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EFFECT OF DEPTHS AND LAND SHAPING METHODS FOR IRRIGATION IN MAIZE

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ABSTRACT

Field experiments were conducted at the Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, during Kharif '86 and rabi 1986-87 to study the effect of depths and land shaping methods for irrigation on growth and yield of Co 1 maize. Irrigations were given at critical stages of the crop growth.

Irrigation with full depth (5 cm) in normal furrows (60 cm) produced the highest grain. Irrigating the crop with 50 per cent depth (2.5 cm) upto grand growth stage reduced the grain yield irrespective of the land shaping methods and the magnitude to reduction was greater under flat bed system. Irrigating the crop through narrow furrows (30 cm) upto grand growth stage and thereafter resorting to full depth by widening furrows resulted in 99.3 per cent of grain yield produced under flat bed system with full depth of irrigation resulting in a saving of 38.5 per cent of irrigation water.

When other factors being equal, the consumptive use of water increases with age of the crop till maturity stage. In maize moisture stress during tasseling, silking and milky stages significantly reduced the grain yield and however, stress at seedling stage did not appreciably reduce the yield (Thiyagarajan, 1981). Adoption of a particular system of irrigation depths on the method of land shaping (Minchael, 1978). Grain yield reductions to the tune of 33 per cent were observed with flood irrigation as against the furrow irrigation in maize (Mosier et al., 1986). Irrigations through wide based bed furrow resulted in comparable grain yield and higher water use efficiency as against normal furrows and check basin systems (SWC, 1987). The present investigation was taken up to study the effect of reduced depth of irrigation water upto grand growth stage under different methods of land shaping on growth and yield of maize.

MATERIALS AND METHODS

Field experiments were conducted during *kharif* 86, and rabi 1986-87 at the Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore. There were five

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Table 1. Effect of depths and land shaping methods for irrigation on growth and uptake of NPK in maize

	Kharif Growth Characters		Uptake at harvest			Growth Character		Uptake at harvest		
	Plant ht (cm)	LAI (60th Day)	N	P	K	Plant ht (cm)	LAI (60th day)	N	P	K
1. Narrow furrow 25% D	280	4.78	231	34	190	245	5.40	212	33	184
2. Normal furrow 50% D.	283	5.78	248	47	205	4.93	212	31	30	175
3. Bed 50% D	269	5.43	242	36	200	220	4.75	203	30	167
4. Bed 100% D	285	5.93	259	38	213	248	5.4	224	33	185
5. Normal furrow 100 : D	299	6.30	277	41	228	260	5.93	240	36	198
SEd (P = 0.05)	12	0.13	3.16	0.88	2.51	3.9	0.177	2.64	0.83	1.99
Cd (=0.05)	12	0.30	7.30	2.93	5.80	8.9	0.41	6.09	1.92	4.60
CD	12	0.30	7.30	2.03	5.8	8.9	0.41	6.09	1.92	4.60

D = Depth of irrigation (5 cm)

irrigation treatments consisting of two levels of water depths (50 and 100 per cent) three land shaping methods (flate bed, normal and narrow furrows). However, the narrow furrow 30 cm width and 15 cm depth) which could be irrigated with 25 per cent depth was maintained as a separate treatment. The narrow furrows were maintained throughout the crop period in *kharif* and upto grand growth stage and then widened to normal furrows with full depth of irrigation in rabi. Two ages of seedlings (5 and 10 days and a direct seedling) were included. The experiments were laid out in split plot design, having irrigations in the main plot and age of seedling in the subplot with three replications.

Irrigation at full depth (5 cm) and 50 per cent depth (2.5 cm) were given at eight critical stages of growth (germination, seedlings, knee high, grand growth, tasselling, stalking, milky and dough). The measurement was made through 'Parshall" fume. The soil type of the experimental site was clay loam (kharif) having 30.5 per cent clay (FC 34% WP 17%) and sandy loam (rabi) having 15.2 per cent clay and 22.8 per cent silt (FC 29% WP 12%). The soil pH was 8.4 and 8.2 and the nutrient status in both the site was low in available nitrogen and phosphorus and high in available potassium. The test variety was Co 1 maize planted with a spacing of 60 x 20 cm. The fertilizer schedule adopted was 125: 62.5 : 50 kg, N, P_2O_5 and K_2O/ha. The effect of age of seedling is not discussed in this paper.

RESULTS AND DISCUSSION

Grain Yield

During both the seasons of the study, the normal furrow with full depth of water resulted in the highest grain yield (Table 2) and was significantly superior to other methods. The grain yield increase was more by 4.96 q/ha (9.8%) in *kharif* and 3.96 q/ha (7.6%) during *rabi* over the flat bed irrigation with full depth. The increase in grain yield in the normal furrow was due to increase in growth characters like plant height, leaf area index and nutrient (NPK) uptake (Table 1) and yield components such as cob length, cob diameter and number of grains per cob (Table 2). The superiority of furrow irrigation in grain yield of maize was as a

Table 2. Effect of depths and land shaping methods for irrigation on yield components and yield of maize

	Kharif 1986					Rabid 1986				
	Cob length	Cob dia meter	No. of grains / cob	Grain yield q/ha	Straw yield q/ha	Cob length	Cob dia-meter	No. of grains/ cob	Grain yield q/ha	Straw yield q/ha
1. Narrow furrow 25% D	18.2	3.8	300	11.80	125.71	18.7	4.4	410	14.39	116.27
2. Normal furrow 50% D.	19.8	4.6	410	10.30	132.72	17.8	4.3	369	12.18	109.61
3. Bed 50% D	18.1	4.2	390	9.50	132.60	16.2	3.9	350	11.57	105.88
4. Bed 100% D	20.1	4.9	439	9.42	140.99	18.8	4.5	415	9.25	117.23
5. Normal furrow 100% D	22.4	5.1	495	10.35	149.70	20.9	4.7	450	10.15	125.23
SEd	0.7	0.10	8.90	0.35	2.66	0.57	0.11	9.70	0.29	2.51
CD	1.63	0.24	20.50	0.80	6.15	1.32	0.26	22.40	0.69	5.81

D = Depth of irrigation (5 cm)

result of increase in yield components (Mosier *et al.*, 1986).

Irrigating the crop with 50 per cent depth through normal furrows produced lower yield by 4.33 q/ha during *kharif* and 5.03% g/ha in *rabi* as compared to full depth of irrigation under normal furrows. The reduction in grain yield was 8.36 and 7.83 q/ha respectively for *kharif* and *rabi* under flatbed with 50 per cent depth as against the full depth in normal furrows. Even among the flat bed treatments, application of 50 per cent depth resulted in lower yield by 3.4 and 4.16 q/ha over the 100 per cent depth. Curtailing the quantum of irrigation water upto grand growth stage irrespective of land shaping methods reduced the grain yield. This might be due to reduction in growth parameters and consequential effect on yield components as reported by Eck (1986).

During *kharif* season, the narrow furrow irrigation resulted in the lowest grain yield because irrigations at reduced depth were given throughout the crop period. On the contrary, during *rabi* irrigations with reduced depth were given upto grand growth phase and thereafter the furrows were widened and irrigated with full depth of water. The grain yield reduction in rabi was 3.97 q/ha (7.7%) as compared to normal furrows with full depth of irrigation. However, the narrow furrow method was superior in grain yield by 3.8 and 1.06 q/ha respectively over the flat bed and normal furrows which received irrigation at 50 per cent depth till the grand growth stage. Narrow furrow irrigation upto grand growth stage resulted in 99.3 per cent of grain yield obtained under flat bed with full depth of irrigation. In sugarcane gradual widening of narrow furrows with the increase in the age of the crop resulted in comparable yield with conventional method of wider furrow irrigation (SWC, 1985).

WATER USE EFFICIENCY

The rainfall received in the cropping period during kharif and rabi was 3.32 and 18 mm respectively. The water requirement during kharif was 532 mm and rabi 517 mm with full depth of irrigation irrespective of land shaping methods (Table 3). The water requirment was the least with the narrow furrow irrigation (382 and 318 mm). The water use efficiency was the lowest under flat bed system with full depth of irrigation water. On the contrary, the highest water use efficiency resulted in the narrow furrow irrigation followed by normal furrows with 50 per cent depth. Irrigation through furrows

Table 3. Effect of depths and land shaping methods for irrigation on the water use efficiency of maize

	Kharif 1986				Rabi 1986			
			Economics				Economics	
	Water requirement	WUE kg/mm	Net return kg/ha	Return/ Rupee invested	Water requirement	WUE kg/mm	Net return kg/ha	Return / rupee invested
1. Narrow furrow 25% D	382	11	3999.15	2.00	317.9	14	4395	2.11
2. Normal furrow 50% D.	492	10	4998.03	2.25	387.9	12	4145	2.04
3. Bed 50% D	492	9	4413.53	2.12	287.9	11	3754	1.95
4. Bed 100% D	532	9	5006.83	2.28	517.9	9	4492	2.15
5. Normal furrow 100% D	532	10	5772.53	2.45	517.9	10	5055	2.26
SE_d		0.3	75.20				0	60.0
CD (P=0.05)		0.8	173.40				0.69	125.0

D = Depth of irrigation (5 cm)Water requirement

was more efficient in using the water for grain production than the conventional flatbed system. This might be due to increased evaporation and percolation losses of water as a result of larger weted area over the flat beds. Stone *et al.* (1979) observed greater water use efficiency under wider spaced furrow than the normal furrows. With the narrow furrows, during *rabi* season there was a saving in irrigation water by 33 per cent over the normal furrow method with full depth of water. In sugarcane gradual widening of narrow furrows with the increase in the age of the crop, there was a saving in irrigaton water by 35 per cent over the conventional wider furrow irrigation (WTC., 1985).

During both the seasons, net return per hectare and return per rupee invested were the highest under normal furrow with full depth of irrigation, while the least was with flat bed system of 50 per cent depth (Table 3). The economic parameters were higher with narrow furrow irrigation in rabi than the normal furrow with 50 per cent depth upto grand growth stage. The flat bed system was less economical even under ample water supply conditions.

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