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Evaluation of New Sugarcane Genotypes Developed Through Fuzz Correlation of Cane Yield and Yield Components

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ABSTRACT

Performance of seven new sugarcane genotypes developed through fuzz was assessed alongwith two local checks at National Sugar Crops Research Institute, PARC Farm, Thatta during 2000-2001. Analyses of variance revealed highly significant differences among genotypes for cane yield and yield components. Th-10 was superior in girth (27.41 mm), height(277.67 cm), number of internodes per cane (29.84) and weight per cane (1.089 kg). S-84-I-736/88 and LCP-81-10/9 possessed maximum number of millable canes per m^2 (13.5 and 12.67) and positively correlated with number of millable canes per m^2 (0.818**), weight per cane (0.676**), height (0.622**), number of internodes per cane (0.494**) and girth (0.114). Coefficient of determination and regression coefficient values rated number of millable canes per m^2 as a major cane yield component

Key words: *Saccharum officinarum;* genotypes, fuzz correlation, cane yield, yield components, Pakistan

INTRODUCTION

Sugar industry is second to Textile in Pakistan and provides employment to a large number of masses. It is based on sugarcane cultivation, the important cash crop of the country. Sugarcane yield is very low (47.6 t ha^{-1}, Anonymous, 2001) in the country due to low yielding varieties and poor management practices for sugarcane growers. In any crop variation plays an important role in variety development of any crops. As sugarcane is highly cross-pollinated crop, therefore, variation in sugarcane is not problem. Sugar cane is basically a tropical plant and flower under such conditions. Sub-tropical conditions occur in lower Sindh and natural flowering has been observed at coastal areas of Thatta and Dadin Districts. The fuzz (the true seed of sugarcane) obtained from theses areas has low viability. The other problem is the non-synchronization of desirable genotypes i.e. different varieties flower at different time and hence can not be crossed under natural conditions. To overcome these problems controlled conditions are required in a glass house specially designed for sugarcane breeding. No such conditions are available in the country so sugarcane breeding with desire is not possible at this time in the country. Under present circumstances one has to rely on local fuzz which crosses under natural conditions or imported fuzz which is although crossed under artificial conditions and has relatively more viability but is according to needs of that particular country. Glaz (2000) reported that sugarcane production can only be improved through adaptation of promising varieties and technologies Higher cane yield is the function of higher genetic potential of the variety (Nazir *et al.*, 1994). Javed *et al.* (2001) reported that 168.05 t ha^{-1}, Khan *et al.* (2002) 146.1 t ha^{-1}, Panhwar *et al.* (2002) 128 t ha^{-1} and Junejo *et al.* (2002) 115 t ha^{-1} cane yield was achievable through newly developed high yielding sugarcane varieties.

Cane yield is believed to be a complex henomenon and depends upon cane yield components and their interrelationship. Correlation analysis provides information on associated response of plant characters and lead to directional model for yield prediction. Mahmood *et al.* (1990) reported that cane yield was positively and highly significantly correlated with number of millable canes m^{-2} and cane girth and significantly with cane length and weight per cane. Furthermore correlations between four cane yield components were positive but significant only in case of weight/cane with cane length and cane girth. Afghan *et al.* (1993) reported that cane yield was strongly and positively correlated with stalks/stool, millable cane and cane weight. Javed *et al.* (2001) reported that cane yield was strongly and positively correlated with cane girth and weight/stool. They further reported that weight/stool had positive and significant association with cane length and cane girth and negative with stalk/stool. Stalk/stool and positive and significant association with cane length and significant negative with cane girth whereas cane girth and cane length were positively and non-significantly associated. Khan *et al.* (2002) reported that cane yield was strongly and positively correlated with cane girth, weight/stool , cane length and non-significantly with tillers/plant. They also reported that weight/stool was significantly associated with cane girth, cane length and tillers/plant, while cane length, cane girth and tillers/plant had positive and non-significant association with one another. Junejo *et al.* (2002) reported that cane yield was positively correlated with plant height, cane thickness and significantly with millable canes. They further reported that plant height was positively and significantly correlated with millable canes and positively with number of internodes/cane and cane thickness while millable canes had negative association with cane thickness. Panhwar *et al.* (2002) reported that cane yield was positively correlated with cane girth and significantly with internodes/stool and highly significantly with cane height and millable canes. They also reported that number of internodes/cane was positively and significantly associated with cane height and non-significantly with millable canes, cane height had positive associated with millable canes and cane girth. The objectives of the study were to evaluated the performance of new sugarcane varieties developed through fizz and to study functional relation between cane yield and yield components.

MATERIALS AND METHODS

The experiment was conducted during the year 2000-2001 in autumn planting season at plant crop at National Sugar Crops Research Institute (NSCRI), Pakistan Agricultural Research Council (PARC) Farm, Thatta and was laid out in randomized complete block design with 3 replications. Each experimental unit had four rows of 6 m length keeping 1 m row spacing. The experimental material comprised 9 genotypes viz. LCP-81-10/9, LCP-81-10/41, LCP-81-10/42, LCP-81-10/56, LCP-81-10/114, S-84-I-736/88, S-84-I-736/237 (developed through fuzz), Th-10 and BL^{-4} (commercial check varieties). All agronomic and cultural practices were adapted uniformly for all treatments. The data on girth (mm), height (cm), number of internodes per cane number of millable cones per m^2, weight per cane (Kg) and cane yield (t ha^{-1}) were recorded at harvesting time. The data for various plant traits were subjected to analysis of variance following the procedures of Steel and Torrie (1980). The characters showing significant differences were tested for their significance using Least Significance Difference (LSD) test. Correlations coefficients among cane yield and yield components were computed MSTATC program.

RESULTS AND DISCUSSION

Analysis of variance revealed that highly significant differences existed among sugarcane genotypes for cane yield and yield components (Table 1). Means of various characters of all genotypes are given in Table 2. Maximum girth was observed in Th-10 (27.41 mm) followed by LCP-81-10/9 (36.91 mm) and LCP-81-10/42 (26.35) whereas minimum in LCP 81-10/41 (22.23 mm) followed by S-84-I-736/88 (23.19 MM). Th-10 (29.84) had maximum number of internodes per cane followed by LCP-81-10/42 (27.84) AND BL^{-4} (27.83) while LCP-81-10/56 (23.34) had minimum internodes per cane followed by S-84-I-736/237 (24.17). S-84-I-736/88 (13.50) out classed every genotype by producing maximum number of millable canes m^{-2}, LCP-81-10/9 and LCP-81-10/41 each produced 12.67 millable canes m^{-2} followed by LCP-81-10/114 (12.17) . LCP-81-10/42 (8.17) had minimum number of millable canes m^{-2} followed by LCP-81-10/56 (8.33) and S-84-I-736-237 (8.50). The checks Th-10 (1.089 kg) and BL-4 (1.031 kg) exhibited maximum weight per cane followed by S-84-I-736/88 (0.942 kg) and LCP-81-10/9 (0.938 kg) whereas LCP-81-10/41 (0.727 kg) and LCP-81-10/56 (0.732 kg) produced canes with minimum weight. Maximum cane yield was produced by S-84-I-736/88 (127.08 t ha^{-1}) followed by LCP-81-10/9 (118.75 t ha^{-1}) and Th-10 (118.33 t ha^{-1}) whereas LCP-81-10/56 (61.67 t ha^{-1}) produced minimum cane yield followed by S-84-I-736/237 (66.25 t ha^{-1}) and LCP-81-10/42 (70.25 t ha^{-1}).

Section is based on characters contributing to cane yield but it is more desirable to make selection on correlated characters resulting in more economical selection. The results of correlation analysis for cane yield and yield components are given in Table 3. Cane yield was positively correlated with its components i.e. height (r= 0.622**), number of internodes per cane (r= 0.494**), number of millable canes m^{-2} (r= 0.818**), weight per cane (r= 0.676**) and girth (r= 0.114). Girth of cane was positively associated with weight per cane (r= 0.518**) and height (r= 0.129) and number of internodes per cane (r= 0.268) and negatively with number of millable canes (r= 0.624**), weight per cane (r= 0.641**) and number of millable canes m^{-2} (r= 0.349). Number of internodes per cane was positively correlated with weight per cane (r= 0.622**) and number of millable canes m^{-2} (r = 0.213). Number of millable canes m^{-2} was positively correlated with weight per cane (r = 0.141). Similar results

Table 1: Mean square values and their significance from analyses of variance for cane yield and yield components during 2000-2001.

Souce of variation	df	Girth	Height	No. of internodes /cane	No. of millable canes/m²	Weight cane/cane	Yield
Replication	2	0.059	1107.336	0.828	0.259	0.003	20.252
Variety	8	8.87**	3653.33**	11.80**	13.676**	0.051**	1762.21**
Error	16	1.169	358.947	1.771	0.509	0.003	83.534

Table 2: Means of cane yield and yield components during 2000-2001

Name of variey	Girth (mm)	Height (cm)	No. of internodes/cane	No. of millable canes/m²	Weight/cane (kg)	Cane yield (t ha^{-1})
LCP-81-10/9	26.91	248.67	25.84	12.67	0.938	118.75
LCP-81-10/41	22.23	213.00	26.17	12.67	0.727	92.08
LCP-81-10/42	26.35	225.84	27.84	8.17	0.864	70.25
LCP-81-10/56	25.18	167.50	23.34	8.33	0.732	61.67
LCP81-10/114	24.98	245.00	27.34	12.17	0.801	97.50
S-84-I-736/88	23.19	274.17	26.84	13.50	0.942	127.08
S-84-I-736/237	23.95	247.17	24.17	8.50	0.778	66.25
Th-10	27.41	277.67	29.84	10.83	1.089	118.33
BL-4	25.59	268.17	27.83	9.33	1.031	96.25
cd-1 (5%)	1.87	32.97	2.30	1.24	0.095	15.82
cd-2 (1%)	2.58	45.18	3.17	1.70	0.131	21.80
CV%	4.31	7.87	5.01	6.68	6.62	9.70

Table 3: Correlation coefficients (r) for cane yield and yield components during 2000-2001

	Height	No. of internodes/cane	No. of millable canes/m²	Weight/cane	Cane yield
Girth	0.129	0.268	-0.279	0.518**	0.114
Height		0.624**	0.349	0.641**	0.622**
No.of internodes/cane			0.213	0.622**	0.494**
No.of millabel canes/m²				0.141	0.818**
Weight/cane					0.676**

** Highly Significant

Table 4: Coefficients of determination (R^2) and regression coeffients (b) between cane yield and yield components during 2000-2001

	R^2	b
Grith	0.0130	1.493
Height	0.3869	0.401
No. of internodes/cane	0.2440	5.509
No. of millable canes/m²	0.6691	9.366
Weight/cane	0.4570	122.893

have been reported by Mahmood *et al.* (1990), Afghan *et al.* (1993), Javed *et al.* (2001), Khan *et al.* (2002), Junejo *et al.* (2002) and Panhwar *et al.* (2002). While sections maximum importance should be given to number of millable canes m^{-2} followed by weight cane, height, number of internodes per cane and girth at the last.

The values of coefficients of determination (R^2) and regression coefficients (b) between cane yield and yield components are given in Table 4. The coefficient of determination for girth (R2 = 0.0130) revealed that 1.3% variation in cane yield was due to girth. The regression coefficient (b = 1.493) depicted that for a unit increase in girth proportionally increased cane yield 1.5 t ha^{-1}. The coefficient of determination for plant height (R2 = 0.3869) indicated that 39% variation in cane yield was due to variation in plant height. The regression coefficient (b= 0.401) predicted that for a centimeter increase in height 400 kg ha^{-1} cane yield would be increased. The coefficient of determination for number of internodes per cane. The regression coefficient(b = 5.509) showed that one number internode increase per cane would increase cane yield 5.5 t ha^{-1}. The coefficient of determination for number of millable canes m^{-2} (R2 = 0.6691) exhibited that 67% variation in cane yield was due to number of millable canes m^{-2}. The regression coefficient (b = 9.366) predicated that an increase of one number of millable cane m^{-2} proportionally increased 9 t ha^{-1} of cane yield. The coefficient of determination for weight per cane (R2 = 0.4570) indicated that 46% variation in cane yield was caused by weight per cane (R2 = 0.4570) indicated that 46% variation in cane yield was caused by weight per cane. Regression coefficient (b= 122.893) revealed that each gram increase in weight per cane would increase cane yield 123 kg ha^{-1}. It is observed from above results that number of millable canes m^{-2}, weight per cane and height were responsible for maximum variation in cane yield and were so major yield components. Mahmood *et al.* (1990) reported that millable canes er m2 and weight per cane were the major yield components on the basis of coefficient of determination values. It is also obvious from regression coefficient that number of millable canes m^{-2} would increase cane yield up to 9 t ha^{-1}, again indicating that number of millable canes m^{-2} would increase cane yield u to 9 t ha^{-1}, again indicating importance of millable canes m^{-2} would increase cane yield u to 9 t ha^{-1}, again indicting importance of millable canes m^{-2} as major cane yield component. Mahmood *et al.* (1990) reported that an increase of one number of millable cones m^{-2} would increase cane yield by 13-14 t ha^{-1}.

The genotypes S-84-I-736/88 and LCP-81-10/9 seem to have got the potential of promising varieties but further studies on these genotypes have to be planned to understand their full potential, before their release as commercial varieties. The correlation coefficient of cane yield with yield components suggested that number of millable canes m^{-2}, weight per cane, height and number of internodes per cane are good yield predicators and could be used for selection. The coefficient of determination and regression coefficient rated number of millable canes m^{-2} as most important variable in influencing and increasing cane yield. In the present study genotypes S-84-I-736/88 and LCP-81-10/9 possessed maximum number of millable canes m^{-2} and also produced highest cane yields, again suggesting the importance of this character. So number of millable canes m^{-2} should be given priority during selections process.

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