2) Water Consumption of Mungbean and Peanut (1977)

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Materials and method

1. Variety: Mungbean: SPR No.1
   Peanut: Tainan No.6
2. Test field: 1/20 m^2 Wagner's pots were used for this purpose. These pots were placed in the plant community similarly as in 1976.
3. Water management:
   The field was irrigated by means of furrow irrigation with 7 to 10 day interval while each pot was supplied with water through two porcelain suction tubes which were placed at the bottom of each pot and connected to a water tank through PVC flexible tube as shown in Fig. 1-6. The elevation difference between the bottom of the tank and the suction tubes was adjusted according to the growth of plants in the pot so as to supply with suitable amount of water, as shown in the following table.

period	Elevation
March 16 — 18	+20 cm*
March 18 — April 18	-60
April 18 — 25	-30
April 25 — June 7	-20

* To moisten the soil enough for germination, water tanks were put on the ground surface. A plus value means the higher elevation of the tanks than the pots.

4. Fertilizer application:
   N: 0.10 g/pot (20 Kg/ha)
   P_2O_5: 0.25 g/pot (50 Kg/ha)
   K_2O: 0.25 g/pot (50 Kg/ha)
5. Seeding:
   March 16, 1977. Ten seeds of mungbean and five seeds of peanut were sown at center of the pots respectively.
6. Thinning:
   Mungbean was thined out up to 3 plants per hill on April 1 and finally up to 2 plants per hill on April 18. Peanut was thined out up to 2 plants per hill on April 1.
7. Spacing in the field: 75 cm × 20 cm, 2 plants/hill
   Each pot which constitutes one hill of the field, was arranged to be apart 5 hills or 2 rows each other. Besides those planted pots, some non-planted pots were similary buried between plant hills on ridges to estimate the evaporation from soil surface.
8. Harvesting time: Mungbean May 26, Peanut June 7
9. Measurement of water consumption: weight of the water tank was checked in every 6 or 7 days.

Results

1. Plant growth:
   Both the crops grew well except that peanut plants in the pots deteriorated at the end of growth stage owing to limited capacity of the pots (Fig.1-7 and 8).
2. Water consumption:
   The rate of evapotranspiration increased as the plant grew and reached the maximum, 7.8 mm/day for mungbean and 7.3 mm/day for peanut, both at eight weeks after seeding or third week of reproductive growth stage when leaf area index (LAI) became nearly the maximum (Table 1-3 to 5).
   The total evapotranspiration during the growth period was about 310 mm in mungbean and 380 mm in peanut. The ratio of evapotranspiration to pan evaporation was 0.72 in mungbean and 0.77 in peanut (Table 1-6 and 7).
   The amount of transpiration was estimated by subtracting evaporation from soil surface (Es) from evapotranspiration (Et), as shown in Table 1-6 and 7. Es was estimated from the evaporation of non-planted pots as mentioned before, but the soil surface of these pots were always moister than that of the planted pots. Thus, Es seemed to be a little over-estimated as compared with the values obtained in 1976.
3. Water requirement:
   Similarly as in 1976, wter requirement was estimated by adopting transpiration per dry weight as shown in Table 1-6. As for peanut, the high value of water requirement for grains was due to poor formation of pods in pot culture.

Table 1-3. Water consumption of mungbean

Date	Period	Precipitation	Period consumption				Daily consumption				T/Ep	Et/Ep
			T	Es	Et	Ep	T	Es	Et	Ep		
	day	mm	mm	mm	mm	mm	mm	mm	mm	mm		
Mar. 17—23	6	0.0	0.0	26.0*	26.0*	42.0	0.0	4.3*	4.3*	7.0	0.00	0.62
23—30	7	3.4	0.0	20.1	20.1	38.4	0.0	2.9	2.9	5.5	0.00	0.52
Apr. 30— 5	6	20.5	6.8	5.8	12.7	27.5	1.1	1.0	2.1	4.6	0.25	0.46
5—12	7	0.0	6.1	2.0	8.1	46.0	0.9	0.3	1.2	6.6	0.13	0.18
12—18	6	0.0	6.4	24.0	30.4	45.0	1.1	4.0	5.1	7.5	0.14	0.68
18—25	7	12.5	13.1	15.2	28.2	38.5	1.9	2.2	4.0	5.5	0.34	0.73
25— 2	7	1.5	14.7	24.8	39.5	49.5	2.1	3.6	5.7	7.1	0.30	0.80
May 2— 9	7	22.0	24.0	30.7	54.7	41.0	3.4	4.4	7.8	5.9	0.58	1.33
9—16	7	0.0	22.4	14.7	37.1	46.0	3.2	2.1	5.3	6.6	0.49	0.81
16—23	7	7.0	21.0	20.3	41.4	45.0	3.0	2.9	5.9	6.4	0.47	0.92
23—26	3	0.5	7.9	3.2	11.1	9.5	2.6	1.1	3.7	3.2	0.83	1.17
Mar. 17—Apr. 18	32	23.9	19.3	77.9	97.3	198.9	0.6	2.4	3.0	6.2	0.10	0.49
Apr. 18—May 26	38	43.5	103.1	108.9	212.1	229.5	2.7	2.9	5.6	6.1	0.45	0.92
Mar. 17—May 26	70	67.4	122.4	186.8	309.4	428.4	1.8	2.7	4.4	6.1	0.29	0.72

Remarks: 1) T, Es, Et, Ep represent transpiration, evaporation from soil, evapo-transpiration, evaporation from free water surface in a pan (1m in diameter) respectively.

2) Those items of the period were calculated by using following formulas:

$$T\ (mm) = (Wt\ (kg) - Wc\ (kg)) \times \frac{1000}{75 \times 20} \times 10$$

$$Es\ (mm) = Wc\ (kg) \times \frac{1000}{500} \times 10 + R\ (mm)$$

$$Et\ (mm) = T\ (mm) + Es\ (mm)$$

$$Ep\ (mm) = P\ (mm) + R\ (mm)$$

where, Wt and Wc are the water consumption of a planted pot and a non-planted pot respectively; R is precipitation in each period.

3)* The value includes watering to moisten the soil for germination.

4) The period, March 17 to April 18, corresponds to the vegetative growth stage.
The period, April 18 to the end, corresponds to the reproductive growth stage.

Table 1-4. Water consumption of peanut

Date	Period	Precipitation	Period consumption				Daily consumption				T/Ep	Et/Ep
			T	Es	Et	Ep	T	Es	Et	Ep		
	day	mm	mm	mm	mm	mm	mm	mm	mm	mm		
Mar. 17—23	6	0.0	0.8	26.0	26.8	42.0	0.1	4.3	4.5	7.0	0.02	0.64
23—30	7	3.4	0.2	20.1	20.3	38.4	0.0	2.9	2.9	5.5	0.01	0.53
30— 5	6	20.5	7.9	5.8	13.7	27.5	1.3	1.0	2.3	4.6	0.29	0.50
Apr. 5—12	7	0.0	8.5	2.0	10.5	46.0	1.2	0.3	1.5	6.6	0.19	0.23
12—18	6	0.0	11.4	24.0	35.4	45.0	1.9	4.0	5.9	7.5	0.25	0.79
18—25	7	12.5	22.1	15.2	37.3	38.5	3.2	2.2	5.3	5.5	0.57	0.97
25— 2	7	1.5	16.4	24.8	41.2	49.5	2.3	3.6	5.9	7.1	0.33	0.83
May 2— 9	7	22.0	20.6	30.7	51.3	41.0	2.9	4.4	7.3	5.9	0.50	1.25
9—16	7	0.0	22.2	14.7	36.8	46.0	3.2	2.1	5.3	6.6	0.48	0.80
16—23	7	7.0	16.6	20.3	37.0	45.0	2.4	2.9	5.3	6.4	0.37	0.82
23—30	7	7.0	22.0	15.7	37.7	40.0	3.1	2.2	5.4	5.7	0.55	0.94
30— 6	7	6.0	17.1	14.0	31.1	36.0	2.4	2.0	4.4	5.1	0.48	0.86
Mar. 17— Apr. 18	32	23.9	28.8	77.9	106.7	198.9	0.9	2.4	3.3	6.2	0.14	0.54
Apr. 18— Jun. 6	49	56.0	137.0	135.4	272.4	296.0	2.8	2.8	5.6	6.0	0.46	0.92
Mar. 17— Jun. 6	81	79.9	165.8	213.3	379.1	494.9	2.1	2.6	4.7	6.1	0.34	0.77

Remarks: The remarks of Table 1-3 apply to this table.

Table 1-5. Relationship between transpiration and leaf area index

Date		Days After sowing	Mungbean			Peanut		
			T	L.A.I	T/L.A.I	T	L.A.I	T/L.A.I
March								
	17—23	1—7 days	0.0	0.05	0.0	0.1	0.08	12.5
	23—30	7—14	0.0	0.12	0.0	0.0	0.20	0.0
	30—5	14—20	1.1	0.12	9.2	1.3	0.24	5.4
April								
	5—12	20—27	0.9	0.29	3.1	1.2	0.83	1.4
	12—18	27—33	1.1	0.46	2.4	1.9	1.55	1.2
	18—25	33—40	1.9	0.51	3.7	3.2	1.75	1.8
	25—2	40—47	2.1	0.72	2.9	2.3	1.87	1.2
May								
	2—9	47—54	3.4	0.88	3.9	2.9	2.03	1.4
	9—16	54—61	3.2	0.88	3.6	3.2	2.42	1.3
	16—23	61—68	3.0	0.88	3.4	2.4	2.80	0.9
	23—26	68—71	2.6	0.88	3.0	—	—	—
	23—30	68—75	—	—	—	3.1	3.17	1.0
	30— 6	75—82	—	—	—	2.4	3.03	0.8

Remarks: T: Transpiration (mm/day)
L.A.I: Leaf area index. The value was calculated by assuming a linear increase throughout the interval between twice of growth check.

Table 1-6. Water requirement of mungbean and peanut

Crop	Amount of transpiration	Dry weight (g/m^2)			Water requirement for		
		whole	top	grain	whole	top	grain
	mm						
Mungbean	177	324	265	125	361	442	936
	122	352	285	—	347	428	—
Peanut	165	525	433	38	314	381	4342
	166	537	441	—	309	376	—

Remarks: Figures of upper line in each crop mean transpiration, dry matter production and water requirement by harvested plants. The lower line means those by all plants which contain thinned plants.

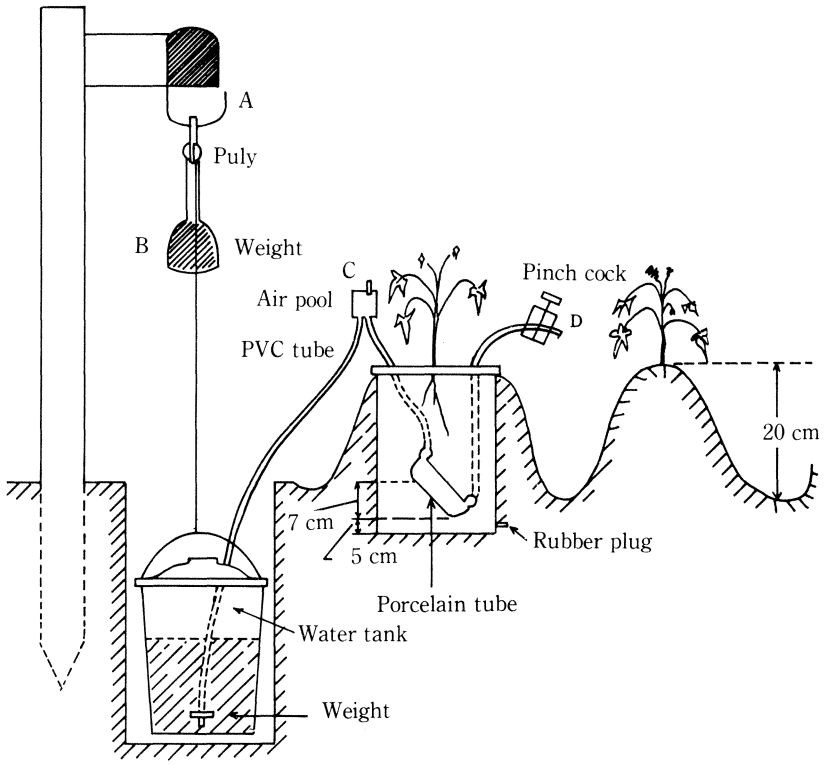

Fig. 1-6. Apparatus for measurement of water consumption

Note: Water in the tube was under negative pressure; air bubble often appeared in the tube. Air was automatically collected in the air pool C and then removed by hanging the water tank in huck A and opening plug C. Sometimes pinch cock D also was opened to clean porcelain tube.
When the hole where water tank was set was filled with water by irrigation or rain, the tank was automatically brought up by weight B.

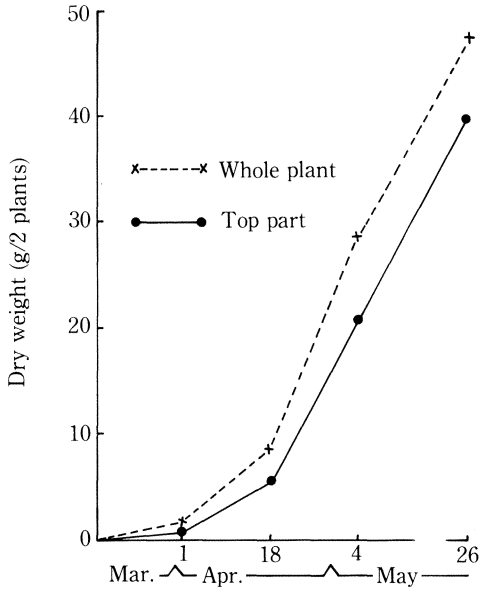

Fig. 1-7. Succesive changes of plant weight of mungbean

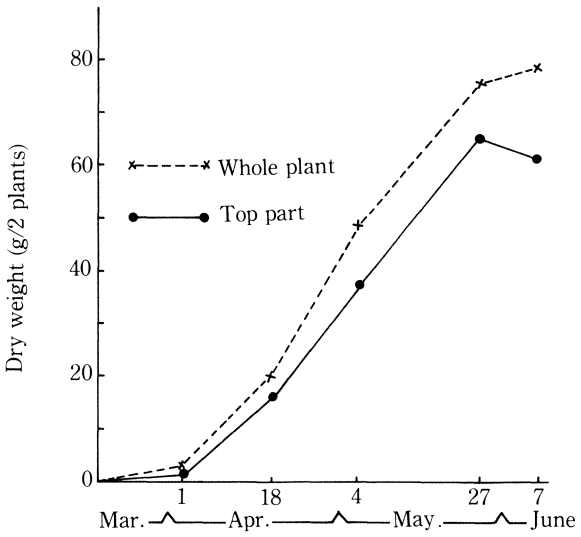

Fig. 1-8. Succesive changes of plant weight of peanut