COMPARATIVE STUDY OF SOME SUGARCANE STRAINS IN RELATION TO YIELD AND QUALITY

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ABSTRACT

A field trail was conducted during 2005-06 with the objectives to evaluate suitability and adoptability potential along with comparing yield and quality triats of fourteen sugarcane strains viz; S2000-SP-203, S2000-US-722, S2001-US-62, S2001-US-71, S2001-US-104, S2001-US-400, S2002-US-36, S2002-US-89, S2002-US-109, S2002-US-114, S2002-US-118, S2002-US-140, SPF-213 (standard) and HSF-240 (standard). All strains varied significantly from each other. Statistically significant and tabulated data showed maximum values of germination (51.27%) and CCS (13.35%) in S2000-US-203, tillers per plant (1.74) and number of millable canes (109.38 000/ha) in S2001-US-400, cane yield (96.53 t/ha) and sugar yield (11.16 t/ha) in S2000-SP-722 respectively when these strains were compared with early maturing as well as medium and late maturing standards.

Keywords: Sugarcane, strains, germination, cane yield, sugar yield and CCS.

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) is a major cash crop of Pakistan and there is no need to emphasize its importance in the agrarian economics of country because of its higher value as a cash crop, a major source of gur, shakkar and white sugar and as a raw material for various agro based industries (Atta *et al.*, 1991). In Pakistan, the cane area under cultivation along with its production is decreasing with the course of time as it was cultivated on an area of 966.4 thousand hectares with an annual production of 47244.1 thousand tons in 2004-2005 while during 2005-2006 the area under cultivation and production was 907.3 thousand hectares and 44665.5 thousand tons respectively (GOP, 2006). Inspite of introduction of many high yielding cultivars in past, the cane yield per hectare did not increases to a desirable level, because of their unstable production behavior, which deteriorate rapidly with the course of time (Ahmad *et al.,* 1996). Similarly sugarcane varieties run out after a certain period of time because of pathogenic attacks or change in the environment. So it is essential to maintain a constant flow of fresh varieties in the fields (Khan *et al.,* 1990). In the same way one of the major causes of our low yields is the short growing season comprising of nine to twelve months as compare to other countries containing fifteen to twenty two months (Mahmood and Nazir, 1987). Thus sugarcane production could never be improved until and unless the promising varieties are adopted on large scale (Glaz, 2000). Some of the research work done in the past regarding study is reviewed in the coming lines. Rao *et al.,* (1992) selected an early maturing variety CoA 89085 (85 A 261) with sucrose% (19.43), CCS% (14.1) and sugar yield (15.68 t/ha) showing resistance to all strains of red rot. More *et al.,* (1993) compared eight cane cultivars with respect to different physical and chemical parameters and found Co 8325 as best because it produced highest cane yield (105 t/ha), ratoon yield (83 t/ha) and sugar yield (14.6 t/ha) as compare to other cultivars. Rajeseharam *et al.,* (1992) tested three varieties CoC. 90063, CoC, 91061 and CoC. 92061 against CoC.671 and found them superior for cane and sugar yield in plant as well as ratoon crop.

Glaze *et al.*, (2000) pointed out that clonal selection at the pre-commercial stages helped to identify the improved genotypes for commercial production of sugarcane. Similarly Chockalingam and Balusamy (1989) noted cane yield (48.8 t/ha) and sugar yield (12.5 t/ha) in cultivar CoC. 771 while comprising eight varieties for similar traits.
The reported study was conducted to evaluate the different agronomic traits of sugarcane strains during selection process at Faisalabad.

MATERIALS AND METHODS

An experiment containing fourteen sugarcane strains was planned at Sugarcane Research Institute Faisalabad during 2005-2006 in RCBD arrangement where each treatment (strain) was replicated thrice. The crop was sown by deep trench method during spring season and harvested in the spring next year. The fertilizers were applied@168-112-112 kg ha^{-1} NPK to the crop sown@70, 000 DBS/ha seed rate. Ametryn and Atrazine was used @ 2.50 litre ha^{-1} to control weeds after first irrigation while earthing up was done 90 days after sowing. All the potash and phosphatic fertilizers were applied at sowing while Urea was applied in three splits i.e. 0,45,90 days after sowing. The following yield and quality parameters were recorded:

1- Germination (%)
2- Tillers per plant
3- Number of millable canes (000 /ha)
4- Cane yield (t/ha)
5- Sugar yield (t/ha)
6- Commercial cane sugar (%)

Where germination and tillering were recorded after 45 and 90 days of sowing while data regarding number of millable canes, cane yield and sugar yield were taken at harvest. Compound samples of each strain were analyzed according to procedures described by Spencer and Meade (1963) on monthly basis so it was not subjected to statistical analysis. However, the means relating germination, tillers per plant, cane yield, number of millable canes and sugar yield were compared at probability levels 5% as mentioned by Steel and Torrie (1980).

RESULTS AND DISCUSSION

The results along with their statistical interpretations, given in tables are discussed in coming lines, under following headings.

Germination:

It is considered the most critical physiological phase, as without it there is no plant. The data given in table indicated that differences in strains were significant for germination. Higher germination percentage, as compare to standard HSF-240, was produced by S2001-US-104, S2000-US-203, S2002-US-109, S2000-SP-722, S2001-US-400, S2001-US-71, S2002-US-114, and S2001-US-62 with 56.56%, 51.27%, 50.40%, 44.12%, 44.01%, 42.03%, 37.87% and 36.89% respectively. But no strain could show higher number of germinant as compare to second standard strain SPF-213 (58.70%). Similarly the lowest germination (27.33%) was noticed in 2002-US-36. The results are also in conformity with those reported by Chang (1999).

Tillers per plant:
The extent and nature of tillering is largely a varietal character. The data presented in table indicated that high tillering compensated relatively poor germination but better germination reduced tillering. The data also showed that differences among different cane stains were significant. Five strains (S2001-US-400, S2002-US-36, S2000-SP-722, S2001-US-104 and S2002-US-118), crossed early maturing standard HSF-240, by producing 1.74, 1.71, 1.71, 1.70 and 1.69 number of tillers per plant. These five strains were also statistically at par with HSF-240. In the same way six strains, which produced higher number of tillers per plant as 1.74, 1.71, 1.71, 1.70, 1.69 and 1.61, were S2001-US-400, S2002-US-36, S2000-SP-722, S2001-US-104, S2002-US-118 and S2002-US-114 as compare to the standard SPF-213 (1.59). The minimum number of tiller per plant (0.75) was observed in S2000-US-203. Variation in the tillers per plant produced by different strains was probably due to their inherent character. The results are in accordance with those reported by Jayamani (1992).

Number of millable canes:
It is the interaction of germination, tillering, resistance against insect pest and disease attack. A perusal of data given in table indicated that statistically significant number of millable canes was noted in all strains. While considering HSF-240 as standard, seven strains produced higher number of millable canes, which were S2001-US-400 (109.38 000/ha), S2000-SP-722 (107.55 000/ha), S2001-US-104 (102.17 000/ha), S2001-US-71 (101.39 000/ha), S2002-US-109 (97.31 000/ha), S2002-US-36 (96.53 000/ha) and S2002-US-118 (94.79 000/ha) respectively. However one strain succeeded to show higher cane count than SPF-213, which was S2001-US-400 (109.38 000/ha). Singh *et al.,* (1993) noticed the similar findings.

Cane yield:
It is the most desirable characteristic from farmer's point of view. Cane yield is the product of genetic potential of a variety and environmental conditions through agronomic management. The yield data revealed that the differences among strains under test were significant. Only one strain (S2000-SP-722) yielded higher canes (96.53 t/ha), that was also the maximum yield is this study, as compare to the medium and late maturing standard SPF-213 (90.32 t/ha). However three strains S2000-SP-722, S2001-US-104 and S2001-US-400 showed higher yields (96.53, 91.18 and 89.24 t/ha) as compare to the early maturing standard HSF-240 (80.90 t/ha). The strain S2002-US-89 yielded the minimum canes (31.94 t/ha) in this study. The results reported by Parameswar *et al.,* (1995) are in accordance with the present explanations.

CCS:
The real cane quality is reflected by its CCS% as it stands the factor of prime importance both for millers and breeders. A perusal of data indicated variable CCS for all strains under study. If HSF-240 was considered as standard, then eight strains S2002-US-203, S2002-US-140, S2002-US-118, S2002-US-36, S2002-US-109, S2001-US-71, S2002-US-114 and S2002-US-89 showed higher CCS% as 13.35%, 13.27%, 12.71%, 12.63%, 12.34%, 12.29%, 12.11% and 11.99% respectively. Similarly ten strains including the previous eight strains compared with HSF-240 produced higher CCS% than medium and late maturing standard SPF-213 (11.23). These were S2000-SP-722 and S2001-US-104. However, S2001-US-62 ranked lowest with respect to CCS% (10.56%) in this study. Highly variable CCS% among different cane cultivars has been recorded by Mcintyre *et al.,* (1994).

Sugar yield:
It is the function of cane yield and corresponding recoverable sugar percentage. While considering early maturing standard HSF-240, five strains out of twelve gave higher sugar yield, which were S2000-SP-722 (11.16 t/ha), S2001-US-71 (10.50 t/ha) S2001-US-104 (10.32 t/ha), S2002-US-36 (10.09 t/ha) and S2001-US-400 (9.73 t/ha) respectively. However two strains namely S2000-SP-722 and S2001-US-71 produced higher sugar yield as 11.16 t/ha and 10.50 t/ha when all strains were compared with medium and late maturing standard SPF-213. Variable sugar yield for different strains was also observed by Sharar *et al.,* (1995).

REFERENCES

1. Ahmad, N., M.S. Nazir, M.Saeed and A. Ghaffar. 1996. Differential decline in biological potential of some diverse sugarcane genotypes. Pak. Sugar J. 11 (4): 9-12.
2. Atta, M., H. Mahmood, K.H. Hussaini and K.B. Malik. 1991. Evaluation of new sugarcane varieties under Faisalabad conditions. (1987-89). Pak. Sugar J.5 (2): 1-4.
3. Chang, Y.S. 1999. ROC25-a very early maturing variety with high sucrose and stable high yielding performance. Taiwan sugar. 46(4): 4-6. [Field Crops Absts, 53 (15), 2000]
4. Chockalingam, S and M.Balusamy. 1989. Yield potential and quality of some promising sugarcane varieties under gudiyatham conditions. Bharatiya Sugar.14 (10): 65-67.
5. Glaz, B. 2000. Sugarcane variety cansus: Florida. Sugar Y. Azucar. pp-23.
6. Glaze, B., J.C. Comstock, P.Y.T. Tai, J.D.Miller, J.S. Brown and L. Z. Long. 2000. Evaluation of new canal point sugar clones (1999-2000). Harvest season USDA Agric. Res. Service, ARSI57. pp-28.
7. Government of Pakistan. 2006. Agricultural statistics of Pakistan. Ministry of Food, Agriculture and Livestock (Economic wing).
8. Jayamani, R. 1992. In the pursuit for an alternative to CoC 671. SISSTA Sugar J.18 (4): 57-59. [Field Crop Absts, 47(7), 1994]
9. Khan, G.S., G. Rehman and A. Qayum. 1990. Release of two early maturing sugarcane varieties for Peshawar valley. Pak. Sugar J. IV (3): 11-15.
10. Mahmood, T. and M.S. Nazir. 1987. Cane yield and quality of autumn sugarcane as influenced by different planting dates. J. Agric. Res. 25(4): 331-334.
11. Mcintyre, R.K., N.G. Inman-Bamber and K.J. Nuss. 1994. An evaluation of the performance of variety N21 in field trials. Proc. of the Annual Congress S. African Sug. Tech. Association. No. 68, 28-30. [Field Crop Absts, 49(2), 1996]
12. More, N.B., J.P. Patil, S.S. Wandre and A.B. Hasabnis. 1993. Comparative study of some sugarcane varieties in relation to yield and quality. Indian Sugar. 43 (9): 695-698.
13. Parameswar, N.S., T.A.S. Setty and M.R. Krishnappa. 1995. Performance of Co-7804 sugar rich cane for coastal zone of Karnataka. Environment and Ecology. 13(2) 477-478. [Field Crop Absts, 48(11), 1995]
14. Rao. J.V.R.B., K.P. Rao, V.R. Rao, J.P. Rao and T.K.V.V.M. Rao. 1992. An early maturing, high sugared and high yielding sugarcane variety, CoA89085 (85A261)- a boon to cane growers and sugar industry in Andhra Pradesh. Indian Sugar. 41(12) 909-911. [Field Crop Absts, 46(12), 1993]
15. Rajesekaram, S., M. Achuthan, A. Sathyavelu and B.J. Pandian. 1992. Recent sugarcane varieties as substitute for CoC.671. SISSTA Sugar J. 19(2): 53-55. [Field Crop Absts, 46(12), 1993]
16. Sharar, M.S., S. Afghan and P. Iqbal. 1995. Comparative growth and yield performance of autumn planted varieties of sugarcane (*Saccharum officinarum* L.). Pak. Sugar J. 9(2): 7-10.

17. Singh, S., M.M. S. Saxena, P.S. Verma and R. Singh. 1993. CoS91269-a Promising variety for U.P. Indian Sugar. 43(2): 115-117.
18. Spencer, E.F. And G.P. Meade. 1963. Cane Sugar Hand Book. John Willey and sons. 9th edition, New York, U.S.A.
19. Steel, A.D. and J.H. Torrie. 1980. Principles and procedures of statistics. Mc. Graw Hill Book Co. New York, U.S.A.

Table: Qualitative and quantitative characteristics of some sugarcane strains

Sr.#	Strains	Germination (%)	Tillers per plant	Number of millable canes (000/ha)	Cane yield (t/ha)	CCS (%)	Sugar yield (t/ha)
1.	S2000-US-203	51.27ab	0.75f	66.66e	43.06f	13.35	5.75g
2.	S2000-SP-722	44.12bcd	1.71ab	107.55ab	96.53a	11.56	11.16a
3.	S2001-US-62	36.89def	1.20cdef	47.92fg	56.25e	10.56	5.94fg
4.	S2001-US-71	42.03cde	1.25bcde	101.39abc	85.41b	12.29	10.50ab
5.	S2001-US-104	56.56a	1.70ab	102.17abc	91.18ab	11.32	10.32a
6.	S2001-US-400	44.01bcd	1.74a	109.38a	89.24ab	10.90	9.73ab
7.	S2002-US-36	27.33g	1.71ab	96.53c	79.86bc	12.63	10.09ab
8.	S2002-US-89	35.73ef	0.95def	38.19g	31.94g	11.99	3.83h
9.	S2002-US-109	50.40b	1.38abcd	97.31bc	66.84d	12.34	8.25cde
10.	S2002-US-114	37.87def	1.61abc	72.22de	64.24de	12.11	7.78e
11.	S2002-US-118	35.42ef	1.69ab	94.79c	73.26cd	12.71	9.31bcd
12.	S2002-US-140	32.96fg	0.81ef	51.74f	54.86e	13.27	7.28ef
13.	SPF-213 (std)	58.70a	1.59abc	108.25a	90.32ab	11.23	10.14ab
14.	HSF-240 (std)	36.15ef	1.66abc	79.95d	80.90bc	11.82	9.56bc
LSD at 0.05		**7.771**	**0.4747**	**10.83**	**10.50**	**-**	**1.45**

Std. = Standard