Mycopath (2013) 11(1): 23-26 **Research Article**

Performance of promising sugarcane clones under different irrigation regimes

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Abstract

To find out well tolerant genotypes of sugarcane (*Saccharum officinarum* L.), a trial was laid out in randomized complete block design under split plot arrangement, having three repeats with a plot size of 9.6 m × 4 m. Three irrigation coefficient viz., 1.0, 0.8 and 0.6 were kept in main plots while the 5 sugarcane clones/varieties (S2003-US-114, S2003-US-778, S2006-US-832, CPF 246 and CPF 247) were planted in sub plots. Significantly higher cane yield of 91.58 t ha^{-1} at 1.0 co-efficient, while the least (74.14 t ha^{-1}) at 0.6 and an intermediate (81.48 t ha^{-1}) at 0.8 co-efficient was recorded. Being smaller canopy with erect leaves and waxy stem, the clone S2006-US-832 excelled among other clones for cane yields of 109, 92 and 88 t ha^{-1} under 1.0, 0.8 and 0.6 coefficients, respectively. The clone S2003-US-778 produced minimum cane yield of 72.22, 65.97 and 60.50 t ha^{-1} under 1.0, 0.8 and 0.6 coefficient, respectively, while all other varieties/clones were intermediate in their expression. Irrigation regimes have no significant effect on sugar recovery.

Key Words: Cane yield, genotypes, irrigation, sugarcane, sugar recovery, water tolerance.

Introduction

Sugarcane is a plant of tropical origin but under areas of low precipitation like Pakistan, does not receive sufficient irrigation water to produce optimum yields. It is most often subjected to moisture stress during peak growth periods resulting into low yields. Rainfall in Pakistan hardly fulfills the water requirements of this crop. In spite of all these, sugarcane is the 2nd most important cash crop of the country after cotton. At 25% of the production costs, irrigation is the single most costly practice in growing sugarcane (Baustista and Wallender, 1993).

The successful cultivation of sugarcane depends upon the availability of adequate irrigation water and management practices (Nazir, 1994). Scarcity of irrigation water is one of the major constraint of low cane yield in Pakistan and it is mostly restricted the sugarcane growing areas in the world (Martin *et al.,* 2007). Water stress during formative phase (tillering phase) has negative impact on yield contributing parameters such as tillers per plant, millable canes per unit area, cane height, cane girth and even the individual cane weight is reduced (Rajkumar and Kambar, 1999). Sugarcane varieties differ markedly in their growth behaviours and yield potentials under water stress conditions (Malik *et al*., 1991, Ali *et al*., 2003). It is further observed that some cane varieties could check the excessive loss of water from surface by rolling their leaves (Malik *et al*., 1991). Under water stress condition the cane yield decreased. More canes per hectare and yield in coefficient 1.0 were observed, where a normal irrigation was applied, than 0.8 and 0.6 coefficients (Ghaffar *et al.,* 2013). To improve water use efficiency, productivity and quality of sugarcane genotypes, proper scheduling of irrigation plays an important role for identification and selection of suitable varieties tolerant to excess and deficient water for adoption at farmers' level (Choudhary and Kanwar, 1986). Limited information is available on irrigation scheduling based on Cumulative Pan Evaporation which integrates soil-plant-atmosphere relationship in a better way (Singh *et al.,* 2006). The present study was conducted to find out the most suitable sugarcane genotypes which can tolerate the drought conditions with minimum yield and sugar losses.

Materials and Methods

The experiment was carried out at farm area of Sugarcane Research Institute, Faisalabad. Pakistan. The trial was laid out in randomized complete block design under split plot arrangement having three repeats with a plot size of 9.6 m × 4 m. The crop was planted in spring 2011. Recommended dose of N, P and K fertilizers, 168, 112 and 112 kg ha^{-1}, respectively was applied to crop. Whole P and K fertilizers were given at the time of planting while the N fertilizer was side dressed in three equal splits at 45, 60 and 90 days after planting. Pan evaporation method was used for designing the coefficients (Allen *et al.*, 1998).

Three irrigation coefficients viz., 1.0, 0.8 and 0.6 were kept in main plot while the 5 clones/varieties (S2003-US-114, S2003-US-778, S2006-US-832 CPF 246 and CPF 247) were planted in subplots. Irrigation was applied on the basis of cumulative pan-evaporation after formative phase of crop. Measured amount of water was applied by using siphon of known discharge. Data regarding germination and tillering were recorded after 45 and 90 days of planting, respectively, while cane count, cane yield and sugar recovery were recorded at the time of harvest (February 2012). Data were analyzed statistically using Fisher's analysis of variance technique and LSD test was used to compare treatment means at 0.05 level of probability.

Results and Discussion

Germination count (%) (Table 1) illustrated non-significant effect of the treatments. However, the maximum germination (46.26%) was recorded in S2006-US-832, while the minimum (38.20%) was noted in S2003-US-778. Difference in germination count is the inherent character of each genotype. Moreover, the genotypes with protruding buds were more vulnerable to bud injuries that lead to low germination. Data regarding tillers per plant also exhibited non-significant effects of the treatments. The most recently approved variety, CPF 247, excelled from rest of genotypes in tillers per plant (2.24). Similarly both the irrigation coefficients and interaction, had non significant effects the said parameter because the irrigation scheduling with respect to their coefficients was induced after this stage. The same observations were recorded by Ghaffar *et al.* (2013).

Millable canes per hectare revealed significant differences among genotypes, while irrigation as well as interaction showed non significant effect. The maximum millable canes (93750.00) were obtained in S2006-US-832, followed by CPF 247 (87962.96). While the other genotypes, S2003-US-114, S2003-US-778 and CPF 246, were statistically similar. It is the inherent character of each genotype to develop millable canes from tillers.

The significant difference in cane count might be due to the inherent potential of the genotypes to withstand moisture stress. These results are in line with Rehman *et al.* (1991). The individual as well as interactive effect of treatments were found significant for cane yield (t ha^{-1}) The clone S2006-US-832 produced maximum yield (109.0 t ha^{-1}) under 1.0 coefficient of irrigation regimes followed by CPF 247 (98.61 t ha^{-1}). While the minimum cane yield (60.50 t ha^{-1}) was produced under I_3 (0.6 coefficient) by S2003-US-778. The maximum yield of S2006-US-832 might be attributed to its more number of millable canes. Moreover, the genotype expressed its maximum potential on all irrigation regimes than others. These findings are in confirmatory with many earlier workers (Johari *et al*., 1998; Singh *et al*., 2006; Inman-Bamber and Smith, 2005; Ghaffar *et al.*, 2013) who reported more yield of genotypes at irrigation without stress. Though the interactive effect of irrigation and irrigation coefficients for canes per hectare was non-significant but significant for cane yield. It depicted that individual cane weight was greatly reduced under water stress and leaded to lower cane yield (Rajkumar and Kambar, 1999).

Irrigation regimes and interaction have non-significant effect on sugar recovery (%), while varieties revealed significant difference among the treatment means. The highest sugar recovery of 13.58% was recorded in CPF 246, while the lowest (11.94%) in S2006-US-832. With respect to genotypes, it is the inherent character to have good or bad sugar recovery. The non-significant effects of irrigation coefficients and interaction over sugar recovery may be due to lower temperature which leads to rapid conversion of non extractable sugar to extractable to increase the sugar recovery. The results are in consonance with Singh *et al.* (2001) and Singh *et al.* (2006) who reported that sugar recovery was not affected due to different levels of irrigation.

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Table 1. Performance of promising sugarcane clones under different irrigation regimes.

Treatments	Germination (%)	Tillers per plant	No. of canes ha^{-1}	Cane yield ($t\ ha^{-1}$)	Sugar recovery (%)
Irrigation regimes					
I_1 = 1.0 coefficient	43.91	2.22	82777.78	91.58 A	13.15
I_2 = 0.8 coefficient	42.99	1.98	80694.44	81.48 B	13.10
I_3 = 0.6 coefficient	41.27	2.08	81388.89	74.14 C	13.03
LSD at $P \leq 0.05$	NS	NS	NS	2.302	NS
Varieties					
V_1 = S2003-US-114	42.55	1.93	77430.56 C	80.55 C	13.48 A
V_2 = S2003-US-778	38.20	1.99	75347.22 C	66.23 E	13.27 A
V_3 = S2006-US-832	46.26	2.18	93750.00 A	96.30 A	11.94 B
V_4 = CPF 246	44.29	2.11	73611.11 C	77.31 D	13.58 A
V_5 = CPF 247	42.32	2.24	87962.96 B	91.61 B	13.19 A
LSD at $P \leq 0.05$	NS	NS	4363	3.240	0.4826
Interactions					
$I_1 \times V_1$	42.36	1.86	81597.22	92.95 c	13.27
$I_1 \times V_2$	43.17	2.22	77430.56	72.22 gh	13.41
$I_1 \times V_3$	41.21	2.26	98611.11	109.0 a	11.59
$I_1 \times V_4$	46.29	2.41	69097.22	85.07 de	14.12
$I_1 \times V_5$	46.53	2.32	93055.55	98.61 b	13.35
$I_2 \times V_1$	47.45	1.86	87152.78	81.25 ef	13.50
$I_2 \times V_2$	40.74	2.22	72916.67	65.97 ij	13.19
$I_2 \times V_3$	38.31	2.26	89930.55	92.01 c	12.06
$I_2 \times V_4$	45.49	2.41	70486.11	77.41 fg	13.59
$I_2 \times V_5$	42.94	2.32	82986.11	90.76 cd	13.15
$I_3 \times V_1$	37.15	2.04	63541.67	67.45 hi	13.68
$I_3 \times V_2$	43.75	1.95	75694.44	60.50 j	13.20
$I_3 \times V_3$	35.07	2.15	92708.33	87.85 cd	12.19
$I_3 \times V_4$	46.99	2.20	81250.00	69.44 hi	13.02
$I_3 \times V_5$	43.40	2.06	87847.22	85.45 de	13.06
LSD at $P \leq 0.05$	NS	NS	NS	5.612	NS

Means having different letters are significantly different from each other.

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