RELATIVE CANE YIELD AND QUALITY APPRAISAL OF DIVERGENT SUGARCANE CLONES IN 4TH CYCLE UNDER THATTA CLIMATIC CONDITIONS

By

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ABSTRACT

The experiment was conducted at National Sugar Crops Research Institute; farm Thatta to investigate the cane yield and quality performance of thirteen sugarcane clones in 4th cycle during 2003-04. The experiment was laid out under randomized complete block design with three replications. Thirteen sugarcane clones viz. HoTh-301, HoTh-307, HoTh-309, HoTh-313, HoTh-316, HoTh-318, HoTh-325, HoTh-332, HoTh-334, HoTh-337, HoTh-340, HoTh-344, HoTh-349 along with Thatta-10 as check were planted in plant crop during October 2003. The results showed that there were highly significant differences amongst the clones for the traits under study. Six sugarcane clones HoTh-318, HoTh-316, HoTh-307, HoTh-344, HoTh-349 and HoTh-332 gave out standing performance by producing highest average cane yield of 119.26, 118.0, 117.68, 116.38, 114.95 and 114.81 t/ha respectively against the check variety Thatta-10 (114.0 t/ha). While, in case of sugar yield the clones HoTh-318, HoTh-307, HoTh-316, HoTh-344, HoTh-349 and HoTh-332 remained superior by producing maximum sugar yield of 15.46, 15.16, 15.13, 15.01, 14.77 and 14.50 t/ha respectively against the check variety Thatta-10, which gave sugar yield of 14.19 t/ha. Contrary to this, the other clones in the trial could not exceed check variety in terms of cane and sugar yield. Thus on account of maximum cane and sugar yield the clones HoTh-307, HoTh-316, HoTh-318, HoTh-332, HoTh-344 and HoTh-349 were advanced to next selection stage for further progression and testing.

INTRODUCTION

Sugarcane (*Saccharum officinarum* , L.) bears a great impact on the economic uplift of the growers. It provides raw material to the sugar industry for the manufacture of sugar and many other by –products and play a distinct role in the economy of Pakistan. Survival of sugarcane industry in Pakistan is at the mercy of sugarcane cultivation. Therefore, evolution of sugarcane varieties higher in cane and sugar yield is need of the time for improving the efficiency of sugar mills. It is generally recognized that sugarcane has a relatively a high average production efficiency, there being limited potential for increasing yields in response to increased agronomic inputs such as irrigation, fertilization and pest controls. Therefore, investment in breeding effort remains the best approach for maximizing cane and sugar productivity in the long run.

Improvement of sugarcane through genetic manipulation has been a direct, on going process following observation that sugarcane produced viable seed. Sugarcane hybrid fuzz is obtained from the flowering parents through planned crosses between parent varieties by conventional breeding methods. Sugarcane is hard to flower under natural environment until some specific temperature; humidity and

photoperiod requirements are fulfilled. Many sugarcane varieties flower and produce viable seed up to 20^0 N or S latitude, where photo thermal environment is favourable. In Pakistan, photo thermal climate is favourable in coastal areas, where many sugarcane varieties flower but only few produce viable fuzz (Keerio and Memon 2004). This potential can be utilized with the provision of artificial photo thermal conditions where synchronized flowering in desired varieties can be induced to run a systemic cross breeding program in Pakistan.

The varietal development program at National Sugar Crops Research Institute, Thatta is being carried out through locally collected fuzz (wind pollinated) and exotic fuzz (artificially crossed), received from different foreign breeding stations. New seedlings of sugarcane are produced from the fuzz. Subsequent selection of the seedlings (clones) is done in different selection stages. After careful examination of these clones in several tests, high cane and sugar yielding ones having resistance to insect pest and disease are selected and issued for commercial cultivation.

According to Glaz, *et al.,* (2000) clonal selection at pre commercial stages helps in the identification of improved genotypes for commercial production of sugarcane. Careful selection of the clones in early stages may lead to the development of superior varieties (Panhwar *et al.*,2003). Balagtas and Laptian (1983) studied 24 foreign clones and stated that the Chinese clone F-148 and Coimbatore variety Co-449 gave better performance over the check. Poltronieri *et al,.* (1982), reported that clones B-4362, CP 49-260 and Co-1007 gave highest stripped cane yields of 175.5,174.8 and 170.3 t/ha compared a new clone CoS-776 with Co-1158. The former did better in respect of tillering, cane formation, ratoonability and juice quality but the differences in cane yield were not significant. Javed, *et al.,* (2001) reported that clone AEC 82-1026 produced significantly higher cane and sugar yield than commercial varieties BL-4 and L-116 under agro-climatic condition of Tando Jam. The other two clones AEC 86-328 and AEC 86-329 were superior to all entries in quality traits. Similarly Khan, *et al.*,(2002) evaluated two sugarcane clones AEC 81-8415 and AEC 80-2046 along with 4 commercial varieties viz. BL-4, PR-1000, BF-129 and L-116 at three location in the province of Sindh and reported that clone AEC 81-8415 was superior to all entries except BL-4 for cane and sugar yield but at par with them in CCS%.

The productive behavior of old sugarcane varieties is deteriorating with the passage of time. Therefore constant replacement of old varieties with new one's is need of the time. Keeping in view this objective present study was conducted to find out the potential sugarcane clones to release them as new commercial varieties in future.

MATERIALS AND METHODS

Large number s of seedling was grown in nursery from exotic fuzz of USA origin. These seedlings (clones) were shifted the main field and year wise tested in several selection stage by rejecting undesirable clones, selections in the course of screenings were as follows:

Year	Selection stage	Clones tested
1999-2000	Single clone trial	1765
2000-2001	First cycle	1624
2001-2002	Second cycle	527
2002-2003	Third cycle	138
2003-2004	Fourth cycle	13

The study was conducted at National Sugar Crops Research Institute, farm, Thatta. Thirteen sugarcane clones viz. HoTh-301, HoTh-307, HoTh-309, HoTh-313, HoTh-316, HoTh-318, HoTh-325, HoTh-332, HoTh-334, HoTh-337, HoTh-340, HoTh-344, HoTh-349 along with Thatta-10 as check were planted in

October 2003 by overlapping method using two budded sets. Plot size was 18 m^2; three rows of each genotype in six meters long furrows at one- meter row spacing were sown. The crop was fertilized @ 275-112-175 Kg NPK t/ha. All P, K and 1/3 N was applied at the time of sowing while remaining 2/3 N was applied in two equal splits, first at the completion of germination and second at the time of earthling up. Uniform management and cultural operations, insect pest and disease control measures were adopted at appropriate stage. The data observations pertaining to cane yield and its parameters, commercial cane sugar percentage (CCS%) and sugar yield were recorded and was subjected to statistical analysis using MSTAT-C statistical programme (MSTAT-C Manual, 1991).

RESULTS AND DISCUSSION

Analysis of variance reveals that highly significant differences were existed among the sugarcane clones for cane yield and yield components (table-1). The results regarding mean performance of different sugarcane clones for quantitative parameters are presented in table-2, which reveals that maximum average cane thickness was observed in clone HoTh-307 (26.0 mm) closely followed by HoTh-332 (25.93 mm), HoTh-344 (25.90 mm) and HoTh-301 (25.86 mm). While, minimum average cane thickness was exhibited in HoTh-340 (21.80 mm) followed by HoTh-334 (23.49 mm) and HoTh-325 (23.96 mm) against check variety Thatta-10 (25.56 mm). As regards the number of internodes per plant, the clone HoTh-318 was at top with 26.69 average internodes/plant followed by HoTh-340, HoTh-332, and HoTh-316, which produced 24.66, 24.33 and 24.18 average number of internodes/plant respectively. Highest average cane height was observed in clone HoTh-340 (207.49 cm), which was closely followed by HoTh-316 (206.10 cm) and HoTh-307 (202.49 cm) and the lowest average cane height was recorded in clone HoTh-334 (148.66 cm), HoTh-301 (155.33 cm) and HoTh-337 (155.66 cm) against the check variety Thatta-10 (200.33 cm). The variable cane height of the clones may be attributed to their variable inherent growth and development potential. A perusal of data in table-2 indicates that average millable canes were highest in HoTh-340 (166.66 canes 000/ha) followed by HoTh-325 and HoTh-301, which produced 133.33 and 123.33 millable canes thousand /ha respectively. While, the clones HoTh-316, HoTh-332 and HoTh-349 were at par by producing 113.33 millable canes thousand/ha. In contrast, the clones like HoTh-337, HoTh-334, HoTh-313 and HoTh-309 produced minimum 83.33, 86.66, 90.00 and 93.33 average millable canes thousand/ha respectively against the check variety Thatta-10 (110.00 canes 000/ha). The differences in number of millable canes among the clones might be due to their variable inherent tillering potential. The data in table-2 further reveals that all the clones in the trial showed varying trend of effectiveness for cane yield. Highest average cane yield was recorded in clones HoTh-318 (119.26 t/ha) followed by HoTh-316 (118.0 t/ha), HoTh-307 (117.68 t/ha), HoTh-344 (116.38 t/ha), HoTh-349 (114.95 t/ha) and HoTh-332 (114.81 t/ha) against the check variety Thatta (114.0 t/ha). On the contrary, the clones HoTh-309 and HoTh-337 were at par and produced minimum average cane yield of 65.0 t/ha followed by HoTh-334 (67.50 t/ha) and HoTh-313 (72.50 t/ha). It is well known that sugarcane varieties are greatly affected by genetic make up (Geddway, *et al.,* 2002). The variation in cane yields and yield components among the varieties may be attributed due to their differences in genetic make up (Verghese *et al.*, 1985; Mali and Singh, 1995). Nazir, *et al,* (1997) reported that higher cane yield is the function of high potential variety. Khan *et al,* (2002) reported that increase in cane yield might be due to

maximum plant height, weight per stool and cane girth.

Month wise quality analysis data is present in table-3, which reveals that maximum mean CCS of 12.97% was recorded from HoTh-318 closely followed by HoTh-344, HoTh-307, HoTh-349, HoTh-316 and HoTh-332 which produced mean CCS of 12.90, 12.89, 12.85, 12.83 and 12.63% respectively against the check variety Thatta-10 (12.45% CCS). While rest of the clones in the trial produced mean CCS% less than that of check variety Thatta-10. Maximum sugar content in the clones might be due to their inherent genetic potential of the parent material. Khan *et al*., (2003) and Memon *et al.*, (2004) in their studies reported variable behavior among newly developed Thatta varieties for cane yield and yield components.

Sugar yield data presented in table-3 reveals that the clones HoTh-318, HoTh-307, HoTh-316 and HoTh-344 were on top by producing maximum sugar yield of 15.46, 15.16, 15.13 and 15.01 t/ha respectively. Moreover, the clones HoTh-349 and HoTh-332 displayed next good performance by producing sugar yield of 14.77 and 14.50 t/ha respectively against the check variety Thatta-10, which produced sugar yield of 14.19 t/ha. In contrast, the other clones like HoTh-309, HoTh-313, HoTh-334 and HoTh-337 exhibited minimum results in terms of sugar yield against the check. The highest sugar yield in clones may be attributed to relatively more average cane yield and subsequent recoverable sugar percentage.

Table-1 Mean square values and their significance from analysis of variance for cane yield and yield components of different sugarcane clones during 2003-04

Source of variation	df	Cane thickness	Cane height	Internodes /plant	Millable canes 000/ha	Cane yield
Replication	2	0.005	11.174	125.625	92.857	103.595
Factor A	13	4.549**	25.720**	1049.00**	1378.755**	1435.172**
Error	26	1.166	2.069	221.663	51.832	21.749

Table-2 Performance of different sugarcane clones for cane yield and yield contributing traits in 4th cycle at NSCRI, farm Thatta during 2003-04

Genotypes	Cane thick-ness (mm)	Cane ht. (cm)	Internodes/ Plant	Millable canes 000/ha	Cane Yield (t/ha)
HoTh-301	25.86	155.33	19.83	123.33	95.00
HoTh-307	26.00	202.49	23.31	116.66	117.68
HoTh-309	24.60	184.63	21.58	93.33	65.00
HoTh-313	24.80	172.83	17.99	90.00	72.50
HoTh-316	25.10	206.10	24.18	113.33	118.00
HoTh-318	25.37	212.42	26.69	120.00	119.26
HoTh-325	23.96	182.66	22.16	133.33	92.50
HoTh-332	25.93	199.94	24.33	113.33	114.81
HoTh-334	23.49	148.66	19.16	86.66	67.50
HoTh-337	25.22	155.66	20.50	83.33	65.00
HoTh-340	21.80	207.49	24.66	166.66	97.50
HoTh-344	25.90	200.16	23.70	116.66	116.38
HoTh-349	25.60	192.00	23.25	113.33	114.95
Thatta-10	25.56	200.33	23.92	110.00	114.00
CV%	4.43	8.33	6.60	6.38	4.78
LSD 0.5%	1.81	24.99	2.41	12.08	7.82
LSD 0.1%	2.45	33.78	3.26	16.33	10.58

Table-3 Quality performance of different sugarcane clones in 4th cycle At NSCRI, Farm Thatta during 2003-04

Genotypes	Month wise Commercial Cane Sugar Percent (CCS%)			Mean CCS %	Sugar Yield (t/ha)
	October	November	December		
HoTh-301	11.43	11.59	11.86	11.62	11.03
HoTh-307	12.68	12.82	13.17	12.89	15.16
HoTh-309	11.39	11.56	11.85	11.60	7.54
HoTh-313	11.26	11.47	11.65	11.46	8.30
HoTh-316	12.64	12.82	13.04	12.83	15.13
HoTh-318	12.80	12.92	13.21	12.97	15.46
HoTh-325	11.41	11.61	11.97	11.66	10.78
HoTh-332	12.31	12.69	12.90	12.63	14.50
HoTh-334	10.69	11.02	11.97	11.22	7.57
HoTh-337	11.34	11.54	12.00	11.62	7.55
HoTh-340	11.22	11.51	11.93	11.55	11.26
HoTh-344	12.57	12.96	13.19	12.90	15.01
HoTh-349	12.63	12.83	13.11	12.85	14.77
Thatta-10	12.30	12.46	12.60	12.45	14.19

Appendix-1 Summary of meteorological data recorded at Meteorological Station of National Sugar Crops Research Institute, Thatta during 2003-04

Year	Month	Temperature ^{0}C		Humidity %	Rainfall (mm)
		Minimum	Maximum		
2003	October	20.45	36.32	51.61	-
2003	November	16.32	30.68	51.24	-
2003	December	11.58	26.01	37.76	-
2004	January	11.98	25.12	50.16	13
2004	February	15.37	29.03	48.72	-
2004	March	18.29	35.83	46.74	-
2004	April	23.56	36.20	56.46	2
2004	May	25.67	39.00	54.58	-
2004	June	28.63	36.95	68.60	-
2004	July	26.64	32.64	72.29	-
2004	August	26.41	31.30	76.00	5
2004	September	24.40	32.35	76.10	-
2004	October	21.00	32.70	69.67	36
2004	November	17.47	32.26	59.73	-
2004	December	14.19	26.77	65.48	-

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