2) Irrigation Effect on Maize and Soybean (1976)

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Material and Method

Bariety:	Maize: Suwan No.1, Soybean: SJ 2
Treatment:	Two levels of irrigation interval (I_1 and I_2), three rates of irrigation amount for vegetative growth stage (V_1, V_2 *and* V_3), and two rates of irrigation amount for reproductive growth stage (R_1 and R_2) were combined each other as follows. Thus, twelve treatment were made.
Interval:	4 days I_1 7 days I_2
Rate of irrigation amount:	(V) (R) 2 — 4 mm/day V_1 R_1 2 — 7 mm/day V_1 R_2 4 — 4 mm/day V_2 R_1 4 — 7 mm/day V_2 R_2 7 — 7 mm/day V_3 R_1 7 — 10 mm/day V_3 R_2
Design and plot size:	The split plot design was employed with 2 replications, disposing the irrigation interval as main plot, the rate of irrigation amount for the vegetative growth stage as sub plot, and that for the reproductive growth stage as sub-sub plot.
The size of sub-sub plot was:	Maize: 81 m_2 (9 m × 9 m) Soybean: 45 m_2 (7.5 m × 6 m)
Sowing:	Maize: January 26, 1976 Soybean: January 29, 1976
Harvesting:	Maize: April 29, 1976 Soybean: May 3, 1976
Spacing:	Maize: 75 cm × 25 cm, 1 plant per hill Soybean: 60 cm × 20 cm, 2 plants per hill
Fertilizer application (Kg/ha):	Maize: N: 150, P_2O_5: 75, K_2O:50 Soybean: N: 20, P_2O_5: 50, K_2O:50
Irrigation practice:	The furrow irrigation was done similarly as in the previous year. Total irrigation amount and rainfall during the experiment are summarized in Table 2-2.

Climatic conditions

The climatic conditions during the experimental period were nearly normal (See Appendix). The air temperature rose gradually from the seeding to the ripening stage; the average maximum temperature of every ten days during the reproductive growth stage was as high as 35° — 38°C. The rainfall was a little during the period except early February; irrigation was done almost regularly as scheduled.

Results

Maize

1. In the vegetative growth stage of maize, irrigation at the rate of 4 mm/day induced better growth than that of 2 mm or 7 mm/day. This effect of irrigation rate was still observed in the reproductive growth stage (Fig. 2-3). In the reproductive growth stage of maize, irrigation at the rate of 7 mm/day had more favorable effects than that of 4 mm/day (Fig.2-3 and 4).

   It was observed that maize could recover from unfavorable growth condition caused by insufficient water supply (2 mm/day) in vegetative growth stage when sufficient water (7 mm/day) was provided in reproductive growth stage; however, unfavorable growth condition caused by excess water supply (7 mm/day) in vegetative growth stage could not be recovered by any means in reproductive growth stage. (Fig.2-4 and 5).
2. Water efficiency in terms of grain yield per unit amount of water was summarized in Table 2-4. To increase maize yield with high water efficiency, irrigation at the rate of 2 mm to 4 mm/day in the vegetative growth stage and 7 mm/day in the reproductive growth stage could be recommended (Table 2-3 and 4).
3. Different levels of irrigation interval, 4 days and 7 days, did not induce a significant difference in the growth and yield of maize.

Soybean

1. The growth of soybean plant was less vigorous with the irrigation of 2 mm per day in the vegetative growth stage. There was not seen a significant difference of the growth between the irrigation rates of 4 mm and 7 mm per day thoughtout the growing period. (Fig.2-6). The grain yield was not significantly affected by the irrigation rate. (Table 2-5, Fig.2-7).
2. Different levels of the irrigation interval did not induce any significant difference in the growth and grain yield of soybean.
3. From the view point of maintaining soybean yield with high water efficiency, the irrigation rate of 2mm to 4 mm/day in the vegetative growth stage and 4 mm/day in the reproductive growth stage could be recommended (Table 2-5 and 6).

Table 2-2. (a) Amount of irrigation water and rainfall on maize field

Treatment			Irrigation	Rainfall	Total
Sign	Rate and interval		mm	mm	mm
	mm/day	day	* **	* **	
$I_1V_1R_1$	2 — 4	4	115.7 + 176 = 291.7	42.1 + 6.7 = 48.8	340.5
V_1R_2	2 — 7	4	115.7 + 308 = 423.7	" " "	472.5
V_2R_1	4 — 4	4	195.7 + 176 = 371.7	" " "	420.5
V_2R_2	4 — 7	4	195.7 + 308 = 503.7	" " "	552.5
V_3R_1	7 — 7	4	315.7 + 308 = 623.7	" " "	672.5
V_3R_2	7 —10	4	315.7 + 440 = 755.7	" " "	804.5
$I_2V_1R_1$	2 — 4	7	119.7 + 168 = 287.7	" " "	336.5
V_1R_2	2 — 7	7	119.7 + 294 = 413.7	" " "	462.5
V_2R_1	4 — 4	7	203.7 + 168 = 371.7	" " "	420.5
V_2R_2	4 — 7	7	203.7 + 294 = 497.7	" " "	546.5
V_3R_1	7 — 7	7	329.7 + 294 = 623.7	" " "	672.5
V_3R_2	7 —10	7	329.7 + 420 = 749.7	" " "	798.5

Remarks: * Irrigation or rainfall in the vegetative growth stage. 70 mm of irrigation for uniform germination was included.
** The same in the reproductive growth stage.

Table 2-2. (b) Amount of irrigation water and rainfall on soybean field

Treatmnet	Irrigation (mm)	rainfall (mm)	Total (mm)
	* **	* **	
$I_1V_1R_1$	91.7 + 208 = 299.7	34.3 + 46.5 = 80.8	380.5
V_1R_2	91.7 + 364 = 455.7	" " "	536.5
V_2R_1	147.7 + 208 = 355.7	" " "	436.5
V_2R_2	147.7 + 364 = 511.7	" " "	592.5
V_3R_1	231.7 + 364 = 595.7	" " "	676.5
V_3R_2	231.7 + 520 = 751.7	" " "	832.5
$I_2V_1R_1$	91.7 + 224 = 315.7	" " "	396.5
V_1R_2	91.7 + 392 = 483.7	" " "	564.5
V_2R_1	147.7 + 224 = 371.7	" " "	452.5
V_2R_2	147.7 + 392 = 539.7	" " "	620.5
V_3R_1	231.7 + 392 = 623.7	" " "	704.5
V_3R_2	231.7 + 560 = 791.7	" " "	872.5

Remarks: * and ** mean the same as in the former.

Table 2-3. Yield and yield components of maize

Treatment	Grain[1] yield t/ha	No. of ears per m^2	No. of grains per ear	100[1] grain weight (g)
$I_1V_1R_1$	2.50	4.9	250	20.6
V_1R_2	3.42	5.2	284	23.2
V_2R_1	2.47	5.2	224	21.5
V_2R_2	3.46	5.1	307	22.2
V_3R_1	2.13	4.6	262	17.9
V_3R_2	1.96	5.0	216	18.6
$I_2V_1R_1$	2.14	4.8	210	21.3
V_1R_2	2.84	5.0	261	21.7
V_2R_1	2.22	4.6	210	21.3
V_2R_2	2.94	5.2	258	22.2
V_3R_1	2.25	4.8	222	21.2
V_3R_2	2.54	4.4	274	21.2

Remarks: 1) 13% moisture content.

Table 2-4. Water efficiency on grain yield of maize

Treatment	Efficiency[1] (Kg/ha/cm)	Treatment	Efficiency (Kg/ha/cm)
$I_1V_1R_1$	74	$I_2V_1R_1$	64
V_1R_2	73	V_1R_2	62
V_2R_1	59	V_2R_1	49
V_2R_2	63	V_2R_2	54
V_3R_1	32	V_3R_1	33
V_3R_2	24	V_3R_2	32

Remarks: 1) Calculated as the grain yield (Kg/ha) per unit amount of water (cm).

Table 2-5. Yield and yield component of soybean

Treatment	Grain yield		No. of	No. of pods	No. of full	Weight of 100
	Gross	Full grain	Plants/m²	per plant	grains/pod	grains
	t/ha	t/ha				
$I_1V_1R_1$	2.37	2.10	16.4	58.5	2.0	13.3
V_1R_2	1.99	1.76	15.6	63.0	1.8	13.8
V_2R_1	2.49	2.40	16.0	72.0	1.9	13.8
V_2R_2	2.69	2.37	15.0	69.0	1.9	14.1
V_3R_1	2.33	2.05	15.0	68.5	1.9	14.8
V_3R_2	2.59	2.36	15.8	63.9	2.0	14.2
$I_2V_1R_1$	2.10	1.91	16.1	56.6	2.0	13.7
V_1R_2	1.75	1.59	15.9	53.8	2.0	13.7
V_2R_1	2.29	2.09	15.9	64.7	1.8	13.4
V_2R_2	2.47	2.19	15.4	84.1	1.6	14.5
V_3R_1	1.99	1.77	16.2	61.5	1.8	13.8
V_3R_2	2.33	2.12	15.2	61.5	1.8	13.5

Remarks: Moisture content of grain was 13%.

Table 2-6. Water efficiency on grain yield of soybean

Treatment	Efficiency (Kg/ha/cm)	Treatment	Efficiency (Kg/ha/cm)
$I_1V_1R_1$	57	$I_2V_1R_1$	49
V_1R_2	35	V_1R_2	29
V_2R_1	54	V_2R_1	47
V_2R_2	43	V_2R_2	38
V_3R_1	33	V_3R_1	31
V_3R_2	30	V_3R_2	26

Remarks: Water efficiency was expressed as the grain yield (Kg/ha) per unit amount of water (cm) including irrigation and rainfall.

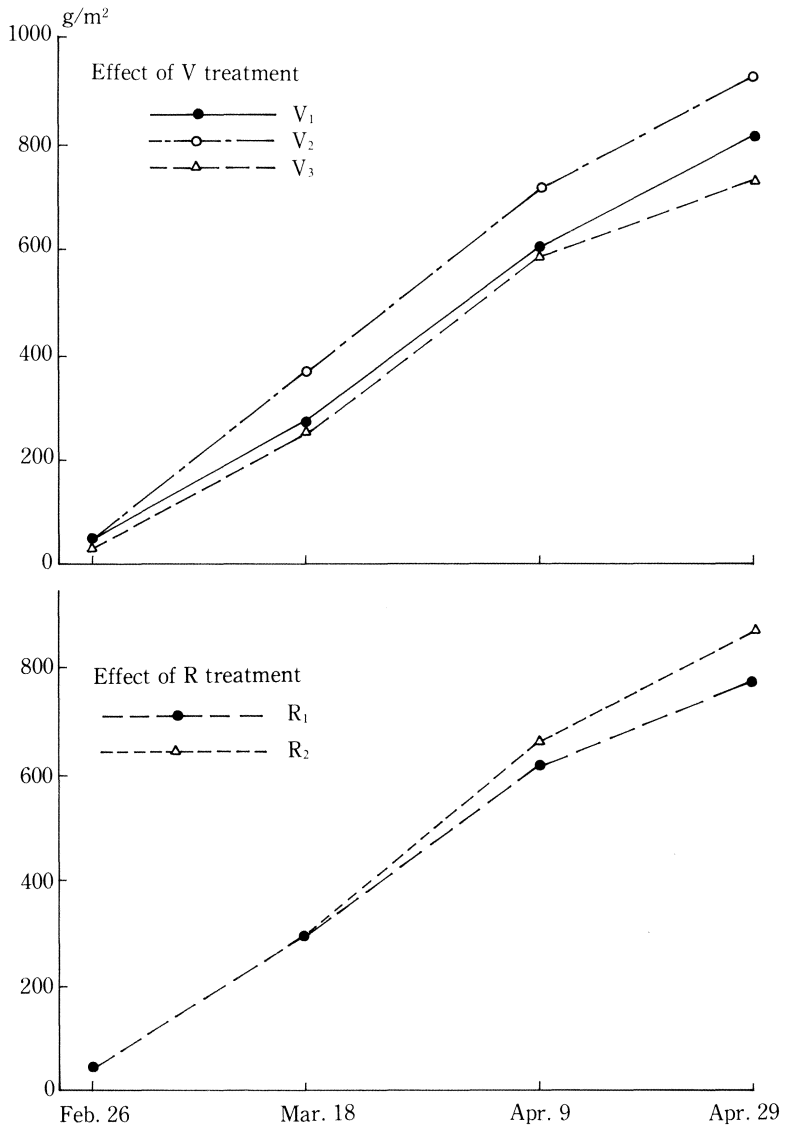

Fig. 2-3. Dry weight of maize plant in relation to rate of irrigation amount

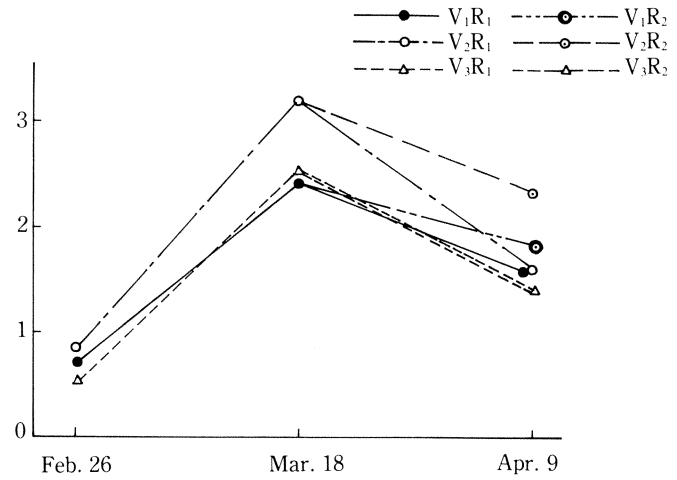

Fig. 2-4. Leaf area index of maize in relation to rate of irrigation amount

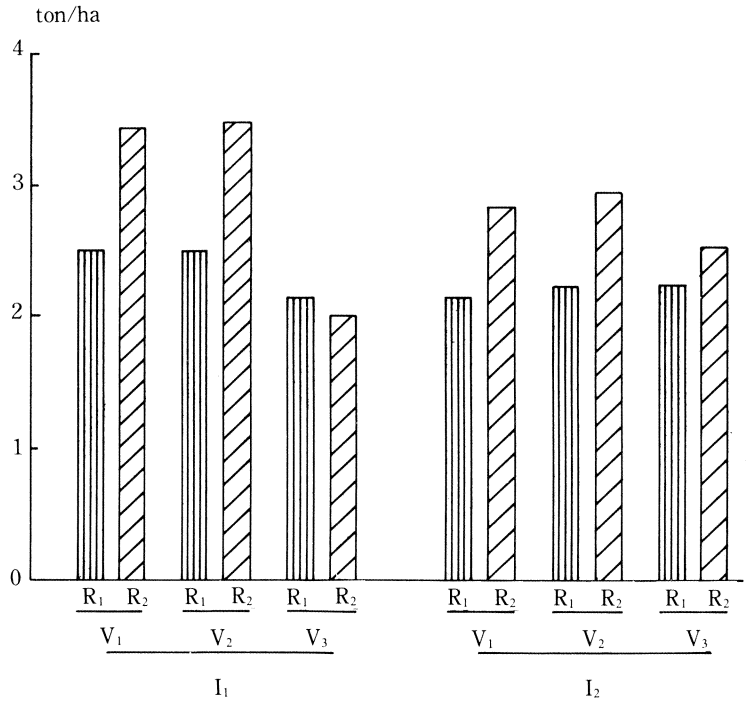

Fig. 2-5. Yield of maize

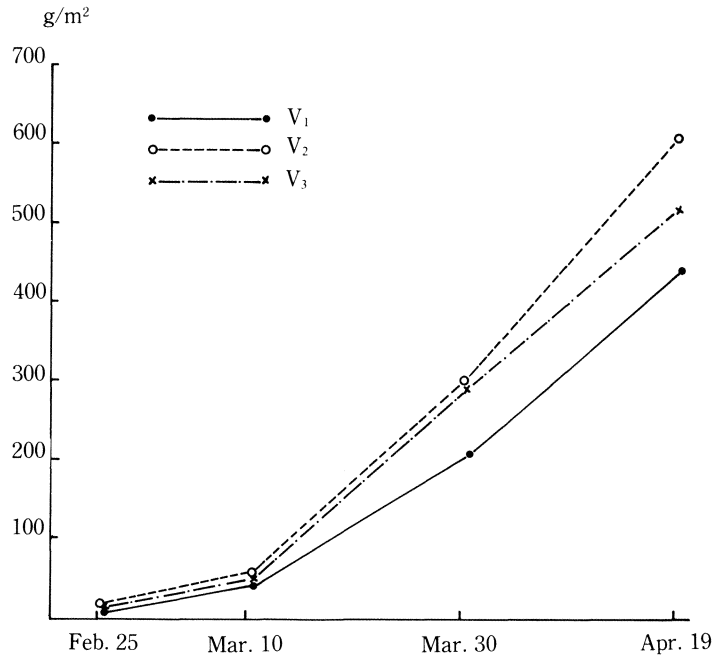

Fig. 2-6. Dry weight of soybean plant as affected by rate of irrigation amount in vegetative growth stage

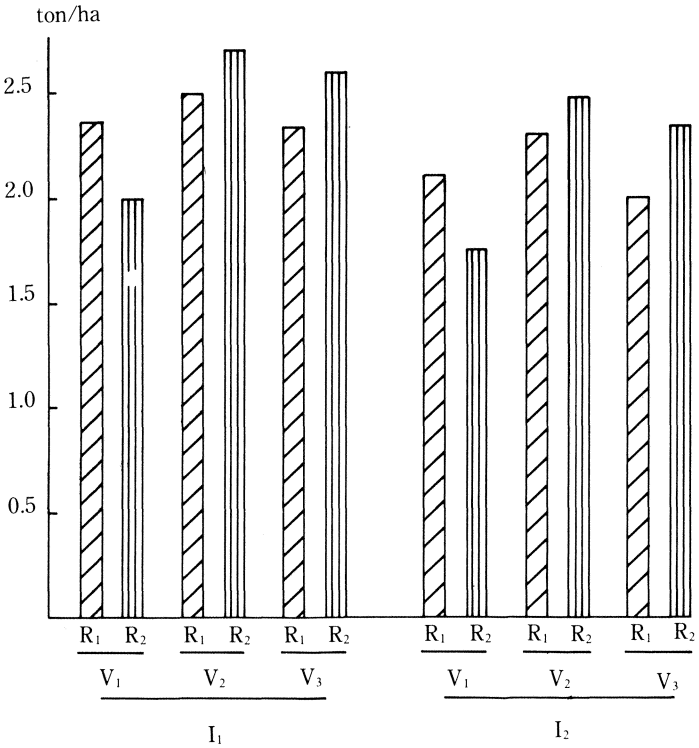

Fig. 2-7. Grain yield of soybean