EVALUATION OF ELITE SUGARCANE CLONES FOR YIELD AND QUALITY ATTRIBUTES UNDER SEMI ARID CONDITIONS

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ABSTRACT

The trial on collative performance of various sugarcane varieties was conducted at Sugarcane Research station, Khanpur during the year 2012-13 under the semi arid conditions of southern Punjab. The varieties included in the trial were S2006SP.30, S2006US.272, S2006US.321, S2006US.640, S2006US.641, S2005US.54, S2003US.718 and HSF.240. The results elucidate that the new promising Sugarcane Variety S2006US.272 with average germination (45.42%), best tillering (2.55 per plant), comparable hundred cane weight (99.33 kg) and stand (104.82 thousand/ha),maximum cane yield (104.07 t/ha) and better CCS (12.28%) excelled the tested genomes in sugar production (12.77 t/ha). It was closely followed by the check variety HSF.240. Hence the studies predict that the new variety S2006US.272 with 11.72 and 13.51 % more cane and sugar yield respectively over control is capable of replacing the check variety. A wide scale testing of the promising variety in different agro ecological zones is, however, invited for regional adoptability.

Key Words: Variety, CCS, Millable canes, Cane Yield, Sugar Yield.

INTRODUCTION

Sowing of a single sugarcane variety, though high yielding, on a vast agro climatic zone is always at peril. The evolution of new breeds of insect pests, the sudden outbreak of a disease or exposure to unusual environmental conditions in these areas may culminate to a condition of minimal productivity which may wreak economic havoc in the farming community. Besides the importance of cultural practices, gain in the yields is due to improved varieties. The improvement in sucrose contents from 9.1 to 13.5 percent in Louisiana is through breeding and selection (Broux, 1984). The evolution of sugarcane varieties higher in cane and sugar yield is, therefore, need of the day to improve farmer productivity and sugar mills efficiency. For this purpose a new sugarcane clone SPF-234 was compared by Aslam *et al*., (1998) with BL.4. The former variety on account of better germination and tillering coupled with better cane weight and sufficient stalk density out yielded all the tested varieties by producing an average stripped cane yield of 139.43 t/ha and mean sugar yield of 14.06 t/ha. Memon and Panhwar, 2004 tested ten sugarcane clones and concluded that HOTH.271, HOTH.236, HOTH.234 remained high cane yielder due to greater cane weight and density. In sugar recovery HOTH.2109 and 2119 excelled the tested clones. Malik and Gill, 2005 reported on the basis of yield and quality performance data for three years that five sugarcane clones CPD.01-346, CPD.01-294, CPD.01-319,CPD 01-349 and CPD.01-335 proved superior to the standard check. Soomro *et al*. 2005

conducted a field trial comprising of 15 sugarcane varieties from all ovr the country including Gulabi.95 as standard. Their results revealed that significantly high cane yield of 117.09 t/ha was obtained from variety S96SP.302 followed by LRK.2001,Q.88 and BF.138.The significantly higher CCS of 12.50 % was recorded for S95HS.185 while S86US.340, NSG.311 and Gulabi 95 ranked second ,third and fourth, respectively. Afghan *et al*., (2010) studied the performance of new sugarcane varieties against the standard SPSG.26 and reported that NSG.311 gave significantly high cane yield of 126 t/ha for both plant and ratoon while sugar recovery of 10.45 % and 10.60% for plant and ratoon against standard check which gave a cane yield of 80 and 74 t/ha for plant and ratoon, respectively. The top yielder produced the maximum sugar yield (13 t/ ha) followed by S96SP.302 (11 t/ha). Unar *et al*., (2010) studied the comparative performance of 9 promising sugarcane genotypes with Thatta.10.The cane yield data revealed that HOTH-348 remained at the top with average cane yield of 121.22 t/ha followed by HOTH-2109 and HOTH-349.The genotype HOTH-349 surpassed in CCS%(13.89). Bashar *et al.*, (2011) conducted a comparative study with six sugarcane varieties and reported that variety ISD.32 produced significantly high cane yield (72.39t/ha) followed by ISD.35(64.00 t/ha) and ISD.33 (57.40 t/ha) primarily due to high number of millable canes per hectare. Gujjar *et al*., (2011) obtained maximum average cane yield of 150,131 and 130 t/ha from sugarcane varieties NSG.555, S97US.102 and HOTH-326, respectively. In quality analysis CP.80-1827 remained at the top by producing CCS of 15.30% followed by CP.89-1945 and CP.82-1172 with mean CCS of 14.73 and 14.59%, respectively while the check Thatta-10 produced an average CCS of 14.49%. Nadeem *et al*., (2011) compared quantitative and qualitative performance of sugarcane varieties. They recorded the highest cane yield of 119.50 t/ha from promising sugarcane variety S2001US.375 due to highest millable canes, better tiller formation and comparable germination. It was followed by S2001US.129 and S2001US.395.The top yielder surpassed the tested genotypes in sugar yield by producing 12.79 t/ha. Islam *et al*., (2013) studied the relative performance of 10 sugarcane varieties under water logged stress conditions and concluded that genotype I-231-03 out yielded all the strains in cane and sugar yield. Keeping in view the importance of varietal role in sugarcane production, the present study was undertaken to evaluate the performance of eight promising sugarcane varieties under hot dry climatic conditions of Southern Punjab.

MATERIAL AND METHODS

The present studies regarding the evaluation of elite sugarcane varieties were conducted at the experimental area of Sugarcane Research Station, Khanpur during Kharif 2012-2013. Seven promising sugarcane genotypes namely S2006SP.30, S2006US.272, S2006US.321, S2006US.640, S2006US.641, S2005US.54 and S2003US.718 were compared in yield and quality with the standard HSF.240. The experiment was sown on loamy soil by dry method during the third week of February in trireplicated RCBD arrangement with a net plot size of 3.6 x 10 m and harvested in December 2012.The test factor was allowed to grow under recommended inputs level. The required agronomic operations were performed as and when required. The germination and tillering data were recorded after 45 and 90 days of sowing while millable cane count, cane weight and yield were recorded at harvest. The juice of cane samples was analyzed for brix, pol, purity and CCS was worked out by

the following formula for quality evaluation.

CCS = 3P/2{1-(F + 5)/100}-B/2{1-(F + 3)/100}

Where P = Pol percentage i.e., Sucrose percentage

F = Fibre percentage

B = Brix percentage

The data collected during the study were statistically analyzed using Fisher's Analysis of Variance Technique and significant means were compared using Least Significant Difference (LSD) Test at 5% probability level Steel *et al.*, (1997).

RESULTS AND DISCUSSION

The results regarding the studied physiological and chemical parameters embodied in table 1 along with their statistical interpretation are discussed in the coming lines.

Germination

Germination is the most important phase in the crop husbandry. It directly affects the establishment of final plant stand per unit area. A shy germinating variety will often fall behind in final harvests. The data regarding the germination percentage (Table-1) of tested genomes show significant statistical differences. The highest germination of 47.85 and 47.71 has been recorded for S2006SP.30 and S2006US.640 which were insignificantly fallowed by S2005US.54 and S2006US.272. The lowest germination of 33.96 % has been exhibited by HSF.240. Aslam *et al.*, (1998) and Nadeem *et al.*, (2011) have also reported significant differences among the germination of sugarcane varieties.

Tillers per plant

Tillering potential of a sugarcane variety is undoubtedly one of the most convincing yield promoting characters. A high tiller producing cane variety will make up the deficiency in germination to a large extent and will also give better ratoon. Average number of tillers given out by the tested varieties ranged from 2.55 to 1.70 per plant as is explicit from the data embodied in Table 1. The differences among the genotypic means remained significant. The promising sugarcane clone S2006US.272 surpassed the collated varieties producing 2.55 tillers per plant. It was non significantly followed by HSF.240 and S2006US.321.The most poor tillering has been recorded for S2006US.641. These differences in the production of per plant tillers by the tested varieties may be attributed to the differences in their genetic constitution. Aslam *et al.*, (1998) and Nadeem *et al.*, (2011) also observed significant tillering differences among sugarcane genotypes.

Cane Weight

A sugarcane crop with heavier stalks predicts a high final harvest provided the plant population remains the same. A perusal of the data embodied in table 1 elucidate that the cane weight differences among the tested clones were gorgeous enough to reach a level of statistical significance. On an average the hundred cane weight varied from 78.33 to 100.67 kg. The genotypes S2006US.321 and S2006US.272 produced matchingly heaviest canes followed by S2006SP.30 and S2003US.718 which remained at par with each other. The minimum 100-cane weight of 78.33 kg has been recorded for S2006US.640.These results are in line to those of Aslam *et al.*, (1998) and Nadeem *et al.*, (2011) who have also reported significant varietal difference in individual cane weight.

Cane Density

Plant Population per unit area is a direct measure of final cane yield provided the individual cane weight remains the same. The final cane stand is the interaction of germination, tillering and tiller mortality. The data regarding the millable cane stand established by the tested genotypes presented

in table-1 explicate significant varietal differences in this regard. The variety S2006US.640 surpassed the tested genomes by producing 107.32 thousand millable canes per hectare which was non significantly followed by HSF.240 and S2006US.272 with 105.46 and 104.82 thousand cane stalks per hectare. The poor most final cane count of 89.54 thousand per hectare has been recorded for S2006US.641 preceded by S2006US.321 and S2006SP.30 which were, however, at par with one other. These differences in the final cane stand of tested varieties may be attributed to the differences in the germination and tillering. Aslam *et al*., (1998), Memon and Panhwar, 2004, Bashar *et al.*, (2011) and Nadeem *et al*., (2011) have also recorded varied plant densities for sugarcane genotypes in their studies.

Stripped Cane Yield

The sole target of a sugarcane grower is to achieve the highest yield potential of a cane variety which is the outcome of the genetic potential of variety, the environmental factor and the management practices in combination. The number and size of millable canes per unit play a dominant role in determining the final cane yield. The data set out in table 1 evince that the promising sugarcane variety S2006US.272 magnificently out yielded the tested clones with a stripped cane yield of 104.07 t/ha. None of the varieties could compete it significantly .It was followed by HSF.240 and S2006US.321 which produced 93.15 and 91.98 tonnes stripped canes per hectare, respectively. The latter two were, however, at par with each other. The lowest cane yielder in the present study was S2006US.641 which produced 74.61 t/ha. It was preceded by S2006US.640. The highest cane yield produced by S2006US.272 may be attributed to the good germination, highest tillering, matchingly heaviest canes and the comparable cane density of promising variety. Measurable cane yield differences among sugarcane varieties have also been reported by Aslam *et al*., (1998), Memon and Panhwar, 2004, Afghan *et al*., (2010), Bashar *et al* ., (2011), Nadeem *et al*., (2011) and Islam *et al*., (2013).

Commercial Cane Sugar (CCS)

CCS is the amount of actual sugar contents of a sugarcane variety and refers to the quality of cane. CCS of a variety holds prime importance as sugarcane is basically sown for sugar in our country. The data summarized in table 1 depict that the highest CCS of 12.35 % has been recorded for S2006US.54 which was closely followed by S2006US.272 and S2006US.718 with 12.28 and 12.35% CCS, respectively. These differences in CCS may be attributed to the genetic make up of the tested varieties. These results are in harmony with those elucidated by Aslam *et al*., (1998), Memon and Panhwar, 2004, Afghan *et al*., (2010), Bashar *et al* ., (2011), Nadeem *et al*., (2011) and Islam *et al*., (2013).

Sugar Yield

The pivotal aim of all the research efforts being carried out on sugarcane is to improve the sugar yield per unit area which is the product of stripped cane yield and corresponding CCS. A perusal of the comparative data given in table 1 evince that only one sugarcane variety S2006US.272 crossed the check variety HSF-240 in sugar yield by producing 12.77 t/ha sugar against 11.25 t/ha of the check. The higher sugar yield produced by S2006US.272 is primarily due to its maximum cane yield and good CCS (12.28 %) in the present study. The differences among the cane varieties in the production of sugar per unit area has also been recorded by Aslam *et al*., (1998), Memon and Panhwar, 2004, Afghan *et al*., (2010), Bashar *et al* ., (2011), Nadeem *et al*., (2011) and Islam *et al*., (2013).

Table.1 Biometric Traits of Elite Sugarcane Clones Under Semi Arid Conditions

Sr. No	Variety	Germination	Tillers/ Plant	100-Cane Weight (Kg)	Cane Density 000/ha	Cane yield t/ha	CCS%	Sugar Yield t/ha
1	S2006SP.30	47.85a	1.95bc	90.33b	93.85c	84.77c	11.89	**10.07bc**
2	S2006US.272	45.42ab	2.55a	99.33a	104.82ab	104.07a	12.28	**12.77a**
3	S2006US.321	38.54bcd	2.32ab	100.67a	91.37c	91.98b	11.89	**10.94ab**
4	S2006US.640	47.71a	2.11abc	78.33f	107.32a	83.98c	12.33	**10.35b**
5	S2006US.641	35.82cd	1.70c	83.33d	89.54c	74.61d	11.23	**8.37c**
6	S2005US.54	46.95ab	1.84bc	86.67cd	104.07ab	90.09b	12.35	**11.12ab**
7	S2003US.718	42.71abc	2.31ab	89.67bc	101.48b	91.02b	12.23	**11.13ab**
8	HSF.240	33.96d	2.48a	88.33bc	105.46ab	93.15b	12.08	**11.25ab**
	LSD	**8.67**	**0.48**	**3.45**	**4.81**	**4.07**	**N.S**	**1.94**

Values with different letter(s) differ significantly (P=0.05)

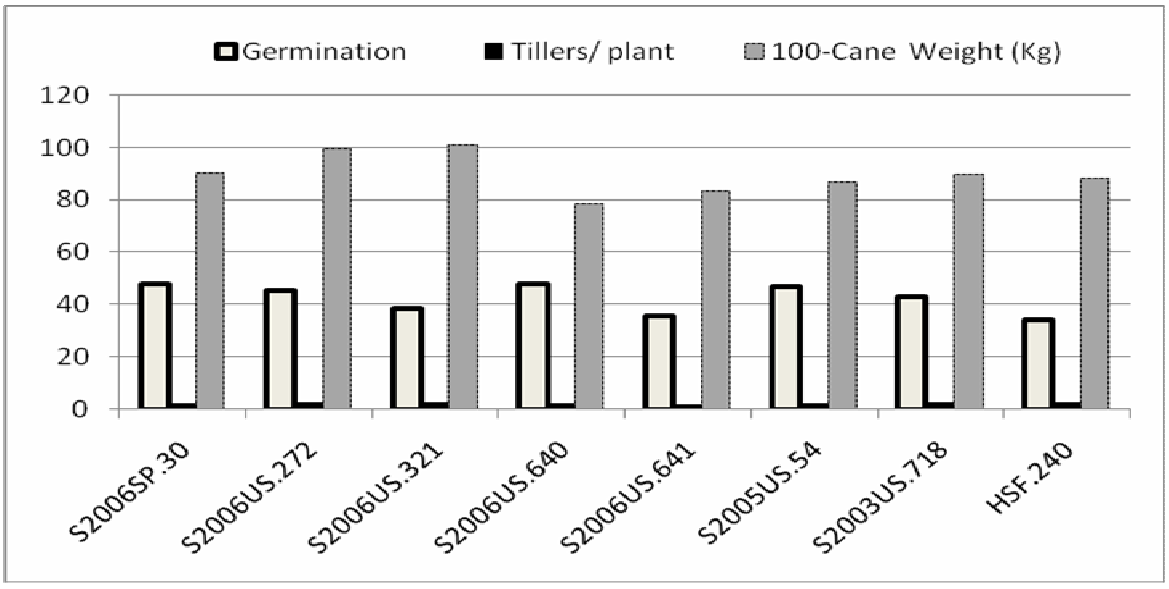

Fig 1: Germination, Tillering and cane weight of different cane Varieties

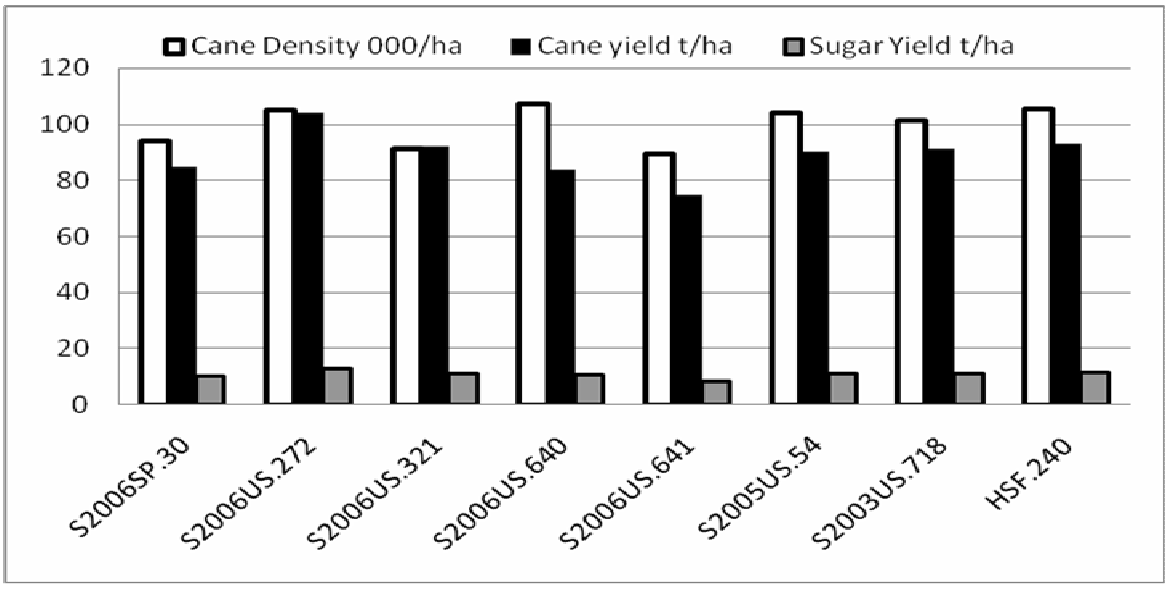

Fig 2: Cane density, Cane yield and Sugar yield of different cane Varieties

LITERATURE CITED

1. Afghan,S., Z.Hussnain, K.Hussain, A.Shahzad, K.Ali, A.Naheed, S.Rizwana, P.Khanum and A.Batool.2010. Comparison of quantitative and qualitative traits of sugarcane (*Saccharum Officinarum* L.) genotypes.Pak.Sug.J.,25(1):11-13.

2. Aslam,M., M.A.Javed and K.B.Malik.1998.Comparative performance of a promising cane variety SPF-234 in southern punjab.Pak.Sug.J.,13(2): 5-10.

3. Bashar,M.K., M.S.Rahman, M.M.Hossain and T.Ahmed.2011.Varietal suitability assessment under rainfed conditions in high barind tract of Bangladesh.Pak.Sug.J.,26(02):6-9.

4. Broux,R.D.1984. Breeding to enhance sucrose contents in Louisiana. Field crop Research, 9:59-67.

5. Gujar,N., M.Y.Arain, R.N.Panhwar, S.Junejo and I.B.Bhatti.2011.Competetive study of some new candidate sugarcane varieties in respect of cane yield and quality under agro-climatic conditions of Thatta. Pak.Sug.J.,26(03):15-20.

6. Islam,M.S., M.K.Bejun, M.R.Alam and M.S.Arefin.2013.Evaluation of some qualititative and quantitative characters of ten sugarcane genotypes under water logging stress conditions. Pak.Sug.J.,28(01):10-15.

7. Malik,K.B.and A.Gill.2005.DFSRI steps in the evolution of high sugar yielding varieties for Sindh province. Proc.40th Ann. Conv. Pak.Soci.Sug.Tech.5-7th ,Sep.PP.142-53.

8. Memon,Y.M.and R.N.Panhwar.2004.Evaluation of elite sugarcane clones in 4th selection cycle for yield and quality attributes under Thatta conditions. Proc.39th Ann. Conv. Pak.Soci.Sug.Tech. 27-29th, Sep.PP.93-99.

9. Nadeem,M.A., M.A.Sarwar, A.Ghaffar F.Ahmad and F.Hussain.2011.Studies on the performance of some sugarcane genotypes at Faisalabad. Pak.Sug.J., 26(01):16-21.

10. Soomro,N.A.,F.M.Baloch,G.S.Tunio,M.U.Usmanikhail and L.M.Baloch.2005.Evaluation of growth and yield performance of different sugarcane varieties developed under different ecological zones of Pakistan. Pak.Soci.Sug.Tech.5-7th, Sep.PP.131-36.

11. Steel, R. G. D., J. H. Torrie D. A. Dicky. 1997. Principles and Procedures of statistics A Biometrical Approach 3rd ed. McGraw Hill Book Co., Singapore: 204-227.

12. Unar,G.S., R.N.Panhwar, D.B.Panhwar, M.Chohan, N.Gujjar, i.B.Bhatti and Q.A.Keerio.2010.Comparative performance of autumn planted promising sugarcane genotypes under Thatta conditions. Pak.Sug.J.,25(03):15-21