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Influence of irrigation and mulching practices on water use, yield components and yield of finger millet (*Eleusine coracana*)

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ABSTRACT

A field experiment was conducted at Annamalai University experimental farm, Annamalainagar, to study the effect of irrigation and mulching practices on yield of finger millet or *ragi* [*Eleusine coracana* (L.) Gaertn.] cv. 'CO 13' during 1998 and 1999. The depth of water was fixed as 50 mm at each irrigation (IW). The IW: CPE ratio of 0.9 consumed more water through irrigation, followed by 0.6 IW : CPE ratio. Scheduling irrigation at an IW: CPE ratio of 0.9 along with sugarcane trash mulching at 10 cm thickness gave higher grain yield and it was at par with 0.6 IW: CPE along with sugarcane trash mulch at 10 cm thickness. The consumptive use of water was highest with 0.9 IW: CPE ratio, followed by 0.6 ratio. The water-use efficiency increased with the decrease in number of irrigations.

Key words : Finger millet, *Ragi*, Irrigation, Mulching

Finger millet or *Ragi* is an important millet crop of India, next to sorghum and pearlmillet. In recent years, gradual decline of yield in *ragi* was noticed due to less importance given to this crop and changing food habit of the people. At present water for irrigation is becoming expensive for the crop production due to depletion of surface and under-groundwater resources by erratic and uneven rainfall. The yield of *ragi* can be enhanced through proper irrigation scheduling.

Crop production could be successful with the use of mulches which reduce evaporation losses from the soil and increase the yield through better conservation of soil moisture. Gupta *et al.* (1990) reported that mulches reduced the heating of soil and loss of water through vaporization because they provided cover on surface soil against solar radiation. Precise information on irrigation scheduling based on IW: CPE ratio and critical stages concept and mulching practices is limited in *ragi* and needs field investigation. Hence an investigation was carried out to study the effect of irrigation and mulching practices on water use, yield components and yield of *ragi*.

MATERIALS AND METHODS

The experiment was conducted in split-plot design replicated thrice with 5 irrigation treatments in the main plots, [irrigation at IW: CPE ratios of 0.9, 0.6 and irrigation at critical stages, viz. 1 irrigation at vegetative, 2 irrigations at vegetative and flowering stages and 3 irrigations at vegetative, flowering and maturity stages] and 3 mulching treatments in the subplots, *viz.* no mulch control, coir pith at 2 cm thickness and sugarcane trash mulching at 10 cm thickness.

Two common irrigation, *viz.*, first irrigation at transplanting and second at 5 days after transplanting were given to all main plots. Whenever the ratio between depth of irrigation water (IW) and cumulative pan evaporation (CPE) reached the required ratio, irrigation was given to the treatments. The depth of irrigation water was fixed as 50 mm. The consumptive use of water was calculated as per procedure described by Dastane (1967). The water-use efficiency was worked out in terms of grain yield/mm water. The mulch materials used were coir pith at 2 cm thickness (10 tonnes/ha) and sugarcane trash at 10 cm thickness (12 tonnes/ha). The soil was clay loam in texture with pH of 7.9 and electrical conductivity of 0.37 dS/m. It was low in available nitrogen (179.3 kg/ha), medium in available phosphorus (20.9 kg/ha) and high in available potassium (342.1 kg/ha).

RESULTS AND DISCUSSION

Water use

The irrigation requirement was higher at 0.9 IW: CPE ratio, viz. 450 and 500 mm, in 1998 and 1999 respectively (Table 1). This was followed by 0.6 IW: CPE ratio, viz. 350 and 400 mm in 1998 and 1999 respectively. The number of irrigations varied from 9 to 10 under 0.9 IW: CPE ratio and 7 to 8 under 0.6 IW: CPE ratio. An IW: CPE ratio of 0.9 required less irrigation interval of 8 and 7 days in 1998 and 1999, respectively, due to low CPE value (55 mm). Irrigation at 0.6 IW : CPE ratio required 11 and 10 days interval in 1998 and 1999 respectively. The consumptive use of water was the highest with 0.9 IW: CPE ratio, followed by 0.6 ratio in both the years due to more number of irrigations given to these treatments. The water-use efficiency (WUE) increased with decrease in number of irrigations. Irrigation given at vegetative stage only recorded the highest WUE. The least WUE was observed under 0.9 IW : CPE ratio.

Yield components and yield

Scheduling irrigation at an IW: CPE ratio of 0.9 along with sugarcane trash mulching at 10 cm thickness registered higher yield components, viz. number of ears/hill, fingers/ear, grains, ear, 1,000-grain weight and grain yield. It was at par with 0.6 IW: CPE ratio along with sugarcane trash mulching at 10 cm thickness (Table 2). The reason for increase in yield components might be owing to adequate supply of water to the crop at active growth phase which enhanced the yield and yield attributes. Patel *et al.* (1990) reported that higher number of productive tillers/hill was recorded under higher moisture regime. The yield components and yield of ragi were significantly reduced under 1 irrigation at vegetative stage and no mulch control due to restricted moisture supply to the crop. Ved Singh *et*

Table 1. Total water applied, consumptive use and water-use efficiency (WUE) in various irrigation treatments

Treatment	Number of irrigations*		Irrigation interval (days)		Water applied				Total (mm)		Consumptive use (mm)		WUE (kg/ha-mm)	
					Effective rainfall (mm)		Irrigation water (mm)							
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
Irrigation IW : CPE ratios and critical stages														
0–9	9	10	8	7	121.5	33.6	450	500	571.5	533.6	560.1	521.4	6.10	6.37
0–6	7	8	11	8	127.6	35.2	350	400	527.6	435.2	512.4	422.3	6.50	7.70
Vegetative stage only	3	3			132.0	38.2	150	150	282.0	188.2	262.6	169.1	9.60	14.45
Vegetative and flowering stages	4	4			132.5	34.5	200	200	332.5	234.5	311.5	213.4	9.08	13.99
Vegetative, flowering and maturity stages	5	5			132.5	34.5	250	250	382.5	284.5	361.1	262.2	8.57	11.38

*Inclusive of 2 common irrigations

Table 2. Effect of irrigation and mulching practices on yield components of *ragi*

Treatment	Ears/hill		Fingers/ear		Grains/ear		1,000-grain weight (g)		Grain yield (kg/ha)	
	1998	1999	1998	1999	1998	1999	1998	1999	1998	1999
Irrigation IW : CPE ratios and critical stages										
0.9	4.33	4.19	11.91	11.70	1,315.47	1,288.19	1.71	1.66	3,418.61	3,322.29
0.6	4.20	4.03	11.88	11.56	1,310.48	1,279.79	1.70	1.65	3,330.94	3,254.70
Vegetative stage only	3.19	3.13	11.42	11.25	1,248.05	1,215.20	1.60	1.59	2,516.53	2,444.29
Vegetative and flowering stages	3.51	3.43	11.58	11.38	1,268.67	1,236.40	1.63	1.61	2,825.59	2,745.23
Vegetative, flowering and maturity stages	3.86	3.73	11.72	11.51	1,289.13	1,258.20	1.67	1.63	3,096.09	2,985.70
CD (P = 0.05)	0.27	0.25	0.09	0.08	18.14	15.88	0.020	0.011	160.33	143.28
Mulching										
No mulch control	3.33	3.27	11.40	11.27	1,257.93	1,222.48	1.62	1.59	2,763.92	2,681.95
Coir pith at 2 cm thickness	3.82	3.70	11.72	11.51	1,285.83	1,253.40	1.66	1.63	3,047.82	2,965.65
Sugarcane trash at 10 cm thickness	4.30	4.13	11.98	11.72	1,315.32	1,290.84	1.71	1.66	3,300.91	3,203.68
CD (P = 0.05)	0.36	0.35	0.20	0.17	25.31	24.90	0.021	0.013	179.86	168.71

al. (1998) reported that deficit water supply at grain-formation stage resulted in lesser yield.

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