3. Effects of Land Preparation on Upland Crops (1976)

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The Experiment II-2 clarified that the soil pulverization could be improved to some extent by shallow tilling and short tilling pitches by using the high speed rotary tiller. In this experiment, a trial was made to examine the effects of tilling depth and soil pulverization on the plant growth.

Materials and method

1 Tilling treatment:

Depth of tilling	shallow (D_1)
	deep (D_2)
Degree of pulverization	coarse (P_1)
	fine (P_2)

The high speed rotary tiller (Kobashi Rotor) was used for tilling. To obtain the different degrees of pulverization, tilling pitch was varied with different combination of rotary gears. The depth of tilling and the soil pulverizing ratio (the percentage of soil pulverized into pieces smaller than 2 cm in diameter) were as follows:

		Tilling depth	Soil pulverizing ratio
		cm	%
D_1	P_1	5	40
	P_2	4	83
D_2	P_1	14	54
	P_2	12	83

The main reason of much higher soil pulverizing ratio than in the previous experiment, seemed due to the irrigation which was done before the starting of the experiment lest the soil should be too dry for tilling.

2 Test crop: maize (C_1) Suwan No.1
soyben (C_2) SJ 2

3 Fertilizer

		Low rate (F_1)	High rate (F_2)
Maize	N	50 + 75 (top)*	75 + 100 (Top)*
	P_2O_5	75	75
	K_2O	37.5	37.5
Soybean	N	10	10 + 10 (Top)*
	P_2O_5	75	75
	K_2O	37.5	37.5

* Top dressing for maize was separately applied on Feb. 23 and Mar. 17. That for soybean was applied once on Feb. 23.

4 Design and plot size: The split plot design with one replication was employed, disposing the C and D treatments as main plot, and P and F treatments as sub-plot. L 16 (2^{15}) outhogonal table was applied for the statistical analysis. Size of sub-plot was 18 m × 7.5 m (135 m^2).
5 Seeding time: January 30, 1976.
6 spacing: maize 75 cm × 25 cm (1 plant/hill)
soybean 75 cm × 20 cm (2 plants/hill) /hill)
7 Harvesting time: May 11, 1976

Result

1 Plant growth

Plant growth in terms of plant height, leaf area index and dry weight was shown in Fig. 3-1, 2 and 3. In these figures, mean values of two treatments among three were plotted for each crop, since the interaction among the three treatments could be neglected. For example, the effect of tilling depth was shown with the average values of the treatments of soil pulverization and fertilizer application for each crop.

Maize plant grew fairly better under shallow tilling, fine pulverization and high rate fertilization than under deep, coarse and low rate treatments, respectively. On the other hand, soybean plant was favorably affected by deep tilling significantly only in the initial growth stage, but none of other treatments induced any significant effect on the growth of soybean.

2 Grain yield

As shown in Fig.3-4, better yield of maize was obtained from shallow tilling and high rate fertilization as compared with deep and low rate treatments respectively; pulverization gave no significant effect on the yield of maize. None of treatments induced any significant effect on the yield of soybean.

Discussion

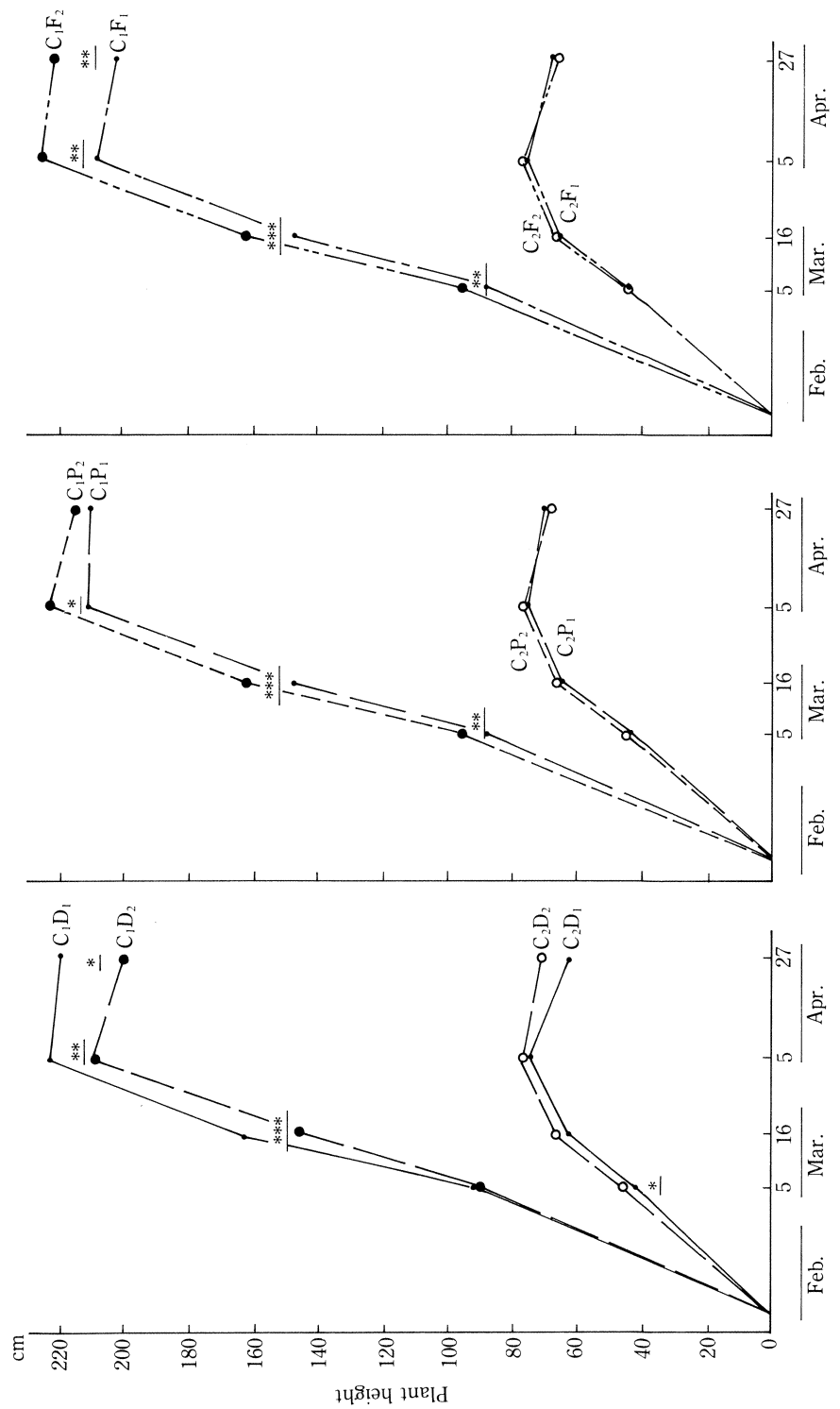
Generally speaking, when seeds are sown on a bed consisting of large clods, seeds fall into pore spaces of varied depth in the bed where soil moisture content is not uniform; thus the seeds result in poor emergence and poor growth. It is generally accepted in

Japan that 60-70% of soil pulverizing ratio is desirable for seedling emergence of upland crops.

In this experiment, the soil pulverizing ratio was much higher than the anticipated value even in the plot of coarse pulverization. Thus, soil pulverization treatment did not induce any appreciable effect on the growth of the test crops except on the plant height of maize.

On the other hand, it is generally said that the deep tilling facilitates development of root system which may result in better crop. However, the favorable effect of deep tilling was seen only in the initial growth of soybean. On the contrary, shallow tilling was found favorable to maize growth. It is most likely that shallow fertilization with shallow tilling brought about quick absorption and efficient use of fertilizer by plant.

Judging from these experimental results, pulverizing soil into fine clods is more essential than deep tilling in heavy clayey paddy soils.



***, ** and *** indicate significant difference at the level of 5%, 1% and 0.1%, respectively**

Fig. 3-1. Plant height in relation to tilling depth, soil pulverization and fertilizer application

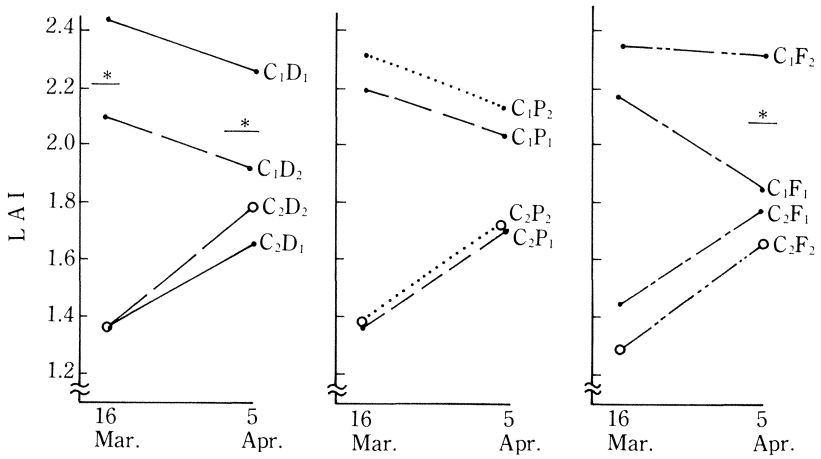


Fig. 3-2. Leaf area index in relation to tilling depth, soil pulverization and fertilizer application

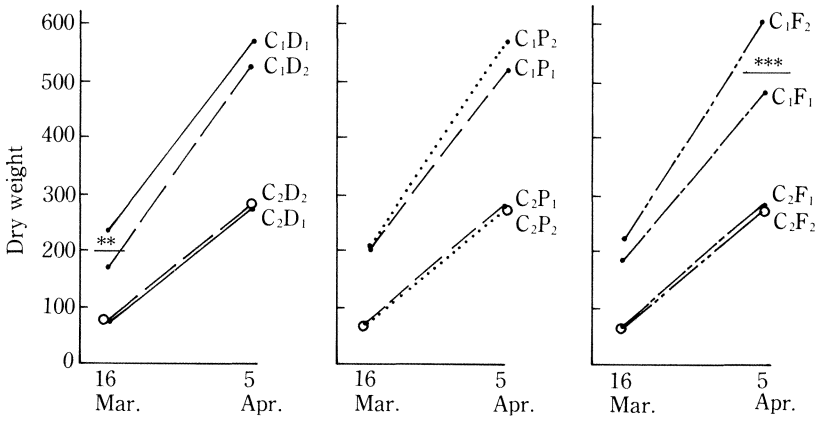


Fig. 3-3. Dry weight of plant in relation to tilling depth, soil pulverization and fertilizer application

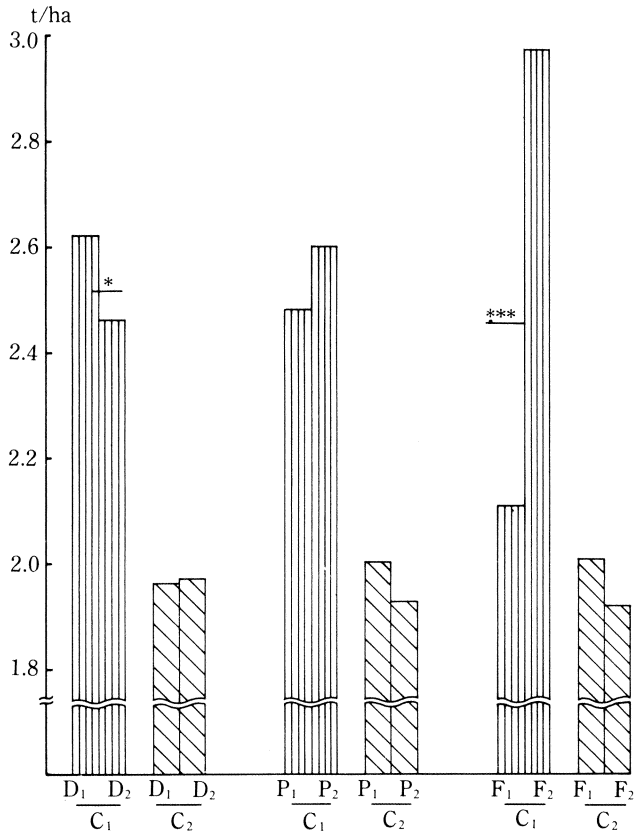


Fig. 3-4. Grain yield in relation to tilling depth, soil pulverization and fertilizer application