

**EFFECT OF IRRIGATION AND MULCHES ON SUMMER
PEARL MILLET [*Pennisetum glaucum* (L.)]
UNDER NORTH GUJARAT AGRO-CLIMATIC CONDITIONS**

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ABSTRACT

*An experiment was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Banaskantha District (North Gujarat) during summer season of 2011 to study the effect of irrigation and mulches on growth and yield of summer pearl millet (*Pennisetum glaucum* L.) under North Gujarat Agro-climatic conditions. Significantly higher grain (5491 kg/ha) and dry fodder (8912 kg/ha) yield was recorded under I_3 treatment (1.0 IW: CPE ratio). Irrigation scheduled at 1.0 IW:CPE ratio (I_3) registered the highest net realization (₹ 41389 ha⁻¹) and BCR (3.47). Significantly the higher grain yield (5351 kg/ha), fodder yield (8744 kg/ha), protein content (10.55 %) and water use efficiency (9.84 kg/ha/mm) were recorded under castor shell mulch (M_2), and it was being at par with treatment M_1 (mustard straw mulch). The highest net return of ₹ 51843 ha⁻¹ with BCR of 4.75 was accrued under the treatment M_2 (castor shell mulch).*

KEY WORDS: Irrigation, interaction, mulch, pearl millet

INTRODUCTION

Pearl millet (*Pennisetum glaucum* L.) is one of the major cereal crops grown in the arid and semi-arid regions of the world. Among the major food grain crops grown in India, pearl millet ranks fourth in the acreage, next to rice, wheat and sorghum. In India, pearl millet popularly known as '*bajra*' or '*bajri*'. It also occupies an important place in the daily diet of many classes of people in India, particularly in Gujarat, Rajasthan, Madhya Pradesh, Maharashtra and Uttar Pradesh, where it is grown comparatively on a large scale. The nutritive value of pearl millet is fairly high and it possesses higher amount of fat content as compared to other cereals. It

contains 5 per cent fat (Ether extract), 12.1 per cent protein, 69.4 per cent carbohydrate, 2.4 per cent sugar, 2-7 per cent mineral matter and gives 360 calories per 100 g with high amounts of vitamins A and B. It imparts substantial energy to the body with easy digestibility (Pal *et al.*, 1996). In addition to grains, it also supplies fair quality of dry fodder in large bulk.

Gujarat has an area of 9061 hundred hectares under *bajra* crop with an annual production of 10809 MT and productivity of 1193 kg/ha (Anonymous, 2011). The area under summer pearl millet is 3829 hundred hectares with an annual production of 941700 MT and productivity of 2459 kg/ha in the

state during 2011 (Anonymous, 2011). Water is the basic input for increasing the crop production. Water stands second next to fertilizer in augmenting the crop yield. Agricultural productivity cannot be maintained without assured supply of moisture to the plant, which is accomplished by irrigation. Among different approaches to schedule irrigation, climatological approach based on the ratio between irrigation water (IW) and cumulative pan evaporation (CPE) was found to be the most appropriate, as it integrates all the weather parameters giving their natural weightage in a given soil-water plant continuum. Scheduling irrigation based on the data of the pan evaporation is likely to increase agricultural production at least to the tune of 15-20 per cent (Dastane, 1972). Proper water management technique for optimum crop production is very important. Apart from several techniques that are in vogue, use of white polyethylene sheet, straw mulches and removal of weeds to check the evaporative loss of soil moisture are important.

Considering the above facts in view, an experiment was planned to study the effect of irrigation and mulches on growth and yield of summer pearl millet (*Pennisetum glaucum* L.) under North Gujarat Agro-climatic conditions.

MATERIAL AND METHODS

The present study was conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Banaskantha District (North Gujarat) during summer season of 2011. The soil of the experimental plot was loamy sand in texture and experimental site was free from any kind of salinity or sodicity hazards, low in organic carbon (0.2%), available nitrogen (170 kg/ha) and available phosphorus (39.10 kg/ha) and high in available potassium (273 kg/ha). There were 12 treatment combinations comprising of three levels of irrigation schedules (I_1 - 0.6, I_2 - 0.8

and I_3 - 1.0 IW: CPE ratios) and four levels of mulches (M_0 -control, M_1 -mustard straw @ 5 t/ha, M_2 -castor shell @ 5 t/ha and M_3 -soil mulch) embedded in a split plot design with four replications.

RESULTS AND DISCUSSION

The results (Table 1) revealed that significantly higher grain (5491 kg/ha) and dry fodder (8912 kg/ha) yield and protein content (10.6%) were recorded under I_3 treatment (1.0 IW: CPE ratio) as compared to I_1 treatment (0.6 IW: CPE ratio), but it was statistically at par with I_2 treatment (0.8 IW: CPE ratio). The increase in yield with higher number of irrigations may be attributed to increased growth and yield attributes. Similar findings were reported by Kachhadiya *et al.* (2010). The highest water use efficiency (10.17 kg/ha/mm) was observed under irrigation scheduled at 0.6 IW:CPE ratio (I_1). Water use efficiency decreased with each successive increase in IW:CPE ratio. When more quantity of water was applied, the reduction in water use efficiency could be because of the fact that in higher moisture regimes, more moisture was used for evaporation and transpiration rather than for production. Kachhadiya *et al.* (2010) also reported similar results. Harvest index was not affected due to different irrigation ratio. Treatment I_3 recorded significantly higher soil status of nitrogen (213.4 kg/ha) and phosphorus (40.0 kg/ha) after harvest of pearl millet crop. In case of phosphorus uptake, treatment I_3 remained statistically at par with treatment I_2 . Similar findings were reported by Rajendran and Sundersingh (1999). Application of irrigation with 1.0 IW:CPE ratio (I_3) resulted in higher net realization (41389 ₹ ha⁻¹) with more benefit cost ratio (3.47).

The results of effect of different mulches were found significant on various traits except harvest index and phosphorus content in soil (Table 1). Significantly the higher grain yield (5351 kg/ha), fodder yield (8744 kg/ha), protein content (10.55 %) and

water use efficiency (9.84 kg/ha/mm) were recorded under castor shell mulch (M_2), and it was being at par with treatment M_1 (mustard straw mulch). Higher yields recorded under above treatments might be due to the fact that mulch plays an important role in changing hydro-thermal regime of the soil and conserving soil moisture resulting into higher values of growth and yield attributes. Kachhadiya *et al.* (2010) also reported similar results. Application of mulches with castor shell mulch (M_2) resulted in significantly higher nitrogen (206.5 kg/ha) content in soil after harvest. However, it remained statistically at par with treatment M_1 (mustard straw mulch). Higher net realization (₹ 51843 ha^{-1}) and BCR of 4.75 was recorded under castor shell mulch (M_2).

The interaction effect of different irrigation schedules and mulches was non-significant for almost all the traits except phosphorus content in soil (Table 1)

CONCLUSION

In view of the results obtained from the present investigation, it could be concluded that for securing the higher grain and fodder yield as well as net realization from summer pearl millet (GHB 558) grown under North Gujarat Agro-climatic conditions on loamy sand soil, the crop should be irrigated through surface irrigation method (total 13 irrigations, each of 50 mm depth) scheduled at 1.0 IW :

CPE ratio along with mulching of castor shell or mustard straw.

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Table 1 : Effect of different treatments on yield, protein content and economics of pearl millet

Treatments	Grain Yield (kg /ha)	Fodder Yield (kg /ha)	Harvest Index (%)	Protein Content (%)	Water Use Efficiency (WUE) (kg/ha/mm)	Nitrogen Content in Soil (kg /ha)	Phosphorus Content in Soil (kg /ha)	Net Realization (₹ /ha)	Benefit Cost Ratio
A. Main Plot (Irrigation) (I)									
I₁	4577	7821	36.8	10.02	10.17	171.5	32.9	35383	3.35
I₂	5002	8363	37.5	10.40	9.10	190.6	36.7	38095	3.40
I₃	5491	8912	38.2	10.69	8.45	213.4	40.0	41389	3.47
S.Em.₊	167.70	237.20	1.12	0.05	0.34	4.20	1.00	--	--
C. D. at 5 %	580.40	820.90	NS	0.18	1.19	14.60	3.40	--	--
C. V. (%)	13.35	11.34	11.94	2.04	14.84	8.82	10.87	---	--
B. Sub Plot (Mulches) (M)									
M₀	4648	8012	36.7	10.21	8.57	178.4	34.0	46304	5.00
M₁	5125	8399	37.9	10.40	9.40	192.8	37.6	49116	4.55
M₂	5351	8744	38.0	10.55	9.84	206.5	37.2	51843	4.75
M₃	4970	8307	37.5	10.31	9.15	189.4	37.2	47792	4.52
S.Em._±	119.40	161.80	0.73	0.07	0.24	5.80	1.03	--	--
C. D. at 5 %	346.50	469.60	NS	0.20	0.68	16.80	NS	--	--
C. V. (%)	8.23	6.70	6.74	2.40	8.79	10.47	9.77	--	--
Interaction effects (I x M)									
C. D. at 5 %	NS	NS	NS	NS	NS	NS	5.18	--	--

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