.8
C-15	I	Jul.29	Oct. 5	Oct.30		Dec.19	61	23	12.7	339	139	47.2	74.3	-	25.4	8.9
	II	Jul.29	"	Oct.30	Nov. 6	Dec.20	56	22	14.4	384	123	47.1	95.7	-	22.3	10.1
	III	Jul.29	"	Oct.30	Nov. 6	Dec.21	63	26	12.6	336	140	47.2	93.1	-	21.8	9.6
	Mean						60	24	13.2	353	134	47.2	87.8	-	23.2	9.5
BG-90-2	I	Jul.29	Oct.28	Nov. 4	Nov.14	Dec.21			11.0	294	160	47.0	71.7	-	28.3	9.7
	II	Jul.29	"	Nov. 4	Nov.10	Dec.21			10.9	291	159	46.4	67.0	-	29.2	9.1
	III	Jul.29	"	Nov. 6	Nov.14	Dec.21			12.6	336	123	41.2	67.5	-	26.6	7.4
	Mean								11.5	307	145	44.5	79.7	-	28.0	8.7

Variety	Block Number	Sowing date	Heading date			Maturity date	Culm length (cm)	Panicle length (cm)	No. of Panicles per hill	No. of panicles per m^2	No. of grains per panicle	No. of grains per m^2 (x1000)	Percentage of ripened grains (%)	Percentage of non-fertilized grains (%)	1,000 grain weight (g)	Field (ton/ha)
			5 %	50 %	95 %											
BR-4		Jul.30	Oct.29	Nov. 8	Nov.15	Dec.18	72	25	13.5	360	218	78.6	84.2	-	14.4	9.5
BR-5		Jul.30	Oct.23	Oct.30	Nov. 6	Dec.18	99	23	17.7	473	147	69.4	83.2	-	11.4	6.6
BG-11-11		Jul.30	Oct.23	Oct.30	Nov. 7	Dec.18	77	22	14.8	395	114	45.2	53.5	-	27.9	6.8
BG-31-11		Jul.30	Oct. 5	Oct.11	Oct.14	Nov.19	65	23	10.8	288	137	39.4	82.7	-	23.0	7.5
BG-33-2		Jul.30	Oct. 5	Oct.11	Oct.15	Nov.19	61	25	10.8	288	171	49.3	84.3	-	22.2	9.2
BG-34-12		Jul.30	Oct. 5	Oct.11	Oct.14	Nov.19	66	23	13.8	368	132	48.7	72.3	-	24.0	8.5
BG-34-8		Jul.30	Oct. 5	Oct.11	Oct.14	Nov.19	69	25	12.4	331	142	46.9	73.8	-	23.9	8.3
BG-34-6		Jul.30	Oct. 5	Oct.11	Oct.14	Nov.20	68	26	12.5	334	123	41.2	77.3	-	25.1	8.0
IR-36		Jul.30	Oct.10	Oct.13	Oct.15	Nov.20	54	22	17.8	475	112	53.1	71.9	-	21.5	8.1
IR-38		Jul.30	Oct.23	Oct.29	Nov. 6	Dec.11	57	23	17.0	454	85	38.8	78.1	-	24.1	7.3
IR-29		Jul.30	Oct.23	Oct.25	Oct.27	Dec.17	60	22	16.2	433	89	38.6	87.1	-	23.8	8.0
IR-10		Jul.30	Oct.21	Oct.23	Oct.25	Dec.11	61	23	17.5	467						
Toitsu		Jul.30	Oct. 6	Oct.15	Oct.18	Nov.21	56	21	11.9	318	105	33.3	75.8	-	26.4	6.7

ANNEX 2 OVERALL RESULTS OF VARIETY TEST

4. Off season in 1979	Block number	Sowing date	Heading date 5 %	Heading date 50 %	Heading date 95 %	Maturity date	Culm length (cm)	Panicle length (cm)	No. of panicles per hill	No. of panicles per m²	No. of grains per panicle	No. of grains per m² (x1,000)	Percentage of ripened grains (%)	Percentage of non-fertilized grains (%)	1,000 grain weight (g)	Yield (t/ha)
Asakinori	I	Feb. 1	Apr. 8	Apr.12	Apr.28	May 15	35	12	30.8	822	24.7	20.3	54.0	39.7	24.5	2.7
	II	"	"	"	"	"	38	14	33.7	900	25.6	23.0	65.5	29.2	24.0	3.6
	III	"	"	"	"	"	40	15	28.3	756	24.0	18.1	60.3	37.0	24.7	2.7
	Mean						38	14	30.9	826	24.8	20.5	59.9	35.3	24.4	3.0
Koganenishiki	I	Feb. 1	Apr. 8	Apr.12	May 1	May 15	45	14	29.8	796	23.4	18.6	34.6	64.1	28.1	1.8
	II	"	"	"	"	"	46	16	38.9	1,039	28.2	29.3	29.4	67.2	26.9	2.3
	III	"	"	"	"	"	46	14	30.3	809	37.9	30.7	19.3	77.2	26.8	1.6
	Mean						46	15	33.0	881	29.8	26.2	27.8	69.5	27.3	1.9
Norin-17	I	Feb. 1	Apr. 5	Apr. 9	Apr.28	May 18	35	12	26.0	694	27.0	18.7	23.2	75.8	23.9	1.0
	II	"	"	"	"	"	41	13	38.7	1,033	26.5	27.4	18.5	79.6	22.1	1.1
	III	"	"	"	"	"	39	13	31.6	844	24.9	21.0	12.7	85.4	23.7	0.6
	Mean						38	13	32.1	857	26.1	22.4	18.1	80.3	23.2	0.9
Reimei	I	Feb. 1	Apr.18	Apr.24	May 3	May 20	37	14	18.1	483	27.7	13.4	58.8	38.8	24.3	1.9
	II	"	"	"	"	"	46	18	30.9	825	29.2	24.1	55.0	36.2	25.1	3.3
	III	"	"	"	"	"	42	16	20.7	553	28.8	15.9	51.5	36.3	24.2	2.0
	Mean						42	16	23.2	620	28.6	17.8	55.1	37.0	24.5	2.4
Toyonishiki	I	Feb. 1	Apr.18	Apr.24	May 1	May 20	38	14	24.9	665	36.2	24.1	33.1	54.6	20.6	1.6
	II	"	"	"	"	"	47	16	39.2	1,047	31.8	33.3	59.1	32.3	24.1	4.7
	III	"	"	"	"	"	42	15	36.1	964	26.8	25.8	56.5	39.4	21.6	3.1
	Mean						42	15	33.4	892	31.6	27.7	49.6	42.1	22.1	3.1
Taichung 65	I	Feb. 1	May 2	May 8	May 20	Jun.25	61	20	10.3	275	61.0	16.8	61.0	20.2	24.3	2.5
	II	"	"	"	May 27	"	69	19	11.1	296	66.2	19.6	65.2	14.2	25.1	3.2
	III	"	"	"	May 27	"	73	21	12.9	344	84.1	29.0	71.0	16.4	25.6	5.3
	Mean						68	20	11.4	305	70.4	21.8	65.7	16.9	25.0	3.7
IR-1561	I	Feb. 1	May 3	May 12	May 17	Jul. 7	45	23	17.6	470	86.9	40.8	79.5	18.1	18.7	6.1
	II	"	"	"	"	"	44	22	17.7	473	91.8	43.4	89.5	7.8	20.4	7.9
	III	"	"	"	"	"	45	22	16.9	451	80.9	36.5	84.0	9.4	19.6	6.0
	Mean						45	22	17.4	465	86.5	40.2	84.3	11.7	19.6	6.7
C-11	I	Feb. 1	May 7	May 12	May 19	Jun.26	50	22	13.6	363	96.4	35.0	76.8	18.1	21.5	5.8
	II	"	"	"	"	"	49	21	14.1	376	90.0	33.9	74.6	13.6	22.3	5.6
	III	"	"	"	"	"	52	21	12.6	336	108.5	36.5	89.3	3.4	22.4	7.3
	Mean						50	21	13.4	358	98.3	35.1	80.2	11.7	22.1	6.2

	Block Number	Sowing date	Heading date 5 %	Heading date 50 %	Heading date 95 %	Maturity date	Culm length (cm)	Panicle length (cm)	No. of Panicles per hill	No. of Panicles per m²	No. of grains per panicle	No. of grains per m² (x1,000)	Percentage of ripened grains (%)	Percentage of non-fertilized grains (%)	1,000 grain weight (g)	Yield (ton/ha)
BG-34-8	I	Feb. 1	May 2	May 6	May 20	Jun.15	53	20	12.5	334	107.6	35.9	77.3	16.2	20.5	5.7
	II	"	"	"	"	"	52	22	14.6	390	107.9	42.1	72.5	23.4	19.3	6.0
	III	"	"	"	"	"	56	23	13.6	363	113.3	41.1	69.2	25.5	20.9	5.9
	Mean						54	22	13.6	363	109.6	39.7	73.0	21.7	20.2	5.9
Taichung Ikukyu	I	Feb. 1	May 5	May 16	May 27	Jun.25	49	19	12.6	336	105.1	35.4	63.9	22.2	20.6	4.7
	II	"	"	"	"	"	50	21	15.6	417	91.4	39.3	62.5	24.7	24.0	5.9
	III	"	"	"	"	"	51	20	15.1	403	101.5	40.9	59.5	19.1	24.3	5.9
	Mean						50	20	14.4	385	100.3	38.5	62.0	22.0	23.0	5.5
Takao	I	Feb. 1	May 8	May 16	May 21	Jun.24	60	20	12.3	328	84.6	27.8	80.3	8.2	22.7	5.3
	II	"	"	"	"	"	77	20	14.1	376	95.4	35.9	75.4	11.9	23.7	6.4
	III	"	"	"	"	"	72	20	12.5	334	99.8	33.3	66.8	12.9	23.7	5.3
	Mean						70	20	13.0	346	93.3	32.3	74.2	11.0	23.4	5.6
IR-22	I	Feb. 1	May 17	May 21	May 27	Jun.16	43	20	20.9	558	78.4	43.7	67.8	26.3	19.3	5.7
	II	"	"	"	"	"	46	22	18.5	494	131.8	65.1	74.7	18.4	19.6	9.5
	III	"	"	"	"	"	46	23	25.3	676	87.6	59.2	80.5	17.1	20.4	9.7
	Mean						45	22	21.6	576	99.3	56.0	74.3	20.6	19.8	8.3
IR-28	I	Feb. 1	May 16	May 22	May 23	Jun.14	43	20	15.4	411	51.9	21.3	81.4		22.3	3.9
	II	"	"	"	"	"	51	21	18.1	483	69.4	33.5	86.0		20.5	5.9
	III	"	"	"	"	"	51	21	17.9	478	61.2	29.2	83.6		22.3	5.4
	Mean						48	21	17.1	457	60.8	28.0	83.7		21.7	5.1
IR-30	I	Feb. 1	May 13	May 19	May 27	Jun.14	42	21	14.2	379	86.2	32.7	63.9	32.0	17.6	3.7
	II	"	"	"	"	"	49	22	17.3	462	97.3	44.9	71.7	19.0	19.2	6.2
	III	"	"	"	"	"	49	20	14.4	384	101.6	39.1	77.9	17.8	18.3	5.6
	Mean						47	21	15.3	408	95.0	38.9	71.2	23.1	18.4	5.2
IR-36	I	Feb. 1	May 6	May 19	May 27	Jun.15	36	20	16.6	443	65.1	28.9	54.1	36.1	20.7	3.2
	II	"	"	"	"	"	44	21	17.6	470	95.3	44.8	59.9	29.5	20.1	5.4
	III	"	"	"	"	"	42	21	20.5	547	52.0	28.5	65.2	27.6	19.9	3.7
	Mean						41	21	18.2	487	70.8	34.1	59.7	31.0	20.2	4.1
IR-127	I	Feb. 1	May 16	May 20	May 27	Jun.26	61	22	7.4	198	204.4	40.4	42.1	46.5	17.6	3.0
	II	"	"	"	"	"	65	22	7.0	187	226.5	42.3	45.2	48.2	17.1	3.3
	III	"	"	"	"	"	62	21	7.9	211	204.2	43.1	53.1	35.4	20.2	4.6
	Mean						63	22	7.4	199	211.7	41.9	46.6	43.3	18.3	3.6

	Block Number	Sowing date	Heading date 5 %	Heading date 50 %	Heading date 95 %	Maturity date	Culm length (cm)	Panicle length (cm)	No. of Panicles per hill	No. of Pabicles per m^2	No. of grains per panicle	No. of grains per m^2 (x1,000)	Percentage of ripened grains (%)	Percentage of non-fertilized grains (%)	1,000 grain weight (g)	Yield (ton/ha)
BG-90-2	I	Feb. 1	May 19	May 22	May 29	Jun.25	47	23	13.7	366	100.8	36.9	67.9	26.7	23.4	5.9
	II	"	"	"	"	"	46	24	15.3	409	105.1	42.9	76.8	18.0	23.4	7.7
	III	"	"	"	"	"	47	23	11.8	315	97.4	30.7	78.2	17.4	23.1	5.6
	Mean						47	23	13.6	363	101.1	36.8	74.3	20.7	23.4	6.7
Reshinchu	I	Feb. 1	May 16	May 20	May 29	Jun.27	66	20	11.2	299	76.6	22.9	53.8	19.4	23.0	2.8
	II	"	"	"	"	"	80	18	14.1	376	102.8	38.7	55.1	23.0	24.7	5.3
	III	"	"	"	"	"	73	18	13.2	352	91.9	32.4	55.0	25.0	23.4	3.8
	Mean						73	19	12.8	342	90.4	31.3	54.6	22.4	23.0	4.0
Toitsu	I	Feb. 1	May 16	May 20	May 28	Jun.19	49	19	12.6	336	90.5	30.4	55.7	26.3	23.2	3.9
	II	"	"	"	"	"	53	21	13.8	368	115.2	42.4	58.2	30.7	24.6	6.1
	III	"	"	"	"	"	49	20	12.9	344	114.1	39.3	60.8	31.7	22.8	5.4
	Mean						50	20	13.1	349	106.6	37.4	58.2	29.5	23.5	5.1
Ishin	I	Feb. 1	May 17	May 22	May 29	Jun.16	48	21	14.4	384	88.7	34.1	61.0	35.1	23.3	4.8
	II	"	"	"	"	"	61	23	15.4	411	108.3	44.5	68.4	21.0	26.1	7.9
	III	"	"	"	"	"	55	22	15.2	406	106.2	43.1	59.0	32.2	22.2	5.6
	Mean						55	22	15.0	400	101.1	40.6	62.8	29.4	23.9	6.1
TOS-103	I	Feb. 1	May 21	May 27	May 31	Jun.16	45	21	13.4	358	75.9	27.2	71.7	22.6	24.5	4.8
	II	"	"	"	"	"	46	23	14.1	376	95.2	35.8	69.1	27.6	23.6	5.8
	III	"	"	May 29	"	"	46	23	13.4	358	98.7	35.3	67.1	24.1	24.3	5.8
	Mean						46	23	13.6	364	89.9	32.8	69.3	24.8	24.1	5.5
HINO	I	Feb. 1	May 19	May 24	May 29	Jun.30	80	24	5.3	142	59.2	8.4	16.3	81.1	21.6	0.3
	II	"	"	"	"	"	87	23	5.8	155	40.8	6.3	25.4	67.9	22.2	0.3
	III	"	"	"	"	"	76	25	5.7	152	79.5	12.1	12.7	84.9	18.5	0.3
	Mean						81	24	5.6	150	59.8	8.9	18.1	77.8	20.8	0.3
Dawn	I	Feb. 1	May 20	May 26	May 30	Jun.25	49	21	17.5	467	80.7	37.7	86.2	12.2	21.5	7.0
	II	"	"	"	"	"	48	22	19.6	523	85.6	44.8	78.3	19.9	21.6	7.6
	III	"	"	"	"	"	48	19	15.2	406	82.9	33.6	60.9	16.7	20.4	4.2
	Mean						48	21	17.4	465	83.1	38.7	75.1	16.2	21.2	6.3
IR-5	I	Feb. 1	May 20	May 26	May 31	Jun.19	43	20	16.7	446	81.9	36.5	57.7	36.2	20.3	4.3
	II	"	"	"	"	"	51	20	18.9	505	107.1	54.0	38.9	45.6	21.5	4.5
	III	"	"	"	"	"	54	21	17.3	462	108.2	50.0	50.0	46.2	22.6	5.7
	Mean						49	20	17.6	471	99.1	46.8	48.9	42.6	21.5	4.8

	Block Number	sowing date	Heading date 5 %	Heading date 50 %	Heading date 95 %	Maturity date	Culm length (cm)	Panicle length (cm)	No. of Panicles per hill	No. of Panicles per m²	No. of grains per panicle	No. of grains per m² (x1,000)	Percentage of ripened grains (%)	Percentage of non-fertilized grains (%)	1,000 grain weight (g)	Yield (ton/ha)
IR-29	I	Feb. 1	May 29	Jun. 1	Jun. 5	Jul. 5	49	20	17.9	478	69.6	33.3	68.3	26.7	21.6	4.9
	II	"	"	"	"	"	55	22	16.1	430	103.3	44.4	76.8	19.9	20.7	7.1
	III	"	"	"	"	"	50	20	14.7	392	89.1	35.0	69.9	19.5	20.7	5.1
	Mean						51	21	16.2	433	87.3	37.6	71.7	22.0	21.0	5.7
Blue Bonnet	I	Feb. 1	May 27	May 29	Jun. 9	Jun.25	93	19	7.5	200	73.4	14.7	50.6	43.6	20.5	1.5
	II	"	"	"	"	"	92	22	6.8	182	55.8	10.1	60.1	30.1	21.8	1.3
	III	"	"	"	"	"	85	21	6.7	179	63.9	11.4	56.4	34.5	20.7	1.3
	Mean						90	21	7.0	187	64.4	12.1	55.7	36.1	21.0	1.1
SML-18	I	Feb. 1	May 29	Jun. 2	Jun. 5	Jun.21	69	26	11.1	296	62.7	18.6	65.3	43.6	28.3	3.4
	II	"	"	"	"	"	66	24	10.6	283	55.0	15.6	54.3	30.1	31.5	2.7
	III	"	"	"	"	"	66	23	10.7	286	47.1	13.5	21.8	34.5	31.8	0.9
	Mean						67	24	10.8	288	54.9	15.9	47.1	36.0	30.5	2.3
IR-20	I	Feb. 1	May 29	Jun. 5	Jun.13	Jun.30	48	25	11.7	312	150.7	47.1	52.7	29.1	15.0	3.7
	II	"	"	"	"	"	49	27	14.8	395	136.3	53.9	57.8	34.7	16.8	5.2
	III	"	"	"	"	"	54	26	13.3	355	131.1	46.6	67.9	23.9	17.8	5.6
	Mean						50	26	13.3	354	139.4	49.2	59.5	29.2	16.5	4.8
IR-24	I	Feb. 1	May 27	Jun. 5	Jun.14	Jul. 4	43	20	12.2	326	106.1	34.6	65.1	28.8	20.5	4.6
	II	"	"	"	"	"	51	22	14.7	392	140.6	55.2	69.0	28.5	21.5	8.2
	III	"	"	"	"	"	47	21	12.4	331	105.3	34.9	68.4	25.1	24.3	5.8
	Mean						47	21	13.1	350	117.3	41.6	67.5	27.5	22.7	6.2
IR-40	I	Feb. 1	May 25	May 28	Jun. 9	Jun.30	50	22	17.3	462	76.0	35.1	57.0	27.5	22.3	4.5
	II	"	May 27	Jun. 4	"	"	54	22	17.3	462	94.9	43.8	59.1	27.5	19.0	4.9
	III	"	May 29	Jun. 4	"	"	57	23	12.9	344	129.9	44.7	79.7	17.7	18.5	6.6
	Mean						54	22	15.8	423	100.3	41.2	65.3	24.2	19.9	5.3
IR-8	I	Feb. 1	Jun. 5	Jun.10	Jun.16	Jul. 9	47	23	11.7	312	93.9	29.3	63.4	28.1	28.5	5.3
	II	"	"	"	"		50	23	14.1	376	102.8	38.7	66.8	29.0	26.8	6.9
	III	"	"	"	"		50	23	14.5	387	92.5	35.8	34.4	50.8	27.3	3.4
	Mean						49	23	13.4	358	96.4	34.6	54.9	36.0	27.5	5.2
IR-38	I	Feb. 1	Jun. 5	Jun. 9	Jun.18	Jun.30	50	23	17.5	467	90.1	42.1	56.7	35.5	18.3	1.4
	II	"	"	"	"	"	50	24	15.4	411	93.5	38.4	73.8	22.6	21.9	6.2
	III	"	"	"	"	"	57	24	12.9	344	106.1	36.5	73.1	19.2	20.8	5.5
	Mean						52	24	15.3	407	96.6	39.0	67.9	25.8	20.3	5.4

	Block Number	sowing date	Heading date 5 %	Heading date 50 %	Heading date 95 %	Maturity date	Culm length (cm)	Panicle length (cm)	No. of Panicles per Hill	No. of Panicles per m²	No. of grains per panicle	No. of grains per m² (x1,000)	Percentage of ripened grains (%)	Percentage of non-fertilized grains (%)	1,000 grain weight (g)	Yield (ton/hs)
IR-298-12-1-1-1	I	Feb. 1	Jun. 3	Jun. 8	Jun.14	Jun.26	63	22	11.8	315	(Damaged by sparrows)					
	II	"	"	"	"	"	59	23	12.1	323	136.7	44.2	73.0	23.1	17.9	5.8
	III	"	"	"	"	"	61	23	12.1	323	116.2	37.5	86.3	10.4	18.0	5.8
	Mean						61	23	12.0	320	126.5	40.9	79.7	16.8	16.8	5.8
IR-2053	I	Feb. 1	Jun. 8	Jun.12	Jun.20	Jul.14	66	25	13.8	368	108.7	40.1	63.5	30.6	20.2	5.1
	II	"	"	"	"	"	60	25	13.7	366	105.4	38.6	77.7	16.8	20.7	6.2
	III	"	"	"	"	"	57	26	13.8	368	122.7	45.2	68.2	22.8	21.9	6.8
	Mean						61	25	13.8	367	112.3	41.3	69.8	23.4	20.9	6.0
IR-2153	I	Feb. 1	Jun. 5	Jun. 9	Jun.13	Jul. 5	58	21	19.6	523	71.0	37.2	72.5	25.5	21.2	5.7
	II	"	"	"	"	"	53	21	18.9	505	94.7	47.8	68.2	27.6	20.6	6.7
	III	"	"	"	"	"	59	22	16.0	427	86.0	36.7	74.1	17.3	22.0	6.0
	Mean						57	21	18.2	485	83.9	40.6	71.6	23.5	21.3	6.1
C-6	I	Feb. 1	May 29	Jun. 9	Jun.15	Jul.12	53	23	12.5	334	122.9	41.0	56.4	36.9	25.3	5.9
	II	"	"	"	"	"	50	24	14.6	390	107.5	41.9	64.3	27.3	23.9	6.4
	III	"	"	"	"	"	55	24	13.1	350	117.7	41.2	73.3	22.4	26.5	8.0
	Mean						53	24	13.4	358	116.0	41.4	64.7	28.9	25.2	6.8
C-15	I	Feb. 1	Jun. 5	Jun.16	Jun.28	Jul. 7	56	22	16.5	441	101.8	44.8	76.6	15.3	20.4	7.0
	II	"	"	"	"	"	53	24	14.8	395	116.9	46.2	56.2	26.6	20.0	5.2
	III	"	"	"	"	"	61	24	13.7	366	130.9	47.9	72.9	22.3	22.1	7.7
	Mean						57	23	15.0	401	116.5	46.3	68.6	21.4	20.8	6.6
IR-1514	I	Feb. 1	Jun.14	Jun.20	Jun.28	Jul.14	43	24	18.1	483	105.9	51.2	58.4	37.0	15.1	4.5
	II	"	"	"	"	"	48	24	18.7	499	119.5	59.7	61.1	33.6	17.2	6.3
	III	"	"	"	"	"	40	25	21.7	579	101.4	58.8	62.8	24.4	17.3	6.4
	Mean						44	24	19.5	520	108.9	56.6	60.8	31.6	16.5	5.7
BG-11-11	I	Feb. 1	Jun.16	Jun.20	Jun.28	Jul.11	73	36	11.3	302	78.6	23.7	65.5	26.5	18.4	2.9
	II	"	"	"	"	"	80	38	13.4	358	132.0	47.2	38.2	43.7	19.5	3.5
	III	"	"	"	"	"	75	27	14.2	379	134.9	51.1	53.1	38.2	20.6	5.6
	Mean						76	34	13.0	346	115.2	40.7	52.3	36.1	19.5	4.0
Cowad Mali	I															
	II															
	III															
	Mean															

ANNEX 3 OVERALL RESULTS OF FERTILIZER ELEMENT TEST (1) (June, 1978 - Oct., 1978)

Treatment	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grains per m^2 (x1000)	Percentage of Ripened Grains (%)	Percentage of Non-fertilized Grains (%)	1,000 Grain Weight (g)	Yield (ton/ha)
Non-N	I	Jun. 8	Aug.26	Sep. 7	Sep.11	Oct. 7	52	20	7.7	206	100	20.5	81.3	7.1	21.1	3.5
	II	"	"	"	"	"	52	23	9.3	248	-	-	-	-	21.1	4.2
	III	"	"	"	"	"	54	23	7.9	211	184	38.8	81.3	5.7	21.2	6.7
	Mean						53	22	8.3	222	142	29.7	81.3	6.4	21.1	4.8
Non-P	I	Jun. 8	"	"	"	"	69	24	11.7	312	129	40.2	86.8	5.3	22.1	7.7
	II	"	"	"	"	"	69	25	13.6	363	132	47.9	90.8	1.2	22.2	9.7
	III	"	"	"	"	"	69	23	11.8	315	113	35.6	93.5	2.2	21.7	7.2
	Mean						69	24	12.4	330	125	41.2	90.4	2.9	22.0	8.2
Non-K	I	Jun. 8	"	"	"	"	70	23	15.0	401	134	53.8	75.8	5.3	21.7	8.9
	II	"	"	"	"	"	66	25	14.3	382	132	50.3	86.7	3.5	21.6	9.4
	III	"	"	"	"	"	65	24	14.2	379	117	44.2	81.0	6.2	20.8	7.5
	Mean						67	24	14.5	387	128	49.4	81.2	5.0	21.4	8.6
Non-N.P.K.	I	Jun. 8	"	"	"	"	52	21	7.6	203	89	18.1	76.2	7.4	20.5	2.8
	II	"	"	"	"	"	53	22	6.2	166	107	17.8	80.7	8.7	20.7	3.0
	III	"	"	"	"	"	55	23	7.2	192	104	20.0	86.0	0.7	20.2	3.5
	Mean						53	22	7.0	187	100	18.6	81.0	5.6	20.5	3.1
Standard (N.P.K.)	I	Jun. 8	"	"	"	"	60	24	14.8	395	-	-	-	-	22.1	9.4
	II	"	"	"	"	"	68	25	12.6	336	126	42.5	84.6	2.8	21.9	7.9
	III	"	"	"	"	"	65	24	13.2	352	117	41.3	84.7	4.3	21.9	7.7
	Mean						64	24	13.5	361	122	41.9	56.4	3.6	22.0	8.3

Note: 1. Variety used for this experiment was C-15

2. Application rates of N, P_2O_5 and K_2O were 150 kg/ha, 100 kg/ha and 100 kg/ha, respectively.

3. Ordinal transplanting method was applied for this experiment with spacing of 25 x 15 cm, 26.7 hills/m^2.

ANNEX 3 OVERALL RESULTS OF FERTILIZER ELEMENT TEST (2) (Feb., 1979 - Jun., 1979)

Treatment	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m²	No. of Grains per Panicle	No. of Grains per m² (x1000)	Percentage of Ripened Grains (%)	Percentage of Non-fertilized Grains (%)	1,000 Grain Weight (g)	Yield (ton/ha)
Non-N	I	Feb. 1	May 18	May 25	Jun. 2	Jun. 16	43	21	11.9	318	78.8	25.0	78.9	17.0	23.2	4.6
	II	"	"	"	"	"	37	22	8.4	224	72.2	16.2	59.2	16.3	22.4	3.0
	III	"	"	"	"	"	39	22	8.3	222	59.1	13.1	47.5	16.9	24.0	2.5
	Mean						40	22	9.5	135	70.0	18.1	61.9	16.7	23.2	3.4
Non-P	I	Feb. 1	May 23	Jun. 2	Jun. 7	Jun. 23	42	21	13.8	368	101.7	37.5	80.2	10.1	20.2	6.1
	II	"	"	"	"	"	45	24	15.6	417	83.1	34.6	64.9	25.3	22.0	4.9
	III	"	"	"	"	"	46	23	15.3	408	81.8	33.4	81.8	11.8	25.2	6.9
	Mean						44	23	14.9	398	88.9	35.2	75.6	15.7	22.5	6.0
Non-K	I	Feb. 1	May 20	May 27	Jun. 5	Jun. 18	43	22	14.4	384	89.0	34.2	85.6	12.5	23.1	6.8
	II	"	"	"	"	"	43	23	17.7	473	85.5	40.4	73.0	18.7	20.8	6.1
	III	"	"	"	"	"	42	25	13.3	355	80.7	28.7	83.0	12.6	22.4	5.3
	Mean						43	23	15.1	404	85.1	34.4	80.5	14.6	22.1	6.1
Non-S	I	Feb. 1	May 22	May 28	Jun. 8	Jun. 20	45	21	16.0	427	97.9	41.8	76.0	17.1	23.1	7.3
	II	"	"	"	"	"	41	21	15.8	422	85.9	36.2	72.0	22.4	22.4	5.8
	III	"	"	"	"	"	45	24	13.8	368	88.4	32.6	74.6	19.8	22.7	5.5
	Mean						44	22	15.2	406	90.7	36.9	74.2	19.8	22.7	6.2
Non-N.P.K.S.	I	Feb. 1	May 12	May 20	May 28	Jun. 18	36	20	8.0	214	64.4	13.8	71.0	24.8	22.7	2.2
	II	"	"	"	"	"	36	20	7.9	211	59.2	12.5	78.1	18.7	23.0	2.2
	III	"	"	"	"	"	36	19	7.8	208	47.5	9.9	60.8	19.8	22.5	1.1
	Mean						36	20	7.9	211	57.0	12.1	70.0	21.1	22.7	1.9
Standard	I	Feb. 1	May 25	May 31	Jun. 8	Jun. 23	43	22	15.2	406	96.6	39.2	87.9	8.5	24.3	8.4
	II	"	"	"	"	"	42	22	16.4	438	82.3	36.0	76.5	16.0	22.6	6.2
	III	"	"	"	"	"	45	24	11.6	390	83.5	32.5	77.0	12.7	24.1	6.0
	Mean						43	23	15.4	411	87.5	35.9	80.5	12.4	23.7	6.9

Note: 1. Used variety for this experiment was TOS 103.

2. Standard fertilization: 180 kgN/ha
200 kg P2O5/ha
150 kg K2O/ha
200 kg S/ha

3. Planting density: 25 x 15 cm (26.7 hills/m²)

ANNEX 3 OVERALL RESULTS OF EXPERIMENT ON EFFECT OF POTASH

Treatment	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grains per m^2 (x1000)	Percentage of Ripened Grains (%)	Percentage of Non-Fertilized Grains (%)	1,000 Grain Weight (g)	Yield (ton/ha)
0 kg K_2O/ha	I	Oct. 21, 1978	Feb. 13	Feb. 18	Feb. 26	May 5	44.7	16.3	40.8	906	59	53.0	26.6	71.8	19.1	2.7
	II	"	"	"	"	"	42.6	17.8	28.8	639	68	43.0	38.3	56.4	19.3	3.2
	III	"	"	"	"	"	37.2	16.9	28.8	639	72	45.6	38.9	48.0	18.9	3.4
	Mean						41.5	17.0	32.8	728	66	47.2	34.6	58.7	19.1	3.1
50 kg K_2O/ha	I	"	"	"	"	"	43.6	18.5	26.2	582	62	35.6	31.6	62.2	19.1	2.1
	II	"	"	"	"	"	40.1	16.4	27.0	599	68	40.2	21.2	75.2	18.6	1.6
	III	"	"	"	"	"	42.1	18.1	23.4	519	62	31.9	36.9	53.4	17.2	2.0
	Mean						41.9	17.7	25.5	567	64	35.9	29.9	63.6	18.3	1.9
100 kg K_2O/ha	I	"	"	"	"	"	40.5	17.6	30.8	684	71	47.8	23.9	74.5	18.3	2.1
	II	"	"	"	"	"	43.2	16.9	34.9	775	66	50.7	16.1	75.2	19.6	1.6
	III	"	"	"	"	"	38.2	17.9	23.4	519	73	37.3	28.3	65.4	17.7	1.9
	Mean						40.6	17.5	29.7	659	70	45.3	22.8	71.7	18.5	1.9
200 kg K_2O/ha	I	"	"	"	"	"	37.4	15.9	26.1	579	73	42.0	25.7	70.0	19.6	2.1
	II	"	"	"	"	"	43.0	18.3	27.0	599	62	36.8	35.2	56.5	19.3	2.5
	III	"	"	"	"	"	43.4	17.3	28.9	642	50	31.9	20.8	73.7	17.9	1.2
	Mean						41.3	17.2	27.3	607	62	36.9	27.2	66.7	18.9	1.9

Remarks 1) Variety: BG-34-8

2) Spacing: 30 x 15 cm (22.2 hills/m^2)

3) Fertilization

170 kg N/ha

0 kg P_2O_5/ha

0 kg K_2O/ha

ANNEX 3 OVERALL RESULTS OF EXPERIMENT ON EFFECT OF SULPHUR

Treatment	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m²	No. of Grains per Panicle	No. of Grains per m² (x1000)	Percentage of Ripened Grains (%)	Percentage of Non-fertilized Grains (%)	1,000 Grain Weight (g)	Yield (ton./ha)
0 kg S/ha	I	Oct. 21, 1978	Mar. 26	Apr. 3	Apr. 10	May 9	36.6	19.7	19.8	440	59	26.0	62.8	22.0	23.1	3.8
	II	"	"	"	"	"	31.4	19.7	17.7	393	51	20.2	65.8	27.4	21.6	2.9
	III	"	"	"	"	"	38.3	19.9	18.3	406	78	31.7	65.9	16.8	24.6	5.1
	Mean						23.4	19.8	18.6	413	63	26.0	64.8	22.1	23.1	3.9
50 kg S/ha	I	"	"	"	"	"	30.1	18.2	18.0	400	49	19.5	47.8	47.8	22.7	2.1
	II	"	"	"	"	"	30.1	18.6	20.4	453	71	32.2	58.6	24.6	20.4	3.8
	III	"	"	"	"	"	30.7	18.5	18.0	400	56	22.3	55.0	30.8	22.4	2.7
	Mean						30.3	18.4	18.8	418	59	24.7	53.8	34.4	21.8	2.9
100 kg S/ha	I	"	"	"	"	"	35.2	18.9	18.9	420	62	26.0	60.3	26.1	23.0	3.6
	II	"	"	"	"	"	39.3	20.1	17.5	389	68	26.5	63.8	16.2	24.8	4.2
	III	"	"	"	"	"	37.5	20.2	21.2	471	70	32.7	62.9	21.4	24.3	5.0
	Mean						37.3	19.7	19.2	427	67	28.4	62.3	21.2	24.0	4.3
150 kg S/ha	I	"	"	"	"	"	39.1	19.3	18.6	413	66	27.1	64.8	47.8	23.9	4.2
	II	"	"	"	"	"	35.4	18.4	17.5	389	60	23.2	61.0	32.2	23.8	3.4
	III	"	"	"	"	"	30.0	19.2	16.5	366	54	19.8	55.5	37.7	22.8	2.5
	Mean						34.8	19.0	17.5	389	60	23.4	60.4	39.2	23.5	3.4

Remarks 1) Variety: IR-8

2) Spacing: 30 x 15 cm (22.2 hills/m^2)

3) Fertilization

170 kg N/ha

0 kg P_2O_5/ha

0 kg K_2O/ha

ANNEX 4 OVERALL RESULTS OF NITROGEN AMOUNT TEST

(Main-Season)

Treatment	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grains per m^2 (x1000)	Percentage of Ripened Grains (%)	Percentage of Non-fertilized Grains (%)	1,000 Grain Weight (g)	Yield (ton/ha)
50 kg N/ha	I	Jun.17, 1978	Sep. 3	Sep. 11	Sep. 15	Oct. 15	52	22	7.9	211	113	23.9	92.0	1.9	19.7	4.3
	II	"	"	"	"	"	55	24	8.4	224	102	22.9	90.4	2.1	20.4	4.2
	III	"	"	"	"	"	56	23	8.3	222	103	23.4	88.6	3.9	19.7	4.1
	Mean						54	23	8.2	219	107	23.4	90.3	2.6	19.9	4.2
100 kg N/ha	I	"	"	"	"	"	57	22	10.5	280	101	28.3	89.4	2.0	21.7	5.5
	II	"	"	"	"	"	59	24	10.5	280	108	30.3	86.7	5.7	20.5	5.4
	III	"	"	"	"	"	57	23	10.7	286	112	31.9	87.2	4.6	20.6	5.7
	Mean						58	23	10.6	282	107	30.2	87.8	4.1	20.9	5.5
150 kg N/ha	I	"	"	"	"	"	62	24	13.1	350	115	40.4	84.8	4.8	21.6	7.4
	II	"	"	"	"	"	65	25	12.5	334	115	38.3	86.3	5.6	21.6	7.1
	III	"	"	"	"	"	65	25	13.1	350	123	43.2	73.0	14.4	21.4	6.8
	Mean						64	25	12.9	345	119	40.6	81.4	8.3	21.5	7.1
200 kg N/ha	I	"	"	"	"	"	67	26	14.1	376	98	36.7	80.7	5.0	21.4	6.3
	II	"	"	"	"	"	67	25	12.3	328	139	45.7	84.9	3.9	21.7	8.4
	III	"	"	"	"	"	70	25	12.9	344	124	42.6	79.4	8.0	22.5	7.6
	Mean						68	25	13.1	349	120	41.7	81.7	5.6	21.9	7.4
250 kg N/ha	I	"	"	"	"	"	68	26	13.1	350	135	47.3	76.6	5.6	21.7	7.9
	II	"	"	"	"	"	65	26	13.4	358	142	50.8	87.6	1.0	22.4	10.0
	III	"	"	"	"	"	68	26	13.9	371	115	42.8	74.3	3.9	21.9	7.0
	Mean						67	26	13.5	360	131	47.0	79.5	4.2	22.0	8.3

Remarks 1) Variety: C-15 (Kuang Chu-15)

2) Planting density: 15 x 25 cm (26.7 hills/m^2)

3) Fertilization

	Application Time	50kgN	100kgN	150kgN	200kgN	250kgN
Basal application	Just after transplanting	30	60	80	110	140
1st top-dressing	Panicle initiation stage	10	20	40	50	60
2nd top-dressing	Full heading stage	10	20	30	40	50

The amount of phosphate applied was half of the total amount of nitrogen in each treatment.

ANNEX 4 OVERALL RESULTS OF NITROGEN AMOUNT TEST

(Off-Season)

Treatment	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grains per m^2 (x1000)	Percentage of Ripened Grains (%)	Percentage of Non-Fertilized Grains (%)	1,000 Grain Weight (g)	Yield (ton/ha)
Control (0-0-0-0)	I	Feb. 1, 1978	May 19	May 25	May 30	June 15	44.4	22.3	11.7	312	77	23.9	67.1	26.5	23.1	3.7
	II	"	"	"	"	"	36.6	20.4	11.2	299	59	17.7	69.4	22.3	24.1	3.0
	III	"	"	"	"	"	39.8	20.4	10.7	286	65	18.6	56.9	39.9	21.7	2.3
	Mean						40.3	21.0	11.2	299	67	20.1	64.5	29.6	23.0	3.0
50-0-0-0	I	"	"	"	"	"	42.6	20.8	12.9	344	75	25.8	72.7	21.2	23.1	4.3
	II	"	"	"	"	"	42.8	22.5	15.4	411	89	36.7	69.6	24.4	23.2	5.9
	III	"	"	"	"	"	39.5	21.0	12.3	328	95	31.1	54.9	32.4	21.1	3.6
	Mean						41.6	21.4	13.5	361	86	31.2	65.7	26.0	22.5	4.6
20-10-10-10	I	"	"	"	"	"	44.8	22.7	11.6	310	68	21.0	86.8	10.4	23.8	4.3
	II	"	"	"	"	"	40.8	20.4	12.3	328	62	20.2	77.3	17.4	22.9	3.6
	III	"	"	"	"	"	38.6	20.6	11.3	302	71	21.3	79.3	16.7	22.2	3.7
	Mean						41.4	21.2	11.7	313	67	20.8	81.1	14.8	23.0	3.9
30-0-20-0	I	"	"	"	"	"	45.2	22.5	15.0	401	106	42.3	50.9	38.4	22.3	4.8
	II	"	"	"	"	"	42.2	22.5	10.9	291	76	22.0	68.6	19.2	23.0	3.5
	III	"	"	"	"	"	41.7	22.0	10.7	286	88	25.1	66.3	24.6	22.5	3.7
	Mean						43.0	22.3	12.2	326	90	29.8	61.9	27.4	22.6	4.0
20-0-20-10	I	"	"	"	"	"	46.4	22.6	14.3	382	91	34.7	64.8	19.6	23.3	5.2
	II	"	"	"	"	"	38.6	21.6	11.1	296	68	20.1	77.4	13.7	23.3	3.6
	III	"	"	"	"	"	43.4	22.0	12.5	334	84	28.0	62.3	26.7	23.0	4.0
	Mean						42.8	22.1	12.6	337	81	27.6	68.2	20.0	23.2	4.3
100-0-0-0	I	"	"	"	"	"	42.5	21.0	13.4	358	76	27.1	64.9	20.1	23.2	4.1
	II	"	"	"	"	"	43.0	22.2	13.5	360	80	28.8	57.3	29.1	23.9	3.9
	III	"	"	"	"	"	44.0	23.0	13.1	350	88	30.6	57.7	28.0	23.6	4.2
	Mean						43.2	22.1	13.3	356	81	28.8	60.0	25.7	23.6	4.1

ANNEX 4 OVERALL RESULTS OF NITROGEN AMOUNT TEST

(Off-Season)

Treatment	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grains per m^2 (x1000)	Percentage of Ripened Grains (%)	Percentage of Non-fertilized Grains (%)	1,000 Grain Weight (g)	Yield (ton ha)
30-30-20-20	I	Feb. 1, 1978	May 19	May 25	May 30	June 15	45.7	22.6	14.6	390	87	34.1	70.2	23.0	23.7	3.7
	II	"	"	"	"	"	41.0	21.3	12.5	334	69	23.1	64.1	21.1	21.5	3.2
	III	"	"	"	"	"	46.8	26.8	16.4	438	83	36.5	56.5	23.6	23.1	4.8
	Mean						44.5	23.6	14.5	387	80	31.2	63.6	22.6	22.8	4.6
60-0-40-0	I	"	"	"	"	"	43.7	22.4	13.8	368	72	26.3	74.9	19.4	23.5	4.6
	II	"	"	"	"	"	42.5	22.5	14.1	376	75	28.3	70.0	23.4	23.0	4.6
	III	"	"	"	"	"	44.1	22.0	12.0	320	82	26.4	72.9	21.8	22.7	4.4
	Mean						43.4	22.3	13.3	355	76	27.0	72.6	21.5	23.1	4.5
40-0-40-30	I	"	"	"	"	"	42.1	21.5	14.1	376	88.7	33.0	65.1	29.1	22.6	4.9
	II	"	"	"	"	"	42.5	22.2	12.8	342	72.0	24.6	74.1	20.8	23.0	4.2
	III	"	"	"	"	"	43.7	21.2	14.4	385	93.0	35.8	60.7	30.6	21.7	4.7
	Mean						42.8	21.6	13.8	368	84.6	31.1	66.6	26.8	22.4	4.6
150-0-0-0	I	"	"	"	"	"	49.3	23.5	14.9	398	89	35.2	69.2	22.3	23.6	5.7
	II	"	"	"	"	"	45.5	22.7	16.3	435	79	34.3	44.4	37.1	21.4	3.3
	III	"	"	"	"	"	42.5	22.1	13.9	371	84	31.2	50.0	29.4	22.7	3.3
	Mean						45.8	22.8	15.0	401	84	33.6	54.5	29.6	22.6	4.2
50-30-40-30	I	"	"	"	"	"	46.6	22.7	14.5	387	101	38.9	62.7	25.1	24.3	5.9
	II	"	"	"	"	"	42.6	21.2	14.7	392	72	28.1	77.8	13.1	23.2	5.1
	III	"	"	"	"	"	36.9	21.9	-		-	-	-	26.1	21.7	-
	Mean						42.0	21.9	14.6	390	87	33.5	70.3	21.4	23.1	5.5
80-0-70-0	I	"	"	"	"	"	49.5	24.6	17.0	454	99	45.1	62.5	30.5	24.2	6.8
	II	"	"	"	"	"	44.6	22.0	16.7	446	122	54.3	54.3	40.4	23.3	6.9
	III	"	"	"	"	"	43.6	21.5	14.1	376	84	31.7	63.6	26.0	24.2	4.9
	Mean						45.9	22.7	15.9	376	102	43.7	60.1	32.3	23.9	6.2

ANNEX 4 OVERALL RESULTS OF NITROGEN AMOUNT TEST

(Off-Season)

Treatment	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grains per m^2 (x1000)	Percentage of Ripened Grains (%)	Percentage of Non-fertilized Grains (%)	1,000 Grain Weight (g)	Yield (ton/ha)
70-0-60-20	I	Feb. 2, 1979	May 19	May 25	May 30	June 15	45.7	22.5	14.5	387	80	30.9	80.4	13.2	23.7	5.9
	II	"	"	"	"	"	44.6	21.9	14.2	379	69	26.1	84.6	27.3	24.0	5.3
	III	"	"	"	"	"	47.7	21.6	12.8	342	76	25.8	69.3	25.3	24.3	4.3
	Mean						44.0	22.0	13.8	369	75	27.6	78.1	21.9	24.0	5.2
200-0-0-0	I	"	"	"	"	"	49.2	23.4	17.5	467	96	44.7	61.6	32.8	24.5	6.7
	II	"	"	"	"	"	46.4	22.6	16.7	446	100	44.7	42.0	42.3	22.6	4.2
	III	"	"	"	"	"	45.5	21.7	15.4	411	90	37.1	56.6	35.6	22.3	4.7
	Mean						47.0	22.6	11.3	441	95	42.2	53.4	36.9	23.1	5.2
80-60-60-30 /1	I	"	"	"	"	"	43.7	22.4	15.2	406	100	40.4	65.7	25.2	23.5	6.2
	II	"	"	"	"	"	40.0	21.0	15.5	414	80	33.0	70.6	22.2	23.1	5.4
	III	"	"	"	"	"	44.0	21.9	15.6	417	101	42.2	67.0	18.0	24.1	6.8
	Mean						42.6	21.8	15.4	412	94	38.5	67.8	21.8	23.6	6.1
120-0-80-0	I	"	"	"	"	"	48.4	22.7	16.2	433	99	42.7	61.9	31.7	23.3	6.2
	II	"	"	"	"	"	46.5	23.2	15.7	419	93	39.0	66.3	24.2	22.8	5.9
	III	"	"	"	"	"	46.1	22.6	16.9	451	108	48.9	53.6	37.5	21.0	5.5
	Mean						47.0	22.8	16.3	434	100	43.5	60.6	31.1	22.4	5.9

Remarks 1) Variety: TOS-103

2) Planting Density: 25 x 15 cm (26.7 hills/m^2)

3) Fertilization

100 kg P_2O_5/ha

/1: 80 kgN/ha just before transplanting

60 kgN/ha on 20th day after transplanting

60 kgN/ha at the spikelet differentiation stage

50 kgN/ha at full heading stage

ANNEX 5 OVERALL RESULTS OF SPACING TEST

(Marin-Benson)

Treatment	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grains per m^2 (x1000)	Percentage of Ripened Grains (%)	Percentage of Non-fertilized Grains (%)	1,000 Grain Weight (g)	Yield (ton/ha)
30x30 cm	I	June 17,1978		Sep.10		Oct. 15	72	27	10.6	283	134	37.8	84.3	2.9	23.0	7.3
(11.1 hills/m^2)	II	"		"		"	68	24	10.2	273	129	35.2	77.6	9.1	21.1	5.8
	III	"		"		"	65	26	9.0	240	123	29.5	94.1	2.9	22.1	6.1
	Mean						68	26	9.9	265	129	34.2	85.3	5.0	22.1	6.4
30x20 cm	I	"		"		"	66	26	13.3	356	118	42.1	81.6	5.5	21.6	7.4
(16.7 hills/m^2)	II	"		"		"	65	25	12.6	337	123	41.6	72.1	14.3	21.6	6.5
	III	"		"		"	64	25	11.9	319	127	40.5	80.7	6.4	21.4	7.0
	Mean						65	25	12.6	337	123	41.4	78.1	8.7	21.5	7.0
30x15 cm	I	"		"		"	74	27	13.6	364	109	39.8	85.7	0.6	22.4	7.6
(22.2 hills/m^2)	II	"		"		"	67	25	12.0	320	114	36.4	95.8	0.7	21.8	7.6
	III	"		"		"	65	26	12.2	326	128	41.7	83.3	5.1	21.0	7.3
	Mean						69	26	12.6	337	117	39.3	88.3	2.1	21.7	7.5
25x15 cm	I	"		"		"	71	27	14.8	395	142	56.2	81.1	6.7	22.7	10.4
(26.7 hills/m^2)	II	"		"		"	68	26	17.6	470	130	60.9	74.2	8.1	21.5	9.7
	III	"		"		"	66	24	12.1	323	102	32.9	91.6	1.0	21.0	6.3
	Mean						68	26	14.8	396	125	50.0	82.3	5.3	21.7	8.8
30x10 cm	I	"		"		"	71	27	16.7	446	116	51.8	75.9	8.1	22.4	8.8
(33.3 hills/m^2)	II	"		"		"	65	25	11.7	313	134	41.8	94.5	0.7	22.1	8.7
	III	"		"		"	61	25	13.3	356	113	40.3	90.4	0.7	21.3	7.8
	Mean						66	26	13.9	372	121	44.6	86.9	3.2	21.9	8.4

Remarks 1) Variety, C-15

2) Fertilization

150 kg N/ha
75 kg P_2O_5/ha

ANNEX 5 OVERALL RESULTS OF SPACING TEST

(Off-Season)

Treatment	Block Number	Sowing Date	Heading date 5%	Heading date 50%	Heading date 95%	Maturity Date	Culm length (cm)	Panicle length (cm)	No. of Panicles per hill	No. of Pahicles per m²	No. of Grains per panicle	No. of Grains per m² (x1,000)	Percentage of Ripened Grains (%)	Percentage of Non-fertilized Grains (%)	1,000 Grain Weight (g)	Yield (ton/ha)
(1) Ordinary transplanting																
15cmx15cm	I	Feb. 1, 1979	May 28	June 5	June 10	June 30	46.4	23.7	11.6	515	102	52.7	86.0	10.5	23.0	10.4
(44.4 hills/m²)	II	"	May 27	May 31	June 4	"	47.1	22.3	11.7	519	74	38.3	88.6	9.6	25.1	8.5
	III	"	May 25	may 29	June 3	"	45.2	22.7	14.1	626	61	38.3	89.5	9.1	24.3	8.3
	Mean						46.2	22.9	12.5	553	79	43.1	88.0	9.5	24.1	9.1
25cmx10cm	I	"	May 28	June 5	June 12	"	45.1	22.6	14.0	560	73	40.6	85.2	10.3	23.4	8.1
(40 hills/m²)	II	"	May 28	June 3	June 8	"	43.2	22.1	12.4	496	79	39.1	87.8	7.7	24.7	8.5
	III	"	May 26	June 29	June 3	"	43.8	21.9	14.0	560	72	40.0	85.2	12.6	23.6	8.0
	Mean						44.0	22.2	13.5	539	74	39.9	86.1	10.2	23.9	8.2
25cmx15cm	I	"	May 28	June 5	June 10	July 3	45.6	21.0	14.5	387	70	27.0	94.3	11.4	23.0	5.9
(26.7 hills/m²)	II	"	May 28	June 1	June 10	"	50.5	24.4	12.4	331	89	29.4	88.3	9.4	23.5	6.1
	III	"	May 28	May 31	June 3	"	44.9	23.0	16.7	446	93	41.4	86.2	11.8	23.6	8.4
	Mean						47.0	22.8	14.5	388	84	32.6	89.6	10.9	23.4	6.8
25cmx25cm	I	"	May 27	June 1	June 8	June 27	45.4	23.3	23.3	373	88	32.6	83.5	12.9	23.9	6.5
(16 hills/m²)	II	"	May 28	June 5	June 10	"	49.7	24.5	22.7	363	81	29.5	90.9	7.6	22.8	6.1
	III	"	May 28	June 3	June 8	"	43.8	22.3	19.4	310	116	35.9	82.0	13.9	23.8	7.0
	Mean						46.3	23.4	21.8	349	95	32.7	85.5	11.5	23.5	6.5
30cmx10cm	I	"	May 28	June 4	June 10	"	47.7	21.5	15.3	509	87	44.3	92.1	6.3	23.0	9.4
(33.3 hills/m²)	II	"	May 25	May 31	June 4	"	46.9	23.4	17.0	566	87	49.5	84.9	11.9	22.6	9.5
	III	"	May 25	May 30	June 5	"	45.9	23.0	15.7	523	83	43.4	85.0	11.8	22.3	8.2
	Mean						46.8	22.6	16.0	533	86	45.7	87.3	10.0	22.6	9.0
30cmx15cm	I	"	May 27	May 29	June 4	June 25	43.8	21.9	16.0	355	61	21.5	93.1	16.3	22.6	4.5
(22.2 hills/m²)	II	"	May 28	June 5	June 12	"	43.5	23.2	16.8	373	91	34.1	90.3	8.7	22.6	7.0
	III	"	May 28	June 3	June 8	"	-	-	19.0	422	79	33.4	84.1	11.4	23.1	6.5
	Mean						43.7	22.6	17.3	383	77	29.7	89.2	12.1	22.8	6.0
30cmx20cm	I	"	May 27	May 31	June 7	"	43.8	22.6	17.9	299	97	28.8	67.4	21.5	22.7	4.4
(16.7 hills/m²)	II	"	May 28	June 5	June 12	June 26	46.2	23.1	19.3	322	102	32.9	78.7	15.2	22.3	5.8
	III	"	May 27	May 31	June 3	"	46.1	22.7	21.2	354	89	31.5	81.5	12.7	22.5	6.0
	Mean						45.4	22.7	19.5	325	96	31.1	76.9	16.5	22.5	5.4

Treatment	Block Number	Sowing Date	Heading date 5%	Heading date 50%	Heading date 95%	Maturity Date	Culm length (cm)	Panicle length (cm)	No. of Panicles per hill	No. of Panicles per m^2	No. of Grains per panicle	No. of Grains per m^2 (x1,000)	Percentage of Ripened Grains (%)	Percentage of Non-fertilized Grains (%)	1,000 Grain Weight (g)	Yield (ton/ha)
30cmx30cm	I	Feb. 1, 1979	May 28	June 1	June 8	June 30	45.0	24.0	21.0	233	88	20.6	87.5	11.0	22.0	4.0
(11.1 hills/m^2)	II	"	May 28	June 3	June 10	"	45.4	23.9	27.6	306	72	21.9	81.7	16.9	23.5	4.2
	III	"	"	"	June 8	"	46.1	23.7	23.2	258	82	21.0	76.5	17.8	23.6	3.8
	Mean						45.5	23.5	23.9	266	81	21.2	81.9	15.2	23.0	4.0
(2) Broadcast transplanting with broadcastable seedling																
17 hills/m^2	I	"	May 25	May 29	June 3	June 28	43.0	19.8	24.0	408	55	22.3	75.8	18.7	22.6	3.8
	II	"	June 4	June 8	June 14	"	51.0	23.4	29.6	503	66	33.2	78.3	15.1	22.7	5.9
	III	"	May 28	June 3	June 8	"	44.6	23.5	18.5	315	82	25.7	85.7	10.6	23.8	5.2
	Mean						46.2	22.2	24.0	409	68	27.1	79.9	14.8	23.0	5.0
22 hills/m^2	I	"	May 25	May 31	June 8	"	47.2	22.1	19.0	418	85	35.7	84.4	9.8	22.0	6.6
	II	"	May 27	May 31	June 4	"	47.0	22.5	19.2	422	70	29.6	78.0	15.3	23.1	5.3
	III	"	May 30	June 4	June 8	"	42.1	19.9	21.7	477	68	32.5	79.0	16.7	21.3	5.5
	Mean						45.5	21.5	20.0	439	74	32.6	80.5	13.9	22.1	5.8
40 hills/m^2	I	"	May 28	May 31	June 8	"	44.7	20.9	18.4	736	66	48.6	72.2	22.8	23.8	8.4
	II	"	May 28	June 5	June 12	"	47.2	22.6	17.6	704	87	61.5	78.3	17.0	23.6	11.4
	III	"	May 27	May 31	June 5	"	47.5	22.9	15.5	620	64	39.6	77.1	19.7	23.1	7.1
	Mean						46.5	22.1	17.2	687	72	49.9	75.9	19.8	23.5	9.0
(3) Ordinary transplanting with broadcastable seedling																
30cmx15cm	I	"	June 4	June 8	June 12	June 27	48.2	23.5	19.4	431	88	37.8	85.5	10.7	22.6	7.3
	II	"	May 28	June 3	June 8	"	47.3	22.8	17.7	393	74	29.0	86.4	10.4	22.6	5.7
	III	"	May 26	June 1	June 8	"	47.0	22.5	20.0	444	95	42.0	73.1	19.8	23.1	7.1
							47.5	22.9	19.0	423	86	36.3	81.7	13.6	22.8	6.7
(4) Direct sowing																
Under the conditions of no puddling																
50kg seed/ha	I	"	May 11	May 17	May 27	June 25	44.1	18.7		893	52	46.4	65.2	26.5	20.8	6.3
75kg seed/ha	I	"	May 20	May 26	May 30	"	36.5	18.3		857	40	34.1	71.4	24.8	25.4	6.2
100kg seed/ha	I	"	"	"	"	"	41.8	18.7		1,027	49	50.5	60.8	27.4	20.9	6.4
Under the submerged condition with puddling																
50kg seed/ha	I	"	May 17	May 27	June 4	"	35.8	18.8		1,037	35	35.8	68.2	23.9	23.7	5.8
75kg/seed/ha	I	"	May 11	May 17	May 27	"	38.9	18.2		967	51	48.9	78.5	13.0	25.8	9.9
100kg seed/ha	I	"	May 12	May 17	May 27	"	38.9	18.3		927	51	47.3	62.0	20.2	24.3	7.1

Remarks 1) Variety: TOS-103 2) Fertilization 180 kg N/ha, 100 kg P_2O_5/ha, 0 kg K_2O/ha

ANNEX 5 OVERALL RESULT OF EXPERIMENT ON THE SOWING RATE

UNDER THE SUBMERGED CONDITION (June 1978 - Oct. 1978)

Treatment	Block Number	Sowing date	Heading date 5%	Heading date 50%	Heading date 95%	Maturity date	Culm length (cm)	Panicle length (cm)	No. of Panicles per hill	No. ov Panicles per m^2	No. of grains per per panicle	No. of grains per m^2 (x1,000)	Percentage of ripened grains (%)	Percenta of non-fertilized grains (%)	1,000 grain Weight (g)	Yield (t/ha)
Seed: 50kg/ha	I	Jun.29	Sep.11	Sep.17	Sep.19	Oct.20	67	25					95.1		22.0	9.4
Broadcasted	II	Jul. 2	Sep.18	Sep.19	Sep.21	"	70	24		490	77.0	37.8	91.6		23.1	8.0
	III	Jul. 3	"	"	"	"	71	25		355						
	Mean															
Seed: 50kg/ha	I	Jun.28	Sep.11	Sep.17	Sep.19	Oct.20	64	23					94.9		21.8	6.65
Row Width: 30cm	II	Jul. 2	Sep.18	Sep.19	Sep.21	Oct.20	68	24				39.9	89.9		22.7	8.15
	III	Jul. 3					70	24		384						
	Mean															
Seed: 80kg/ha	I	Jun.29	Sep.11	Sep.17	Sep.19	Oct.20	72	25					91.9		22.9	10.2
Broadcasted	II	Jul. 2	Sep.18	Sep.19	Sep.21	Oct.20	72	24		535						
	III	Jul. 3	"	"	"	"	73	23		382		35.5	87.2		22.9	7.1
	Mean															
Seed: 80kg/ha	I	Jun.28	Sep.11	Sep.17	Sep.19	Oct.20	68	24					92.1		22.9	9.6
Row Width: 15cm	II	Jul. 2	Sep.18	Sep.19	Sep.21	Oct.20	70	24					93.1		23.3	10.6
	III	Jul. 8	"	"	"	"	69	25								
	Mean															
Seed: 80kg/ha	I	Jun.28	Sep.11	Sep.17	Sep.19	Oct.20	60	22				43.8	89.7		21.5	8.5
Row width: 20cm	II	Jun.29	"	"	"	"	70	24		433						
	III	Jul. 3	Sep.18	Sep.19	Sep.21	"	69	23		532						
	Mean															
Seed: 80kg/ha	I	Jun.28	Sep.11	Sep.17	Sep.19	Oct.20	62	21					91.6		22.1	6.7
Row Width: 30cm	II	Jun.29	"	"	"	"	69	24		588						
	III	Jul. 3	Sep.18	Sep.19	Sep.21		67	24		447						
	Mean															
Seed: 80kg/ha	I	Jun.28	Sep.11	Sep.17	Sep.19	Oct.20	60	22					90.9		22.3	8.1
Row width: 40cm	II	Jun.29	Sep.11	"	"	"	68	25		573						
	III	Jul. 3	Sep.18	Sep.19	Sep.21	"	68	23		338						
	Mean															
Seed: 100kg	I	Jun.28	Sep.11	Sep.17	Sep.19	Oct.20	68	25				50.6	92.1		22.6	10.5
Row width: 30cm	II	Jul. 2	Sep.18	Sep.19	Sep.21	"	72	23					92.8		22.9	9.5
	III	Jul. 3	"	"	"	"	69	24		381						
	Mean															

Note: 1. Variety used for this experiment was C-15 2. Application of fertilizers are, 180 kg/ha of N, 75kg ha of P_2O_5

ANNEX 6. A BRIEF NOTE ON THE "BROADCAST TRANSPLANTING" METHOD

The "Broadcast Transplanting" method conveniently and effectively saves labor in transplanting. This method is outlined below.

1. Seedling-boxes-concepts

Matsushima, one of the authors of the present report, has been engaged in many pot-experiments throughout his long research career over a period of 40 years, in which he pulled rice hills out of pots and examined the roots.

He always wondered how easily the rice hills can be pulled out of pots without injury to roots, moreover, the roots remained intact as a lump completely wrapping the soil and practically no soil falls out of this lump. This was a direct hint in conceiving a small pot in group.

The box size has 61cm length, 31cm width and 3.4cm height to contain 578 small seedling pots. The box size is the same as that of transplanter-used seedling boxes to make it convenient for other uses. In vertical section, a pot is 1.6cm^2 at the top and at the a little narrower bottom, with a 2.5mm hole at the bottom. The height is 3.2 cm.

When the seedling roots fill the inside of the pot the roots shoot out of the hole and absorb the fertilizer in the seedling bed outside the pot. Thus, it was possible to obtain much larger seedlings than those in non-hole pots, giving mature seedlings of 6 - 7 leaves.

Because they are made of plastic, boxes can be used semiperma-nently.

2. Method of Use of Seedling-boxes

The number of boxes required for broadcasting seedlings per 10a differs with planting density, as listed below.

No. of hills Per m^2	15.1	18.2	21.2	24.2	27.2	30.3
Required No. of boxes	26	31	37	42	47	52

Because in general the denser the planting density the better the result, it is more profitable to increase the number of hills by 20 - 30% more than the normal number per m^2.

The pot-use soil is prepared after passing it through a 5mm sieve during the farming leisure season. The pots are filled with soil. Loamy soil or clay loamy soil is preferable. At this time the use of a strongly acid soil (pH 4.5 - 5) is useful for the control of damping-off disease and sudden withering when it is cold.

The soil requirement per box is about 4 ℓ, and 140 ℓfor 35 boxes per 10a.

For fertilization of pot-use soil, 10g ammonium sulphate, 10g superphosphate and 5g potassium chloride are used per box (4ℓ), and for seedling bed-soil under seedling boxes, no fertilizer is applied.

Moreover, if Tachigaren (3-hydroxy-5-methyl isoxazole) is mixed into the soil 3 to 5g per box, it will be effective in the control of damping-off and sudden withering, and it will expedite the seedling growth.

After mixing in Tachigaren and fertilizing the soil, the soil is put into the pot and pressed down by shaking so that the soil is neither too tight nor too loose. Next, the soil is pressed down by a soil pressor to form sowing-holes in which about 2 to 4 seeds are inserted. For less than one hectare, hand sowing will do, but in the case of a larger cultivating acreage a specially designed seeder can conveniently be used.

In short, in the early stage, full warmth is to be maintained. In the later stage, gradual growth is controlled by accustoming the seedling to cold. If transplanting is deemed as delayed from the neighboring farms, it may be unavoidable to plant young seedlings of 25 - 35 days, but mature seedlings of 50 - 60 days (the longer the better) with 6 - 7 leaves are better. Under the different temperatures in seedling beds the dry matter weight of seedlings with the same leaf age sometimes differs by 8 fold. The longer the time taken to reach mature seedling, the stiffer, shorter, thicker and healthier the seedling will be. However, one thing to be remembered is not to delay the transplanting time in order to leave the seedling in the seedling bed longer. Transplanting should be carried out sooner than on neighboring farms.

Accordingly, in order to lengthen the number of days in the seedling stage, sowing should be earlier than general. Moreover, since seedlings grown in boxes easily take root even at a low water temperature, earlier transplanting than normal is perfectly possible.

As for water management after the germination, healthy seedlings can be raised more easily by irrigating with as small amount of water as possible.

Accordingly, watering should be carried out up to 1/3 the depth of seedling-boxes from only when the soil inside the pots becomes too dry or leaf-blades show symptoms of wilting. In such a way watering is made as small as possible so that as much air as possible can be supplied to roots. If it is unavoidable that healthy seedlings must be raized under a high temperature soil moisture should be controlled to supress seedling growth.

Full attention should be given to excessive soil drying (wilting), and in case of any such symptom, water should be supplied immediately.

The amount of seeds to be sown per Box is 60 to 80g of dried seeds or 72 to 96g of soaked seeds, taking the seed weight of 1,000 grains as 30g.

After the sowing is completed, excessive soil is removed by a plank. Then, the boxes are put inside the vinyl-tunnel-hot-seedling-bed or vinyl-tunnel-upland-seedling-bed in the North Temperature zone, or directly on the ordinary seedling-bed in the South Temperate zone or Tropical Zone. After being pressed down firmly on the seedling bed, boxes are packed tightly together.

With a view to saving labor, a mixed sowing method using soil, seed and fertilizers has been devised.

In this method, soil, seed and fertilizers are mixed, and the soil put into the pot as before. The amount of seeds must be increased by 20% in this method. The labor requirement is only 23% of that in the normal method.

After the seedling-boxes have been arranged side by side, the water-level is raised to about 1/3 depth from the bottom of the boxes.

The water seeps up to the soil surface by capillary action. After seeing that all pots are wet on the surface, the cover of the seedling bed is closed in the North Temperate Zone. In case water does not seep up to the soil surface, watering pots from above will be necessary. In such a way three conditions are met and ensure satisfactory germination.

After germination, up to the development of third leaf (the first green leaf is set as the first leaf), seedlings should be kept warm, but after that they should be allowed to get accustomed to low temperatures gradually. In cold seasons, when the fourth leaf emerges, the vinyl cover is removed during the daytime to expose the seedling to direct sunlight and cold. A secret in raising the seedling is to be patient and let the seedling grow gradually. Once the seedlings are accustomed to cold, they become strong and will not be damaged by light frost and snow.

Top-dressing should be applied dependent on the growth condition, but in general it is not required. Nevertheless, the application of 6g of water-diluted ammonium sulphate per m^2, 3 to 4 days before transplanting, expedites growth after transplanting in the paddy field.

When uprooting seedlings, one must lift the seedling-boxes and must remove the soil adhered to the reverse side of the box with a plank. If the soil in the pots is too wet, it is advisable to leave the boxes on the land to dry excessive water for a half day. If the soil is too dry, however, it is better to water the boxes once and leave them on the land for one or two hours before pulling out the seedlings. To pull up seedlings, hold several seedlings and pull them out, or beat on the reverse side of the box with a club so that the seedlings may be pulled out easily.

Pulled-up seedlings can be carried to paddy fields in boxes or baskets, but the use of cart is more convenient and efficient.

3. Method of transplanting

In transplanting, seedlings are not transplanted one by one by hand, but they are thrown into the air over the paddy field. As each seedling has enough roots with soil, if dropped from eye level, the base of the seedling always falls first and the seedling will fix upright into the muddy soil in most cases.

When broadcasting, grab many seedlings, shake the seedlings so as to separate them one from another at the base, and then broadcast them into the air so that they speed separately. The first throwing uses about 60 to 70% of the required number of seedlings and the balance of 40 to 30% is used to fill thin parts to give a more them distribution.

For further information, see Matsushima's book "Rice Cultivation for the Millions" (Japan Scientic Societies Press, Tokyo).

The best time for transplanting is immediately after puddling of the paddy field with shallow water depth.

One matter to be careful of in management after transplantation is the application of herbicide. The best time is around 4 to 5 days after transplanting when the seedlings stand upright (typically 30 kg/ha of herbicide (MO) may be applied).

ANNEX 7 OVERALL RESULTS OF THE SEASONAL PLANTING TEST

Name of Variety	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m²	No. of Grains per Panicle	No. of Grains per m² (x1000)	Percent Ripened Grains (%)	Percent Non-fertilized Grains (%)	Wt of 1,000 Grains (g)	Yield (ton ha)
IR-8		Jun.20, 1977		Sept. 28		Oct. 30	58	23	14.5	322	117	37.7	86.1	-	26.8	8.7
		Aug.22, 1977		Dec. 8		Jan. 9	40	22	19.3	428	91	38.8	49	25.7	24.7	4.7
		Nov. 6, 1977		Apr. 21		May 24	48	22	23.3	622		46.0	57.1	18.9	23.6	6.2
		Nov.16, 1977		Apr. 26		May 24	42	22	17.9	478		31.3	71.8	30.8	21.5	3.5
		Dec. 1, 1977		May 13		Jun. 6	64	20	18.9	505		Sample Missing				4.5
		Dec.15, 1977		May 23		Jun.15	62	21	16.4	438		28.0	41.0	28.9	23.0	2.6
		Jan. 2, 1978		May 26		Jun.27	63	21	15.4	411		24.3	65.7	15.4	21.9	4.0
		Jan.16, 1978		May 29		Jul. 9	48	20	17.7	473		30.8	68.2	12.0	25.8	5.4
		Feb. 1, 1978		Jun.10		Jul.24	49	23	17.1	457		30.2	88.7	2.2	25.3	6.8
		Feb.15, 1978		Jul. 3		Aug. 9	51	21	18.8	502		42.7	73.4	20.4	26.1	8.2
	I	Jun. 1,1978	Sep. 7	Sep.10	Sep.13	Oct.14	62	24	12.0	320	108	34.4	82.1	-	30.6	8.7
	II	Jun. 1,1978	Sep. 7	Sep.10	Sep.13	Oct.14	54	21	10.7	286	98	28.1	87.5	-	30.3	7.5
	Mean						58	23	11.4	303	103	31.3	84.8		30.4	8.1
	I	Jul.13, 1978	Oct. 6	Oct.10	Oct.13	Nov.14	-	-		264	97	25.5	76.2	-	27.2	5.3
	II	Jul.13, 1978	Oct. 6	Oct.10	Oct.13	Nov.14	-	-		238	100	23.7	87.7	-	27.9	5.8
	Mean									251	99	24.6	82.0		27.6	5.6
	I	Jul.21, 1978	Oct.22	Oct.25	Oct.27	Dec.12	51	22	9.8	262	94	24.6	83.7	-	28.5	5.9
	II	Jul.21, 1978	Oct.22	Oct.25	Oct.27	Dec.12	51	22	10.7	286	105	30.1	83.6	-	28.3	7.1
	III	Jul.21, 1978	Oct.22	Oct.25	Oct.27	Dec.12	48	22	11.0	294	100	29.4	82.3	-	28.7	6.9
	Mean						50	22	10.5	281	100	28.0	83.2		28.5	6.6
	I	Aug. 1, 1978	Oct.24	Oct.30	Nov. 7	Dec.17	48	22	14.5	387	121	46.8	69.1	-	28.4	9.2
	II	Aug. 1, 1978	Oct.24	Oct.30	Nov. 7	Dec.18	50	22	12.8	342	119	40.7	67.9	-	27.7	7.6
	Mean						49	22	13.7	365	120	43.8	68.5		28.1	8.4
	I	Sep. 2, 1978	Dec.25	Jan. 2	Jan. 9	Feb.13	40	16	11.4	304		11.1	44.6	40.4	22.4	1.1
	II	Sep. 2, 1978	Dec.25	Jan. 2	Jan. 9	Feb.13	39	15	10.8	288		12.6	33.3	37.4	20.9	1.4
	Mean						40	16	11.1	296		11.9	48.9	38.9	21.7	1.3
	I	Oct. 2, 1978				Apr.11	27	18	13.9	371	30	11.1	38.6		21.8	1.0
	II	Oct. 2, 1978					27	17	14.3	382	27	10.2	37.6		20.9	0.8
	Mean						27	18	14.1	377	29	10.7	37.8		21.4	0.9
	I	Nov. 2, 1978	Apr.12	Apr.17	May 5	Jun.4	27	15	10.7	286	66	19.0	63.1	26.6	24.1	2.8

Name of Variety	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grains per m^2 (x1000)	Percent of Ripened Grains (%)	Percent Non-fertilized Grains (%)	Wt. of 1,000 Grains (g)	Yield (ton/ha)
IR-8	I	Dec. 2, 1978	May 8	May 19	May 20	Jun.3	50	20	15.9	425	48	20.2	41.9	35.0	21.3	1.8
	II	Dec. 2, 1978	May 3	May 12	May 21	Jun.3	50	21	15.8	422	45	19.0	63.1	26.6	24.1	2.9
	III	Dec. 2, 1978	May 8	May 12	May 20	Jun.3	50	20	15.8	422	58	24.7	46.1	42.1	24.9	2.8
	IV	Dec. 2, 1978	May 8	May 12	May 21	Jun.3	51	20	15.7	420	72	30.3	61.2	26.7	24.6	4.6
	Mean						50	20	15.8	422	56	23.6	53.1	32.6	23.7	3.1
	I	Jan. 1, 1979	Apr.25	May 1			43	21	11.1	296	54	16.1	38.4	35.2	24.9	1.6
	I	Jan.20, 1979	Jun.16	Jun.22	Jul. 8	Jul.28	55	24	16.8	449	88	39.2	65.4	21.4	25.8	6.6
	II	Jan.20, 1979	Jun.16	Jun.22	Jul. 8	Jul.28	49	23	15.6	416	76	31.6	71.1	18.3	26.8	6.0
	III	Jan.20, 1979	Jun.16	Jun.22	Jul. 8	Jul.28	49	22	15.6	416	69	28.5	57.1	28.2	25.6	4.2
	Mean						51	23	16.0	427	78	33.1	64.5	22.8	26.1	5.6
	I	Feb. 1, 1979	May 20	May 26	May 31	Jun.19	47	23	11.7	313	94	35.2	63.4	28.1	28.5	6.4
	II	Feb. 1, 1979	May 20	May 26	May 31	Jun.19	50	23	14.1	376	103	46.5	66.8	29.0	26.8	8.3
	III	Feb. 1, 1979	May 20	May 26	May 31	Jun.19	50	23	14.5	387	93	43.0	34.4	58.0	27.3	4.1
	Mean						49	23	13.4	359	97	41.6	54.9	38.4	27.5	6.3
	I	Feb. 7, 1979	Jun.16	Jun.20	Jun.26	Jul.30	59	25	13.3	355	85	30.2	75.3	15.1	20.3	4.6
	II	Feb. 7, 1979	Jun.16	Jun.20	Jun.26	Jul.30	64	27	14.5	387	72	28.0	47.0	35.2	20.2	2.6
	III	Feb. 7, 1979	Jun.16	Jun.20	Jun.26	Jul.30	65	27	16.0	427	Damaged & Sparrows					
	Mean						63	26	14.6	390	79	29.1	61.2	25.2	20.3	3.6
	I	Feb.17, 1979	Jun.30	Jul. 6	Jul.10	Jul.20	51	24	12.1	323	81	26.2	71.6	19.4	27.9	5.3
	II	Feb.17, 1979	Jun.30	Jul. 6	Jul.10	Jul.20	50	24	11.5	307	88	26.9	78.6	12.7	28.2	6.0
	III	Feb.17, 1979	Jun.30	Jul. 6	Jul.10	Jul.20	50	23	11.1	296	71	20.9	82.6	10.4	28.6	4.9
	Mean						50	24	11.6	309	80	24.7	77.6	14.2	28.2	5.4
	I	Feb.27, 1979	Jul. 5	Jul.11	Jul.20	Aug. 4	55	24	18.2	486	96	46.4	69.3	17.1	25.0	8.1
	II	Feb.27, 1979	Jul. 5	Jul.11	Jul.20	Aug. 4	59	25	15.4	411	100	41.3	73.0	17.6	26.4	7.9
	III	Feb.27, 1979	Jul. 5	Jul.11	Jul.20	Aug. 4	47	23	11.1	296	94	27.9	81.9	14.5	24.6	5.7
	Mean						54	24	14.9	398	97	38.5	74.7	16.4	25.3	7.2
	I	Apr. 1, 1979	Jul.24	Jul.28	Aug. 6		59	27	12.5	334	104	34.6	63.2		27.0	5.9
	II	Apr. 1, 1979	Jul.24	Jul.28	Aug. 6		51	22	12.4	331	83	27.7	84.5		27.0	6.3
	III	Apr. 1, 1979	Jul.24	Jul.28	Aug. 6		54	22	14.1	376	87	32.8	77.0		30.2	7.6
	Mean						55	24	13.0	347	91	31.7	74.9		28.1	6.6

Name of Variety	Block Number	Sowing Date	Heading Date 5%	50%	95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grains per m^2 (x1000)	Percent of Ripened Grains (%)	Percent of Non-fertilized Grains (%)	Wt. of 1,000 Grains (g)	Yield (ton/ha)
IR-8	I	May 1, 1979	Aug. 20	Aug. 21												
	II	May 1, 1979	Aug. 20	Aug. 24												
	III	May 1, 1979	Aug. 20	Aug. 24												
	Mean															
IR-20		Jun.20, 1977		Sept.27		Oct.29	61	26	16.0	355		54.4	79.6	-	18.7	8.1
		Aug.22, 1977		Nov. 27		Dec.22	49	22	18.4	408		48.7	66	20.6	16.8	5.4
		Nov.22, 1977		Mar.26		May 9	44	20	17.2	459		25.8	64.5	16.3	20.2	3.4
		Dec. 1, 1977		Apr. 9		May 13	38	19	11.9	318		30.4	72.4	19.6	15.0	3.3
		Dec.15, 1977		Apr.19		May 20	45	20	19.0	507		37.6	76.6	9.1	13.9	4.0
		Jan. 2, 1978		Apr.23		May 24	42	20	17.1	457		28.4	74.9	11.0	15.8	3.4
		Jan.16, 1978		May 8		May 30	45	22	19.1	510		48.1	51.4	18.0	15.7	3.9
		Feb. 1, 1978		May 23		Jun.15	73	24	15.6	417		32.5	68.5	8.5	16.4	3.6
		Feb.15,1978		Jun. 4		Jul.30	46	22	16.9	451		42.1	80.6	5.2	17.4	5.9
	I	Jun. 1, 1978	Sep.2	Sep.4	Sep.6	Oct. 7	68	29	13.3	355		51.7	80.7	-	20.2	8.4
	II	Jun. 1, 1978	Sep.2	Sep.4	Sep.6	Oct.7	58	24	12.5	334		49.5	81.8	-	19.5	7.9
	Mean						63	27	12.9	345		50.6	81.3		19.9	8.2
	I	Jul. 3, 1978	Sep.30	Oct.4	Oct.7	Nov.6	-	-	11.7	312	118	36.9	83.3	-	19.3	5.9
	II	Jul. 3, 1978	Sep.30	Oct.4	Oct.7	Nov.6	-	-	13.2	352	105	37.0	89.2	-	19.2	6.3
	Mean								12.5	332	112	37.0	86.3		19.3	6.1
	I	Aug. 1, 1978	Oct.25	Oct.29	Nov. 6	Dec.12	61	25	14.7	392	141	55.3	55.0	-	19.0	5.8
	II	Aug. 1, 1978	Oct.25	Oct.29	Nov. 6	Dec.12	61	25	14.9	398	131	52.1	57.6	-	19.0	5.7
	Mean						61	25	14.8	395	136	53.7	56.3		19.0	5.8
	I	Sep. 2, 1978	Dec. 1	Dec. 6	Dec.11	Jan. 3	48	21	11.6	310		24.2	56.8	-	14.9	2.0
	II	Sep. 2, 1978	Dec. 1	Dec. 6	Dec.11	Jan. 3	47	20	9.4	251		21.7	57.9	-	17.0	2.1
	Mean						48	21	10.5	281		23.0	57.4		16.0	2.1
	I	Oct. 2, 1978														
	II	Oct. 2, 1978														
	Mean															

Name of Variety	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grains per m^2 (x1000)	Percent of Ripened Grains (%)	Percent of Non-fertilized Grains (%)	Wt. of 1,000 Grains (g)	Yield (ton/ha)
IR-20	I	Nov.2, 1978	Mar.24	Apr.1	Apr.17	May 28	55	15	15.7	420	44	18.4	44.4	49.4	15.9	1.1
	I	Dec. 2, 1978	Apr.14	Apr.17	May 3	May 31	61	25	13.8	368	62	22.6	39.0	37.8	17.3	1.6
	II	Dec. 2, 1978	Apr.14	Apr.17	May 3	May 31	61	25	12.5	334	35	11.7	43.6	50.0	17.6	0.8
	III	Dec. 2, 1978	Apr.14	Apr.17	May 3	May 31	59	26	10.0	267	70	18.8	50.8	38.2	18.9	1.8
	IV	Dec. 2, 1978	Apr.14	Apr.17	May 3	May 31	56	26	12.0	320	75	23.9	60.5	29.2	21.8	3.1
	Mean						59	26	12.1	322	61	19.3	48.5	38.8	18.9	1.8
	I	Jan. 1, 1979	Apr.24	Apr.30	May 2	May 28	44	22	15.2	405	48	19.6	50.7	34.3	19.3	1.9
	I	Jan.20, 1979	Jun.20	Jun.26	Jul.12	Jul.28	52	26	15.4	411	Damaged by Sparrows					
	II	Jan.20, 1979	Jun.20	Jun.26	Jul.12	Jul.28	52	25	19.6	523	Damaged by Sparrows					
	III	Jan.20, 1979	Jun.20	Jun.26	Jul.12	Jul.28	49	26	15.6	416	72	29.9	54.0	35.9	15.7	2.5
	Mean						51	26	16.9	450						
	I	Feb. 1, 1979	May 29	Jun. 5	Jun. 13	Jun. 30	48	25	11.6	311	151	47.0	79.4	29.1	15.0	5.6
	II	Feb. 1, 1979	May 29	Jun. 5	Jun. 13	Jun. 30	49	27	15.3	408	136	55.5	78.8	34.7	16.8	7.3
	III	Feb. 1, 1979	May 29	Jun. 5	Jun. 13	Jun. 30	54	26	13.3	355	131	46.1	89.0	23.9	17.8	7.4
	Mean						50	26	13.4	358	139	49.7	82.4	29.2	16.5	6.8
	I	Feb. 7, 1979	Jun.15	Jun.17	Jun.22	Jul. 14	55	28	15.0	400	128	51.2	67.2	22.6	17.1	5.9
	II	Feb. 7, 1979	Jun.15	Jun.17	Jun.22	Jul. 14	52	24	14.4	385						
	III	Feb. 7, 1979	Jun.15	Jun.17	Jun.22	Jul.14	60	27	16.0	427						
	Mean						56	26	15.1	404						
	I	Feb.17, 1979	Jun.13	Jun.18	Jun.22	Jul.16	50	23	11.1	296	Damaged by Sparrows					
	II	Feb.17, 1979	Jun.13	Jun.18	Jun.22	Jul.16	52	27	13.9	372	123	45.6	77.0	16.6	17.0	6.0
	III	Feb.17, 1979	Jun.13	Jun.18	Jun.22	Jul.16	51	27	12.6	337	123	41.3	68.2	22.8	17.5	4.9
	Mean						51	26	12.5	335	123	43.5	72.6	19.7	17.3	
	I	Feb.27, 1979	Jul. 2	Jul.8	Jul.12	Aug.28	58	25	16.7	446	115	51.0	83.3	10.6	19.3	8.2
	II	Feb.27, 1979	Jul. 2	Jul.8	Jul.10	Aug.28	61	28	17.3	462	116	53.4	85.5	8.5	19.0	8.7
	III	Feb.27, 1979	Jul. 2	Jul.8	Jul.10	Aug.28	60	27	19.0	508	118	59.8	75.5	17.1	18.1	8.2
	Mean						60	27	17.7	472	116	54.7	81.4	12.1	18.8	8.4

Name of Variety	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grains per m^2 (x1000)	Percent of Ripened Grains (%)	Percent of Non-fertilized Grains (%)	Wt. of 1,000 Grains (g)	Yield (ton/ha)
IR-20	I	Apr. 1, 1979	Jul.20	Jul.24	Jul.30		56	23	17.3	462	87	40.2	79.7		17.2	5.5
	II	Apr. 1, 1979	Jul.20	Jul.24	Jul.30		60	27	15.4	411	132	54.5	77.4		18.2	7.7
	III	Apr. 1, 1979	Jul.20	Jul.24	Jul.30		56	28	14.3	381	124	47.3	83.5		17.4	6.9
	Mean						57	26	15.7	418	114	47.3	80.2		17.6	6.7
	I	May 1, 1979	Aug. 4	Aug.12	Aug.20											
	II	May 1, 1979	Aug. 4	Aug.12	Aug.20											
	III	May 1, 1979	Aug. 4	Aug.12	Aug.20											
	Mean															
C-11		Jan.15,1977		Aug.27		Oct. 2	56	23	15.7	349	88	30.1	91	-	24.8	6.8
		Sep.11,1977		Dec. 3		Jun.14	45	19	20.1	446	92	41.1	70	8.7	21.2	6.1
		Oct.10,1977		Feb. 5		Apr.16	42	17	41.1	912		70.5	21.7	60.9!	19.6	3.0
		Nov. 3,1977		Mar.18		Apr.16	40	18	19.9	531		40.1	64.0	20.0	19.5	5.0
		Feb.13,1978		May 29		Jul.29	46	20	34.0	908		49.3	42.2	46.9	20.5	4.3
	I	Jun. 1,1978	Aug.14	Aug.17	Aug.20	Sep.14	73	25	14.5	387	106	41.0	87.5	3.5	24.4	8.7
	II	Jun. 1,1978	Aug.14	Aug.17	Aug.20	Sep.14	66	23	12.8	342	84	29.0	87.4	4.0	24.5	6.2
	Mean						70	24	13.7	365	96	35.0	87.5	3.8	24.5	7.5
	I	Jul. 3,1978	Sep. 7	Sep.14	Sep.16	Oct. 8	63	22	11.0	294	94	27.7	72.7	15.0	25.0	5.1
	II	Jul. 3,1978	Sep. 7	Sep.14	Sep.16	Oct. 8	59	23	9.7	259	89	25.7	71.5	4.6	24.3	4.5
	Mean						61	23	10.4	277	92	26.7	72.1	9.8	24.7	4.8
	I	Jul.21,1978	Sep.18	Sep.25	Sep.29	Oct.26	66	21	12.7	339		32.5	79.9		23.5	6.1
	II	Jul.21,1978	Sep.18	Sep.25	Sep.29	Oct.26	64	22	12.8	342		34.6	86.5		24.0	7.2
	III	Jul.21,1978	Sep.18	Sep.25	Sep.29	Oct.26	58	22	12.2	326		35.0	91.4		22.8	5.2
	Mean						63	22	12.6	336		30.7	85.9		23.4	6.2
	I	Aug. 1, 1978	Oct. 5	Oct.13	Oct.16	Dec.24	49	20	15.0	401	102	40.8	81.6	-	24.1	8.0
	II	Aug. 1, 1978	Oct. 5	Oct.13	Oct.16	Dec.24	62	22	16.7	446	105	46.8	87.3	-	24.0	9.8
	Mean						56	21	15.9	424	104	43.8	84.5		24.1	8.9
	I	Sep. 2, 1978	Nov.18	Nov.25	Dec. 2	Dec.26	45	19	12.5	334		30.4	73.6	-	20.7	4.6
	II	Sep. 2, 1978	Nov.18	Nov.25	Dec. 1	Dec.26	47	20	13.6	363		31.5	81.7	-	22.1	5.7
	Mean						46	20	13.1	349		31.0	77.7		21.4	5.2

Name of Variety	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grains per m^2 (x1000)	Percent of Ripened Grains (%)	Percent of Non-fertilized Grains (%)	Wt. of 1,000 Grains (g)	Yield (ton/ha)
C-11	I	Oct. 2,1978														
	II	Oct. 2,1978														
	Mean															
	I	Nov. 2,1978	Mar. 3	Mar. 19	Mar. 29	May 25	47	21	15.8	422	56	23.8	53.3	35.4	19.3	2.4
	II	Nov. 2,1978														
	III	Nov.2, 1978														
	Mean															
	I	Dec. 2,1978	Mar.25	Apr. 1	Apr. 5	May 28	48	21	25.6	683	39	26.3	37.6	46.3	18.3	1.8
	II	Dec. 2,1978	Mar.26	Apr. 1	Apr. 7	May 28	48	22	9.3	248	103	25.5	37.6	52.0	17.2	1.7
	III	Dec. 2,1978	Mar.24	Mar.29	Apr. 5	May 28	48	22	24.9	665	32	21.3	43.5	48.7	18.2	1.7
	IV	Dec. 2,1978	Mar.26	Apr. 1	Apr. 5	May 28	48	21	25.2	672	41	27.5	46.1	47.8	18.8	2.4
	Mean						48	22	21.3	567	54	25.2	41.2	48.7	18.1	1.9
	I	Jan. 1, 1979	Apr.9	Apr.17	Apr.22	May 23	44	16	14.3	382	45	17.2	67.6	33.2	19.9	2.3
	I	Jan.20,1979	May 20	May 28	Jun.16	Jul.15	51	23	18.9	505	90	45.5	46.8	45.0	19.1	4.1
	II	Jan.20,1979	May 20	May 28	Jun.16	Jul.15	47	21	14.9	398	31	12.1	60.7	20.3	18.8	4.2
	III	Jan.20,1979	May 20	May 28	Jun.16	Jul.15	48	22	16.5	440	53	23.1	61.3	21.4	20.4	2.9
	Mean						49	22	16.8	448	58	23.6	56.3	28.9	19.4	3.7
	I	Feb. 1, 1979	May 5	May 12	May 19	Jun.26	50	22	13.4	363	96	42.1	74.0	18.1	21.5	7.0
	II	Feb. 1, 1979	May 5	May 12	May 19	Jun.26	49	21	14.1	376	90	40.8	67.1	13.6	22.3	6.7
	III	Feb. 1, 1979	May 5	May 12	May 19	Jun.26	52	21	12.6	336	109	43.9	97.0	3.4	22.4	8.8
	Mean						50	21	13.4	358	98	42.3	79.4	11.7	22.1	7.5
	I	Feb. 7, 1979	May 23	May 28	Jun. 5	Jun.20	49	19	13.3	355	Damaged by Sparrows					
	II	Feb. 7, 1979	May 23	May 28	Jun. 5	Jun.20	48	21	14.1	376						
	III	Feb. 7, 1979	May23	May 28	Jun. 5	Jun.20	50	21	9.4	251						
	Mean						49	20	12.3	327						
	I	Feb.17,1979	May 25	May 29	Jun. 4	Jul. 9	41	21	10.5	280	61	17.2	71.6	15.4	20.6	2.5
	II	Feb.17,1979	May 25	May 29	Jun. 4	Jul. 9	44	20	12.9	344	61	20.9	84.5	10.4	20.0	3.5
	III	Feb.17,1979	May 25	May 29	Jun. 4	Jul. 9	45	21	12.1	324	66	21.2	91.7	5.9	21.0	4.1
	Mean						43	21	11.8	316	63	19.8	82.4	10.6	20.5	3.4

Name of Variety	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m2	No. of Grains per Panicle	No. of Grains per m² (x1000)	Percent of Ripened Grains (%)	Percent of Non-fertilized Grains (%)	Wt. of 1,000 Grains (g)	Yield (ton/ha)
C-11	I	Feb.27,1979	May 31	Jun. 5	Jun. 9	Jun.26	47	20	19.2	512	52	26.7	76.9	15.2	20.8	4.3
	II	Feb.27,1979	May 31	Jun. 5	Jun. 9	Jun.26	40	16	8.3	221		Damaged by Sparrows				
	III	Feb.27,1979	May 31	Jun. 5	Jun. 9	Jun.26	44	17	13.5	360						
	Mean						44	18	13.7	364						
	I	Apr. 1, 1979	Jun.18	Jun.25	Jun.30	Aug. 5	49	17	14.3	381		Damaged by Sparrows				
	II	Apr. 1, 1979	Jun.18	Jun.25	Jun.30	Aug. 5	50	19	14.9	398						
	III	Apr. 1, 1979	Jun.18	Jun.25	Jun.30	Aug. 5	54	21	19.2	512	56	28.9	65.1	-	21.2	4.0
	Mean						51	19	16.1	430						
	I	May 1, 1979											51.0	6.3	21.2	7.0
	II	May 1, 1979											88.6	4.9	21.3	7.5
	III	May 1, 1979											83.5	10.1	21.5	4.6
	Mean												88.4	7.1	21.3	6.4
C-6		Nov.15, 1977		Apr. 14		May 14	46	21	18.8	502		31.8	65.3	20.0	23.6	4.9
		Dec. 1, 1977		May 5		Jun. 5	46	23	18.0	481		36.4	58.5	10.4	23.0	4.9
		Dec.15, 1977		May 17		Jun.8	66	21	17.5	467		30.7	47.3	21.0	23.0	3.3
		Jan. 2, 1978		May 23		Jun.15	65	21	14.3	382		23.8	49.3	21.8	22.5	2.7
		Jan.16, 1978		May 26		Jun.27	70	22	17.0	454		32.1	61.0	20.6	25.0	4.9
		Feb. 1, 1978		Jun. 4		Jul.18	51	22	15.9	424		34.1	66.4	15.5	24.9	5.6
		Feb.15, 1978		Jun.27		Jul.29	54	22	16.5	441		34.2	74.4	13.4	26.5	6.7
	I	Jun. 1, 1978	Sep. 4	Sep. 7	Sep. 10	Oct.10	68	26	11.3	302	121	36.4	80.6	-	29.9	8.8
	II	Jun. 1, 1978	Sep. 4	Sep. 7	Sep. 10	Oct. 10	59	25	10.6	283	108	30.7	84.1	-	30.7	7.9
	Mean						64	26	11.0	293	115	33.6	82.4		30.3	8.4
	I	Jul. 3, 1978	Oct. 6	Oct.10	Oct. 12	Nov. 14	-	-	9.4	251	122	30.7	88.4	-	27.8	7.6
	II	Jul. 3, 1978	Oct. 6	Oct.10	Oct. 12	Nov. 14	-	-	9.7	259	114	29.4	82.9	-	-	7.0
	Mean								9.6	255	118	30.1	85.8			7.3
	I	Jul.29, 1978	Oct.23	Oct.31	Nov. 7	Dec. 19	-	-	12.7	339	142	48.1	65.1	-	26.7	8.4
	II	Jul.29, 1978	Oct.23	Oct.31	Nov. 7	Dec. 20	-	-	11.1	296	154	45.4	82.7	-	27.1	10.2
	Mean								11.9	318	148	46.8	73.9	-	26.9	9.3

Name of Variety	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grains per m^2 (x1000)	Percent of Ripened Grains (%)	Percent of Non-fertilized Grains (%)	Wt. of 1,000 Grain Weight (g)	Yield (ton/ha)
C-6	I	Aug. 1, 1978	Oct. 29	Nov. 7	Nov. 14	Dec. 16	57	24	12.2	326	123	40.1	63.3	-	28.4	7.2
	II	Aug. 1, 1978	Oct. 29	Nov. 6	Nov. 13	Dec. 16	56	24	14.2	379	130	49.3	67.8	-	28.2	9.4
	Mean						57	24	13.2	353	127	44.7	65.6		28.3	8.3
	I	Sep. 2, 1978	Oct. 16	Dec.23	Jan. 2	Feb.13	47	16	12.2	326		42.7	50.0	39.4	21.1	4.6
	II	Sep. 2, 1978	Dec. 16	Dec.22	Jan. 2	Feb.13	44	16	9.3	248		36.6	51.4	41.9	23.9	4.5
	Mean						46	16	10.8	287		37.0	50.7	40.7	22.5	4.5
	I	Oct. 2, 1978			Feb. 28	Apr.11					54	14.2	29.7		20.6	0.8
	II	Oct. 2, 1978				Apr. 11					48	13.7	24.6		21.0	0.7
	Mean															
	I	Nov. 2, 1978	Mar.28	Apr.11	Apr.17	Jun. 2	42	15	12.9	344	40	13.8	67.8	20.7	22.2	2.0
	I	Dec. 2, 1978	May 8	May 12	May 20	Jun. 3	57	26	18.9	505	50	24.9	44.4	45.4	23.3	2.5
	II	Dec. 2, 1978	May 8	May 19	May 20	Jun. 3	58	26	13.8	368	42	15.4	32.8	52.7	21.8	1.1
	III	Dec. 2, 1978	May 8	May 19	May 20	Jun. 3	56	27	15.0	400	41	16.3	42.1	45.0	20.3	1.4
	IV	Dec. 2, 1978	May 8	May 12	May 22	Jun. 3	54	26	14.9	398	76	30.4	64.4	36.4	23.7	4.7
	Mean						56	26	14.9	418	52	21.8	45.9	42.4	22.2	2.4
	I	Jan. 1, 1979	May 20				49	20	13.4	358	80	28.7	54.6	26.8	24.7	3.8
	II	Jan. 1, 1979														
	III	Jan. 1, 1979														
	Mean															
	I	Jan. 20,1979	Jun.20	Jun.26	Jul. 2	Jul. 28	51	23	16.5	440	80	35.4	48.7	29.6	24.1	4.2
	II	Jan. 20,1979	Jun.20	Jun.26	Jul. 2	Jul. 28	73	23	13.6	363	73	26.5	64.8	14.1	26.0	4.4
	III	Jan. 20,1979	Jun.20	Jun.26	Jul. 2	Jul. 28	50	23	13.3	355	75	26.6	63.3	21.3	25.6	4.3
	Mean						51	23	14.5	386	76	29.5	58.9	21.7	25.1	4.3
	I	Feb. 1, 1979	Jun. 5	Jun. 9	Jun.15	Jul. 14	53	23	12.5	334	123	41.0	56.4	36.9	25.3	5.9 5.6
	II	Feb. 1, 1979	Jun. 5	Jun. 9	Jun.15	Jul. 14	50	24	14.6	390	108	41.9	64.3	27.3	23.9	6.4 6.6
	III	Feb. 1, 1979	Jun. 5	Jun. 9	Jun. 15	Jul. 14	55	24	13.1	350	118	41.2	73.3	22.4	26.5	8.0 7.0
	Mean						53	24	13.4	358	116	41.4	64.7	28.9	25.2	6.8 6.8
	I	Feb. 7, 1979	Jun.14	Jun.20	Jun.30	Jul. 20	55	25	11.5	307	102	31.4	74.5	14.0	24.7	5.8
	II	Feb. 7, 1979	Jun.14	Jun.20	Jun.30	Jul. 20	59	25	10.0	267	109	29.0	76.7	10.6	26.3	5.9
	III	Feb. 7, 1979	Jun.14	Jun.20	Jun.30	Jul.20	64	26	14.4	385	Damaged by Sparrows					
	Mean						59	25	12.0	320	106	30.2	75.6	12.3	17.0	5.9

Name of Variety	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m²	No. of Grains per Panicle	No. of Grains per m² (x1000)	Percent of Ripened Grains (%)	Percent of Non-fertilized Grains (%)	Wt of 1,000 Grains (g)	Yield (ton/ha)
C-6	I	Feb.17, 1979	May 23	May 28	Jun. 5	Jul. 19	45	17	10.8	289	Damaged by Sparrows					
	II	Feb.17, 1979	May 23	May 28	Jun. 5	Jul. 19	38	16	12.9	344						
	III	Feb.17, 1979	May 23	May 28	Jun. 5	Jul.19	41	24	11.5	307	57	17.6	77.8	13.7	21.4	2.9
	Mean						41	19	11.7	313						
	I	Feb.27, 1979	Jul. 4	Jul.10	Jul.16	Aug. 4	57	24	13.6	363	99	35.8	68.4	23.6	25.4	6.3
	II	Feb.27, 1979	Jul. 4	Jul.10	Jul.16	Aug. 4	57	24	18.3	488	106	51.7	76.7	16.7	23.3	9.3
	III	Feb.27,1979	Jul.4	Jul.10	Jul.16	Aug. 4	60	25	16.9	451	86	38.7	68.0	20.7	25.2	6.6
	Mean						58	24	16.3	434	97	42.1	71.0	20.3	24.6	7.4
	I	Apr. 1, 1979	Jul.22	Jul.26	Aug. 4		57	23	12.7	339	78	26.5	64.1		25.7	4.3
	II	Apr. 1, 1979	Jul.22	Jul.26	Aug. 4		60	23	13.0	348	93	32.2	78.4		27.3	6.9
	III	Apr. 1, 1979	Jul.22	Jul.26	Aug. 4		54	23	12.8	342	76	25.9	83.9		28.6	6.3
	Mean						57	23	12.8	343	82	28.2	75.5		27.2	5.8
	I	May 1, 1979	Aug. 12	Aug. 18	Aug. 25											
	II	May 1, 1979	Aug. 12	Aug. 18	Aug. 25											
	III	May 1, 1979	Aug. 12	Aug. 18	Aug. 25											
	Mean															
TOS-103		Jul.28, 1977		Oct. 17		Nov. 18	53	25	19.8	440	118	51.8	83	-	22.8	9.8
		Feb.13, 1978		Jun. 4		Jul. 18	42	21	16.3	435		33.2	83.2	10.2	23.7	6.5
	I	Jul.29, 1978	Oct.12	Oct.18	Oct.21	Dec. 19	-	-	13.5	360	88	31.6	88.5	-	24.8	6.9
	II	Jul.29, 1978	Oct.12	Oct.18	Oct.21	Dec. 20	-	-	12.7	339	123	41.7	85.7	-	23.4	8.4
	III	Jul.29, 1978	Oct.12	Oct.18	Oct.21	Dec. 20	-	-	12.3	328	98	32.0	92.5	-	25.5	7.6
	Mean								12.8	342	103	35.1	88.9		24.6	7.6
	I	Jan.20, 1979	Jun. 8	Jun.15	Jun.28	Jul.22	57	25	17.3	462	101	46.8	59.8	33.9	24.9	7.0
	II	Jan.20, 1979	Jun. 8	Jun.15	Jun.28	Jul.22	52	24	18.2	486	65	31.5	39.6	45.8	23.4	2.9
	III	Jan.20, 1979	Jun. 8	Jun.15	Jun.28	Jul.22	53	25	18.7	499	90	45.0	54.7	35.8	25.3	6.3
	Mean						54	25	18.1	482	85	41.1	51.4	38.5	24.5	5.4

Name of Variety	Block Number	Sowing Date	Heading Date 5%	Heading Date 50%	Heading Date 95%	Maturity Date	Culm Length (cm)	Panicle Length (cm)	No. of Panicles per Hill	No. of Panicles per m^2	No. of Grains per Panicle	No. of Grain $per\ m^2$ (x1000)	Percent of Ripened Grains (%)	Percent of Non-fertilized Grains (%)	Wt. of 1,000 Grains (g)	Yield (ton/ha)
TOS-103	I	Feb. 1, 1979	May 21	May 27	May 31	Jun. 16	45	24	13.4	357	76	27.2	54.4	22.6	24.5	3.6
	II	Feb. 1, 1979	May 21	May 27	May 31	Jun. 16	46	23	14.1	376	95	35.8	65.7	27.6	23.6	5.6
	III	Feb. 1, 1979	May 21	May 27	May 31	Jun. 16	46	23	13.4	358	99	35.3	64.6	24.1	24.3	5.5
	Mean						46	23	13.6	364	90	32.8	61.6	24.8	24.1	4.9
	I	Feb. 7, 1979	May 28	Jun. 3	Jun. 5	Jun. 22	41	23	15.0	400	48	19.4	76.3	20.5	23.7	3.5
	II	Feb. 7, 1979	May 28	Jun. 3	Jun. 5	Jun. 22	45	23	12.8	342						
	III	Feb. 7, 1979	May 28	Jun. 3	Jun. 5	Jun. 22	50	25	15.5	414						
	Mean						45	24	14.4	385						
	I	Feb.17,1979				Jul. 12	43	24	14.2	379	72	27.5	86.1	13.1	23.8	5.7
	II	Feb.17,1979				Jul. 12	41	23	11.9	318	67	21.4	79.2	14.8	24.5	4.2
	III	Feb.17,1979				Jul. 12	41	24	14.5	387	67	25.7	77.3	18.7	23.3	4.7
	Mean						42	24	13.5	361	69	24.9	80.9	15.5	23.9	4.9
	I	Feb.27, 1979	Jun.15	Jun.18	Jun. 22	Jul. 28	39	22	15.1	403	59	23.7	73.4	12.2	22.7	4.0
	II	Feb.27, 1979	Jun.15	Jun.18	Jun. 22	Jul. 28	48	25	14.7	392	68	26.6	83.6	14.7	24.2	5.4
	III	Feb.27, 1979	Jun.15	Jun.18	Jun.22	Jul. 28	44	24	11.5	307	80	24.4	88.9	9.9	24.9	5.4
	Mean						44	24	13.8	367	69	24.9	82.0	12.3	23.9	4.9
	I	Apr. 1, 1979	Jul.3	Jul. 8	Jul. 14		46	20	13.7	366	42	15.5	81.8		24.2	3.1
	II	Apr. 1, 1979	Jul.3	Jul. 8	Jul. 14		47	23	11.5	307	68	20.8	84.0		24.7	4.3
	III	Apr. 1, 1979	Jul.3	Jul. 8	Jul. 14		50	24	12.6	337	72	24.2	89.3		25.3	5.4
	Mean						48	22	12.6	337	61	20.2	85.0		24.7	4.3
	I	May 1, 1979														
	II	May 1, 1979														
	III	May 1, 1979														

ANNEX 8 DAILY EVAPOTRANSPIRATION, PICHE EVAPORATION AND PAN EVAPORATION

Date	January, 1979						February, 1979						March, 1979						April, 1979						May, 1979					
	Evapotrans-piration	(mean)	Piche Evaporation	(mean)	Pan Evaporation	(mean)	Evapotrans-piration	(mean)	Piche Evaporation	(mean)	Pan Evaporation	(mean)	Evapotrans-piration	(mean)	Piche Evaporation	(mean)	Pan Evaporation	(mean)	Evapotrans-piration	(mean)	Piche Evaporation	(mean)	Pan Evaporation	(mean)	Evapotrans-piration	(mean)	Piche Evaporation	(mean)	Pan Evaporation	(mean)
1							8.0		15.0		5.8		10.5		16.0		6.5		13.5		19.0		8.5		5.5		10.5		4.5	
2							6.0		13.7		8.9		12.0		11.4		15.0		14.5		15.9		9.9		14.0		11.3		9.2	
3							6.4		13.3		4.8		16.0		18.0		13.0		13.5		18.0		10.1		16.0		13.5		10.0	
4							6.0		16.0		9.3		10.0		17.0		8.5		16.5		15.5		11.0		9.0		12.0		12.6	
5							7.4	6.8	13.7	14.3	9.2	7.6	9.0	11.5	17.0	15.9	10.0	10.6	21.0	17.3	18.0	17.3	15.5	11.0	14.5	12.3	13.4	12.1	6.4	8.5
6							8.2		15.3		10.9		9.5		15.5		9.0		24.0		23.3		17.4		-		14.4		5.0	
7							5.5		16.5		8.6		13.0		16.0		17.5		29.0		26.5		20.5		20.0		10.4		12.4	
8							9.0		16.0		12.7		14.0		23.0		16.5		14.0		19.0		10.7		16.0		17.0		11.1	
9							7.5		15.8		9.5		12.0		24.5		14.0		17.5		18.5		12.3		13.5		16.4		7.9	
10							10.0	8.0	15.8	15.9	12.3	10.8	11.0	11.9	18.0	19.4	10.0	13.4	12.5	21.0	17.8	21.0	10.7	14.3	-	16.5	10.4	13.7	18.6	11.0
11							9.0		17.0		10.5		6.0		18.2		11.0		14.5		23.5		10.8		19.0		10.8		7.5	
12							8.0		16.2		7.5		10.0		17.3		11.4		13.0		21.9		10.3		7.5		12.8		9.0	
13							7.0		15.2		9.0		10.0		19.3		11.4		14.5		16.8		12.2		18.5		14.4		10.0	
14	8.0		10.6		8.0		8.0		15.5		9.0		10.0		18.0		12.7		16.5		17.7		17.1				16.0		9.0	
15	8.0	8.0	14.2	12.4	7.0	7.5	8.0	8.0	13.3	15.4	7.5	8.7	10.0	9.2	18.5	18.3	10.8	11.5	24.0	21.1	25.5	21.1	14.7	13.0		18.4	13.6	13.5	11.0	9.3
16	7.0		20.0		11.5		8.0		15.6		8.1		8.5		19.0		12.2		-		24.4		12.7				17.5		12.0	
17	6.0		16.2		7.5		9.0		14.2		10.5		11.0		19.0		11.0		17.5		18.6		14.0				11.5		16.5	
18	9.0		11.1		7.0		9.0		11.5		10.5		10.5		19.8		12.2		20.0		17.0		14.4				15.8		10.7	
19	6.0		11.2		7.0		9.5		18.5		10.5				19.5		14.3		18.5		13.2		8.0				12.8		12.8	
20	8.0	8.7	13.7	14.4	7.0	8.0	8.5	8.8	15.0	15.0	12.2	10.4		10.0	22.0	19.9	11.5	12.2	18.0	17.3	13.2	17.3	12.6	12.3		18.3	15.0	14.5	8.8	12.2
21	6.0		17.0		12.0		9.4		16.0		7.5				22.0		12.7		21.5		16.5		17.0				18.0		9.0	
22	8.0		13.5		11.0		8.0		16.0		17.7				22.0		11.5		-		23.0		15.0				12.8		12.5	
23	8.0		14.4		9.0		9.1		15.5		12.3				21.0		10.7		15.4		20.3		11.8				17.4		11.7	
24	8.0		13.7		11.0		8.0		16.0		10.0				19.0		12.8		10.0		19.0		14.4				15.5		6.8	
25	8.0	7.6	16.0	14.9	11.0	10.8	8.0	8.5	16.0	15.9	8.0	11.1			21.0	21.0	16.5	12.8	20.7	19.7	19.5	19.7	15.2	14.7		16.7	13.0	15.3	13.0	10.6
26	11.0		13.8		11.0		11.0		10.5		7.5				23.0		12.2		24.5		21.1		15.8			-	16.0		10.2	
27	5.0		16.0		10.0		9.5		15.5		14.2				23.6		11.0		25.5		19.2		14.8				17.0		8.7	
28	9.0		16.2		11.0		13.0		16.5		11.8				20.4		12.0		22.0		18.0		14.2				-		12.3	
29	6.5		16.3		10.5										19.0		13.5		21.0		18.0		14.3				16.0		10.5	
30	10.0		18.7		10.0										18.0				17.0		14.3		13.0						11.5	
31	6.1	7.9	15.3	16.1	8.0	10.1		11.2		14.2		11.2			19.5	20.6		12.2		18.1		18.1		14.4		21.3		16.3		10.6

Note 1: Variety, IR-20, sown on December 2, 1978, transplanted on January 11, 1979, headed on April 14, harvested on May 14.

JICA