

## Response of summer pearl millet (*Pennisetum glaucum* L.) to depth and time of irrigation scheduling

P.D. SONAWANE\*, S.C. WADILE, P.P. GIRASE, S.S. CHITODKAR AND D.A. SONAWANE  
Agronomy Section, College of Agriculture, DHULE (M.S.) INDIA

### ABSTRACT

Field experiment was conducted on medium black soil during summer season of 2004, 2005 and 2006 in order to find out the optimum depth and time of irrigation for pearl millet. Irrigation scheduling was done on the basis of open pan evaporation. Results indicated that the application of irrigation at 40 mm depth produced significantly higher grain yield (45.89 qha<sup>-1</sup>), fodder yield (71.57 qha<sup>-1</sup>) and water use efficiency (116.56 kg ha<sup>-1</sup> cm) as compared to 60 mm irrigation depth. Irrigation scheduled at 1.00 IW/CPE ratio produced maximum grain yield (75.76 qha<sup>-1</sup>) but the water use efficiency was found to be significant at 0.50 IW/CPE ratio (127.11 kg ha<sup>-1</sup>cm) which was at par with irrigation given at critical growth stages (123.60 kg ha<sup>-1</sup>cm) For obtaining the higher yield and water use efficiency of Summer pearl millet, the application of 40 mm depth of irrigation water at critical growth stages *i.e.* at 15-20, 25-30, 40-45, 50-55, 60-65, 70-75 days after sowing was found better for pearl millet crop.

**Key words :** Irrigation, Scheduling, IW/CPE

### INTRODUCTION

Pearl millet (*Pennisetum glaucum* L.) is mostly grown in Rajasthan (46 %), Maharashtra (19%), Gujarat (11%), Uttar Pradesh (8%) and Haryana (6 %) as its cultivation is mostly rain fed as a mono cropping to some extent in the pearl millet growing area but high intensity involving double cropping are followed enhance the productivity per unit area per unit time. If the water is available, it can be cultivated in summer because it gives very good response during this season and less incidence of pest and diseases.

Irrigation to pearl millet is being scheduled at IW/CPE ratio on the basis of open pan evaporation values helps in working out permissible intervals between successive irrigations. In this view the present investigation was undertaken to find out the suitable depth and IW/CPE ratio for irrigation scheduling to summer pearl millet.

### MATERIALS AND METHODS

The field experiment was conducted during the summer season of 2004, 2005 and 2006. The experiment was laid out in Factorial Randomized Block Design (FRBD) with three replications. Treatments were comprised of two depth of irrigation D<sub>1</sub>-60 mm, D<sub>2</sub>-40 mm and four time of irrigation I<sub>1</sub>-1.00 IW/CPE ratio, I<sub>2</sub>-0.75 IW/CPE ratio, I<sub>3</sub>-0.50 IW/CPE ratio and I<sub>4</sub>-Irrigation at critical growth stages (at seedling, tillering, leaf boot stage, flowering, grain filling and grain development stage) *i.e.* at 15-20, 25-30, 40-45, 50-55, 60-65, 70-75 days after sowing, respectively. The fertilizer was applied as per the RDF *i.e.* 90:45:45 kg NPK/ha.

Half dose of nitrogen and complete dose of P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O were applied at the time of sowing and remaining half dose of nitrogen was top dressed a month after sowing.

Crop was sown in the month January during every experimental time. The crop was sown at 45 cm row spacing with 15 cm plant spacing by using 3 kg seed rate per hectare. Irrigations was given as per treatment up to harvest of crop. The open pan evaporation was used for measuring evaporation (mm). The quality of irrigation water applied during each irrigation was measured with the help of 'V' notch measuring device.

### RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been presented under following sub heads:

#### *Seasonal irrigation requirement :*

Data presented in Table 1 indicate that the total quantity of irrigation water increased with increase in IW/CPE ratio. On an average the total water applied at 60 mm depth was 66,48,36,42 ha-cm and at 40 mm depth was 64,48,32,28 ha-cm for 1.0, 0.75, 0.50 and at CGS, respectively.

#### *Effect of irrigation depth :*

The depth of irrigation significantly influences the grains and straw yield during every time of experiment and when the data was pooled over the years. The irrigation scheduled at 1.00 IW/CPE ratio produced significantly higher grain (48.69 qha<sup>-1</sup>) and fodder (75.76

\* Author for correspondence.

qha<sup>-1</sup>) yield over rest of the treatments but it was found at par with 0.75 IW/CPE ratio (45.79 qha<sup>-1</sup>) (71.46 qha<sup>-1</sup>). These results are in conformity with the results reported by Vyas *et al.* (1994) and Patel *et al.* (1994).

#### Water use efficiency :

The mean water use efficiency was 105.20 kg ha<sup>-1</sup>cm. The highest water use efficiency was observed in 40 mm depth of irrigation (116.66 kg ha<sup>-1</sup>cm) than 60 mm depth of irrigation (93.84 kg ha<sup>-1</sup>cm). Similar results reported by Iruthayaraj and Sennaiyan (1984) also found higher water use efficiency in pearl millet with 7 irrigation of each 40 mm depth.

In respect of time of irrigation the irrigation scheduled

at 0.50 IW/CPE ratio gives significantly higher water use efficiency 127.11 kg ha<sup>-1</sup>cm which was at par with irrigation given at critical growth stages (125.60 kg ha<sup>-1</sup>cm).

#### Interaction : Depth of irrigation x time of irrigation:

The interaction between depth of irrigation and irrigation time was found significant in respect of water use efficiency. The irrigation given at critical growth stages with 40 mm depth of water recorded significantly higher water use efficiency (151.86 kg ha<sup>-1</sup>cm) than rest of the treatment combinations during all the season as well as when the data was pooled over the years.

From the above results it is concluded that for

**Table 1 : Pooled mean of irrigation water applied and water use efficiency of summer pearl millet as influenced by different treatments (2004, 2005 and 2006)**

Sr. No.	Treatments	Grain yield (kg ha <sup>-1</sup> )	No. of irrigations applied	Effective rainfall (mm)	Total water applied (ha -cm)	WUE (kg ha <sup>-1</sup> cm)	
	Depth of irrigation water (D)						
1.	60 mm	I <sub>1</sub> (60 mm CPE)	4806	11	--	66	72.82
2.	60 mm	I <sub>2</sub> (80 mm CPE)	4471	8	--	48	93.12
3.	60 mm	I <sub>3</sub> (120 mm CPE)	4107	6	--	36	114.08
4.	60 mm	I <sub>4</sub> (at CGS)	4004	7	--	42	95.34
5.	40 mm	I <sub>1</sub> (40 mm CPE)	4932	16	--	64	77.06
6.	40 mm	I <sub>2</sub> (53 mm CPE)	4686	12	--	48	97.16
7.	40 mm	I <sub>3</sub> (80 mm CPE)	4485	8	--	32	140.15
8.	40 mm	I <sub>4</sub> (at CGS)	4252	7	--	28	151.86

**Table 2 : Mean grain and fodder yield of pearl millet as influenced by different treatments during 2004, 2005 and 2006**

Sr. No.	Treatments	Grain yield (kg ha <sup>-1</sup> )				Fodder yield (q ha <sup>-1</sup> )			
		2004	2005	2006	Pooled mean	2004	2005	2006	Pooled mean
	Depth of irrigation water (D)								
1.	D <sub>1</sub> - 60 mm	42.02	46.08	42.31	43.47	62.85	73.51	67.57	67.97
2.	D <sub>2</sub> - 40 mm	44.09	48.42	45.18	45.89	65.59	77.02	72.12	71.57
	S.E. ±	0.36	0.65	0.63	0.32	0.55	1.00	1.19	0.45
	C.D. (P=0.05)	1.10	1.96	1.93	0.91	1.66	3.03	3.62	1.37
	Time of irrigation (I)								
1.	I <sub>1</sub> - 1.00 IW/CPE ratio	47.91	50.44	47.72	48.69	70.98	80.53	75.76	75.76
2.	I <sub>2</sub> - 0.75 IW/CPE ratio	43.58	48.53	45.25	45.79	64.81	76.88	72.70	71.46
3.	I <sub>3</sub> - 0.50 IW/CPE ratio	40.93	46.07	41.88	42.96	61.87	73.51	66.93	67.43
4.	I <sub>4</sub> - Irrigation at CGS	39.80	43.96	40.13	41.30	59.20	70.15	63.97	64.44
	S.E. ±	0.51	0.91	0.89	0.45	0.77	1.41	1.68	0.63
	C.D. (P=0.05)	1.55	2.76	2.70	1.28	2.35	4.28	5.12	1.86
	Irrigation (D x I)								
	S.E. ±	0.72	1.29	1.27	0.63	1.09	2.00	2.38	0.89
	C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS

NS-Non significant

**Table 3 : Mean water use efficiency of pearl millet as influenced by different treatments during 2004, 2005 and 2006**

Sr. No.	Treatments	Water use efficiency (kg ha <sup>-1</sup> cm)			
		2004	2005	2006	Pooled mean
A	Depth of irrigation water (D)				
1.	D <sub>1</sub> – 60 mm	90.54	99.66	91.32	93.84
2.	D <sub>2</sub> – 40 mm	111.74	123.32	114.62	116.56
	S.E. ±	0.77	1.59	1.38	0.81
	C.D. (P=0.05)	2.34	4.82	4.20	2.45
B	Time of irrigation (I)				
1.	I <sub>1</sub> – 1.00 IW/CPE ratio	73.74	77.63	73.45	74.93
2.	I <sub>2</sub> – 0.75 IW/CPE ratio	90.80	100.41	94.27	95.16
3.	I <sub>3</sub> – 0.50 IW/CPE ratio	121.05	136.35	123.94	127.11
4.	I <sub>4</sub> – Irrigation at CGS	119.02	131.56	120.21	123.60
	S.E. ±	1.09	2.25	1.96	1.18
	C.D. (P=0.05)	3.30	6.82	5.94	3.57
C.	Irrigation (D x I)				
	S.E. ±	1.54	3.18	2.77	1.62
	C.D. (P=0.05)	4.67	9.65	8.40	4.91

**Table 4 : Pooled mean of water use efficiency (kg ha<sup>-1</sup> cm) of pearl millet as influenced by interaction of depth of irrigation x time of irrigation during 2004, 2005 and 2006**

Treatments	Time of irrigation (IW/CPE)				Mean
	1.00	0.75	0.50	At CGS	
Depth of irrigation (D)					
60 mm	72.82	93.15	114.08	95.34	93.85
40 mm	77.06	97.16	140.15	151.86	116.56
Mean	74.94	95.16	127.11	123.60	105.20
	S.E. ±				1.62
	C.D. (P=0.05)				4.91

obtaining the higher yield and water use efficiency of summer pearl millet it should be irrigated 40 mm depth of irrigation water at critical growth stages *i.e.* at 15-20, 25-30, 40-45, 50-55, 60-65, 70-75 days after sowing which was found most suitable.

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