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SELECTION AND EVALUATION OF DIVERSE SUGARCNE GENOTYPES IN 4TH STAGE

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ABSTRACT

Comparative performance of 12 sugarcane genotypes were tested in 4th stage against two local check varieties at National Sugar Crops Research Institute, Thatta. Study aimed at to identify potential sugarcane genotypes for releasing them as new commercial varieties in future. Genotypes under evaluation were developed from bi parental cross of USA origin fuzz (true seed). The experiment was laid out using a triplicate Randomized Complete Block Design (RCBD). Significant differences among the genotypes were observed for cane yield and contributing parameters and sugar yield. Plant crop attained more cane yield, CCS% and sugar yield as compared to ratoon crop. The traits i.e. cane height and millable canes for plant crop while, cane girth and millable canes for ratoon crop showed strong significant relationship for enhancing cane yield. Insect pest infestation stated that attack in ratoon crop was remained 20.32% higher than plant crop. Stem borer accounted high infestation followed by top and root borer among the genotypes. The genotypes HoTh-402, HoTh-404, HoTh-408, HoTh-409, HoTh-414 and HoTh-430 on account of their better performance were selected for further testing and progression in final selection trials. The selected genotypes have great promise to be good commercial varieties in future.

Keyword: Genotypes, *Saccharum officinarum,* sugarcane, cane yield, CCS%, insect pest infestation

INTRODUCTION

Sugarcane (*Saccharum officinarum* L) is an important cash crop globally not only for sugar production, but also increasingly as a bioenergy crop due to its phenomenal dry matter production. In Pakistan sugar cane is cultivated under many diverse agroecological conditions. Demand for white sugar and bioenergy is increasing day by day due to consistent increase in population, but its present production is not enough to meet the increasing demand because of low production (Cheema and Mahmood 2005). Amongst many other sugarcane yield production limiting factors the lack of high cane and sugar yielding varieties is considered major factor affecting the cane production (Chohan *et al*., 2007). Ahmad *et al*. (1992) reported that yield level of ratoon crop was lower due to poor ratooning potential of the varieties. The average cane yield can be improved by developing high yielding varieties through different breeding techniques (Memon *et al*., 2004).

New sugar cane varieties are produced by sexual means and propagated vegetatively. Each year a new population of original seedlings consisting of thousands of new varieties is produced through fuzz (true seed). These are screened clonally through several selection stages, their numbers being reduced at each stage and the selected ones tested in larger plots in which their performance can be evaluated more reliably. The time taken to release sugarcane variety ranges from eight to twenty years (Skinner *et al.,* 1987; Tai *et al.* 1992). Major criteria for advancement from one stage to the next are high yields, quality index, disease resistance or tolerance and agronomic traits (Glaz *et al.*, 2002). From these stages, 4th stage is the final stage of the selection pathway which involves testing varieties in replicated trial (Panhwar *et al.* 2006). Glaz and Miller (1982) reported that 4th Stage results reasonably well predicted the commercial yields of released genotypes. The yielding ability of sugarcane varieties is strongly influenced by environment variation, so replicated trials are necessary to assess this character accurately (Heinz 1987). The growth performance is a character that affect the yield of cane crop, growth habits, erectness, cane length, girth of cane and stooling depending upon genetic makeup which may be detected by overall performance of the clones (Kazi *et al.*, 2010 and Zafar *et al.*, 2005). Verma, *et al.*, (1999) reported that stalk girth, stalk height, millable cane CCS% and yield of 16 varieties were significantly and positively correlated with each other, so selection may be done on the basis of above characteristics. Genetic selection , play a major role for higher cane yield and cane improvement, agronomic practices just trigger the inherent potential of variety (Keerio *et al.*, 2003) The efforts are needed to increase cane and sugar production per unit area to cope with the sugar and other by products requirements of the country. The situation demand new set of varieties, which is possible only through breeding efforts. Keeping in view the objective of present study was to find out the potential sugarcane genotypes to release them as new commercial varieties in future.

MATERIALS AND METHODS

New genotypes were developed from bi parental cross of USA origin fuzz (true seed) at National Sugar Crops Research Institute, PARC Thatta (24°, 46', 28" N, 67°, 53', 41"E). Nursery was raised for seedling development from fuzz. The large number of seedling clones was developed and year wise tested/screened under several selection stages in single plant, 1st stage, 2nd stage and 3rd stage. Their numbers were reduced at each stage and only promising clones were promoted to the next selection stage on the basis of better brix% and cane girth. The selected clones from the third stage were further tested/ evaluated in replicated trials where the performance of clones was tested for cane yield, yield parameters, quality and insect pest and diseases attacks. The 12 best selected sugarcane genotypes from 3rd stage were tested / evaluated in 4th stage along with two local check varieties Thatta-10 and BL-4. The experiment was laid out according to Randomized Complete Block Design (RCBD) with three replications for Plant Crop (2004-2005 and Ratoon Crop 2005-2006). Each treatment was comprised of 7.5 meter long three rows at 1.25 meters row to row distance. Three budded cane sets were sown in 9 inch deep furrows, than sets were buried under thin layer of soil. The NPK nutrients were applied in the form of NPK fertilizer (9:18:18) according the recommended dose. All the cultural practices and control measures were taken uniformly as per requirement. On maturity three rows from each plot were harvested to record data on cane yield and yield components. Five canes, selected randomly, from each plot were utilized for recording commercial cane sugar (CCS%) and sugar yield (tha^{-1}) as suggested by Meade and Chen (1977). Pre-harvested data for top, stem and root bores infestation (in percentage) was collected by selecting whole line of each genotype and calculated according to Khan *et al.*, (2006). The combine mean infestation (in percentage) of these three borer complexes was calculated for each genotype and classified as Resistant (0-8.0%), Less susceptible (8.01-9.0%), Moderate susceptible (9.01-10.0%), susceptible (10.01-11.0%) and Highly susceptible (≥11.00%) according to Khanzada (2002). The data was analyzed statistically using program MSTATC (1991) for analysis of variance, comparison of genotypic means compared by LSD at ($p < 0.05$) and coefficient of correlation.

Before sowing a composite soil samples from experimental area was analyzed for the physico-chemical properties and NPK nutrient status of soil at the soil lab of NSCRI, PARC, Thatta. Indicated that soil was relatively heavy fine in texture, strongly alkaline in reaction, low in ECe, Organic matter, N and P while adequate in K.

Table-1: Some physico-chemical properties of soil of experimental area at NSCRI, farm Thatta

Soil Depth (cm)	Soil Texture			Texture class	pH (1:5)	EC_e (dSm^{-1})	OM (%)	N (%)	P ($mgkg^{-1}$)	K ($mgkg^{-1}$)
	Clay (%)	Silt (%)	Sand (%)							
0-15	47.80	10.35	41.85	Clay	8.78	2.40	0.89	0.044	5.00	122.0
15-30	49.05	11.60	39.35	Clay	8.80	2.80	0.82	0.041	3.50	99.0

RESULTS

Plant Crop: Significant differences among the genotypes were observed for all plant traits studied (Table-2). The perusal of data for cane girth in Table-2 indicated that maximum average cane girth (30.43 mm) was recorded for genotype HoTh-409, followed by HoTh-430 (27.90mm), HoTh-402 (26.70mm), Th-10 (26.67mm) and HoTh-408 (26.37mm). While the genotype HoTh 414, HoTh-434 and HoTh-404 gave the similar results (25.97, 25.80 and 25.07 mm respectively). Rest of the genotypes HoTh-432, HoTh-419, HoTH-424, HoTh-438 and BL-4 accounted 24.43, 23.77, 23.70, 22.70 and 22.10 mm cane girth respectively. Minimum average cane girth (21.80 mm) was recorded for the genotype HoTh-406.

Table-2 further revealed that maximum average cane height 242.00 cm was recorded for genotype HoTh-430 followed by HoTh-404 (230.70 cm), HoTh-409 (225.00 cm) Th-10 (219.30 cm) HoTH-402 (2011.70 cm), HoTh-408 (201.70 cm) and HoTh-414 (194.00 cm). The genotypes, HoTh-432, BL-4 and HoTh-424 attained the same, height (186.70 cm). Rest of the genotypes HoTh-406, HoTh-419 and HoTh-438 attained the cane height of 178.70, 149.30, and 138.70 cm respectively. Minimum average cane height (129.00 cm) was observed in the genotype HoTh-434.

Maximum average millable canes (121667 ha^{-1}) were recorded for genotype HoTh-404 followed by HoTh-409 (110000 ha^{-1}) was recorded for and HoTh-409 respectively. While HoTh-414 and Th-10 were produced similar number of millable canes (106667 ha^{-1}) followed by, HoTh-430 (103667 ha^{-1}), HoTh-438 (101667 ha^{-1}), HoTh-402 (10000 ha^{-1}), HoTh-408 (98333 ha^{-1}) and BL-4 (96333 ha^{-1}). The genotypes HoTh-419, HoTh-406, HoTH-424 and HoTh-432 produced 93333, 90000, 87666 and 86667 ha^{-1} millable canes respectively. Minimum average millable canes (73333 ha^{-1}) were obtained from HoTh-434.

Maximum average cane yield (110.00 t ha^{-1}) was recorded from genotype HoTh409, followed by HoTh-404 (96.67 t ha^{-1}), HoTh-430 (92.11 t ha^{-1}), and Th-10 (85.00 t ha^{-1}). Genotype HoTh-402 and HoTh-414 produced similar cane yield (78.33 t ha^{-1}). The genotypes HoTh-408, BL-4, HoTh-419, HoTh-424, HoTh-438, HoTh-406 and HoTH-432 attained 76.67, 75.00, 68.33, 66.67, 65.33, 62.33 and 61.67 t ha^{-1} cane yield respectively. Minimum (54.93 t ha^{-1}) cane yield was obtained from HoTh-434.

Maximum average CCS (15.01%) was recorded in genotype HoTh-414 followed by HoTh404 (14.74 %), Th-10 (14.35 %), HoTh-409 (14.27 %), HoTh-402 (14.25 %), HoTh-430 (14.21 %), HoTh-419 (14.08 %), HoTh-408 (14.03 %). The genotypes HoTh-438 BL-4 HoTh-432, HoTh-434 and HoTH-424 produced 13.44, 13.26, 13.25, 13.20 and 12.26 % respectively. Minimum CCS 12.08 % was recorded from HoTh-406.

Maximum average sugar yield 15.00 tha^{-1} was recorded in genotype HoTh-409 followed by HoTh-430 (13.20 t ha^{-1}) Th-10 (12.89 t ha^{-1}) HoTh404 (11.30 t ha^{-1}), HoTh-402 (10.68 t ha^{-1}), HoTh-414 (10.52 t ha^{-1}), HoTh-408 (10.50 t ha^{-1}) and BL-4 (10.30 t ha^{-1}). The genotypes HoTh-438, HoTh-419, HoTh-432, HoTh-434 and HoTH-406 accounted 10.25, 9.62, 9.49, 8.36 and 8.25 t ha^{-1} sugar yield respectively. The lowest (8.17 t ha^{-1}) average sugar yield was obtained from HoTh-424.

Ratoon Crop: Significant differences among the genotypes were observed for all plant traits studied (Table-3). The perusal of data for cane girth indicated that maximum average cane girth (29.39 mm) was recorded for the genotype HoTh409 followed by Th-10 (27.52mm), HoTh-408 (26.07 mm), HoTh-414(25.80 mm), HoTh-402 (25.20 mm) HoTh-430 (25.16mm) and HoTh-404 (25.00 mm). Minimum average cane girth (21.39 mm) was recorded for the genotypes HoTh-438.

Maximum average cane height was attained by genotype HoTh-409 (226.66 cm) and HoTh-414 (205.33cm). The genotypes HoTh-402, HoTh-408 and Th-10 were produced canes of similar height (184.66 cm). Followed by HoTh-430 (168.66 cm), HoTh-404 (165.66 cm), HoTh-424 (163.00 cm), BL-4(162.33 cm) and HoTh-406 (160.00 cm). Minimum average cane height (124.33 cm) was observed for the genotypes HoTh-438.

Table-2. Analysis of variance and mean's comparison for growth factors in plant crop

Source of variation	Df	Mean squares					
		Cane Girth (mm)	Cane Height (cm)	Millable cane (ha^{-1})	Cane Yield (t ha^{-1})	CCS (%)	Sugar Yield (t ha^{-1})
Replication	2	2.642	696.738	12273540.70	138.45	0.0102	0.0193
Genotype	13	15.228**	3658.396**	171633454.10**	426.77**	0.111**	0.081*
Error	26	3.00	313.45	25692530.20	124.48	0.0135	0.0285
Genotype		**Mean separation**					
HoTh-402		26.70 ab	211.70 bcd	100000 bcde	78.33 de	14.25 bc	10.68 de
HoTh-404		25.07 bcd	230.70 ab	121667 a	96.67 b	14.74 ab	11.30 d
HoTh-406		21.80 e	178.70 ef	90000 ef	62.33 hi	12.08 e	8.25 g
HoTh-408		26.37 bc	201.70 bcd	98333 cde	76.67 efg	14.03 c	10.50 de
HoTh-409		30.43 a	225.00 ab	110000 b	110.00 a	14.27 bc	15.00 a
HoTh-414		25.97 bcd	194.00 cde	106667 bc	78.33 de	15.01 a	10.52 de
HoTh-419		23.77 cde	149.30 fg	93333 def	68.33 fgh	14.08 c	9.62 f
HoTh-424		23.70 cde	186.70 de	87667 f	66.67 gh	12.26 e	8.17 g
HoTh-430		27.90 ab	242.00 a	103666 bcd	92.11 bc	14.21 bc	13.20 c
HoTh-432		24.43cde	186.70 de	86667 f	61.67 hi	13.25 d	9.49 f
HoTh-434		25.80 bcd	129.00 g	73333 g	54.93 i	13.20 d	8.36 f
HoTh-438		22.70 cde	138.70 g	101666 bcd	65.33 gh	13.44 ef	10.25 cd
Th-10		26.67 ab	219.30 abc	106667 bc	85.00 cd	14.35 bc	12.89 b
BL-4		22.10 de	186.70 de	96334 def	75.00 ef	13.26 d	10.30 cd
Over all Mean		**25.24**	**191.44**	**98285.71**	**75.88**	**13.74**	**10.60**
CV%		6.90	9.63	20.21	23.99	2.42	2.73
LSD 0.05		2.89	30.93	1050	8.19	0.54	0.46
SE		0.404	5.668	3850	3.19	0.133	0.295
Correlation (r)		0.124	0.269*	0.398**	--	0.22*	0.981**

*, ** Statistically significant at the 0.05and 0.01probability levels, respectively

Means within same columns followed by different letters are significantly different at 0.05 probability levels, according to Least significant difference (LSD) Test. SE = Standard Error, r = coefficient of correlation with cane yield.

Table-3. Analysis of variance and mean's comparison for growth factors in ratoon crop

Source of variation	Df	Mean squares					
		Cane Girth (mm)	Cane Height (cm)	Millable cane (ha^{-1})	Cane Yield (t ha^{-1})	CCS (%)	Sugar Yield (t ha^{-1})
Replication	2	0.405	41.25	23328560.90	50.96	0.0128	0.982
Genotype	13	2.332**	189.57**	107646520.20**	150.88*	0.195**	2.793*
Error	26	0.380	38.25	24399175.20	58.88	0.0175	1.02
Genotype		**Mean separation**					
HoTh-402		25.20 bcd	184.33 abc	100000 ab	73.00 abc	14.77 a	11.32 ab
HoTh-404		25.00 bcde	165.66 bcd	101333 a	71.66 abc	14.07 ab	10.0 bcd
HoTh-406		21.62 e	160.00 cd	88334 f	62.66 cde	11.79 g	7.46 d
HoTh-408		26.07 bc	184.33 abc	98333 abc	80.33 abc	14.12 ab	10.37 bc
HoTh-409		29.39 a	226.66 a	101666 a	82.33 ab	14.39 ab	11.79 ab
HoTh-414		25.80 bcd	205.33 ab	100000 ab	91.33 a	14.58 ab	13.31 a
HoTh-419		23.11 cde	131.33 d	90000 ef	67.33 cde	13.31def	8.19 cd
HoTh-424		23.27 cde	163.00 bcd	95000 cde	66.00 cde	13.87 bc	9.15 bcd
HoTh-430		25.16 bcde	168.66 bcd	100000 ab	82.33 ab	13.46 de	11.72 ab
HoTh-432		24.26 bcde	155.00 cd	88333 f	61.66 cde	12.73 f	9.14 bcd
HoTh-434		23.61 cde	149.33 cd	96667 bcd	60.33 de	13.26 ef	7.98 cd
HoTh-438		21.39 e	124.33 d	91666 def	58.00 e	13.04 ef	7.56 d
Th-10		27.52 ab	184.66 abc	98333 abc	75.00 abc	14.74 a	11.13 ab
BL-4		22.21 de	162.33 bcd	96334 cde	69.00 cde	13.21 ef	9.27 bcd
Over all Mean		**24.54**	**168.92**	**96142.79**	**71.49**	**13.66**	**9.88**
CV%		6.25	17.13	10.73	17.18	3.23	17.08
LSD 0.05		2.56	47.81	541	20.34	0.72	2.75
SE		0.388	4.512	1587	2.221	0.140	0.327
Correlation (r)		0.478**	0.044	0.437**	--	0.088	0.947**

*,** Statistically significant at the 0.05and 0.01probability levels, respectively

Means within same columns followed by different letters are significantly different at 0.05 probability levels, according to Least significant difference (LSD) Test. SE = Standard Error, r = coefficient of correlation with cane yield.

The genotype HoTh409 and HoTh-414 produced (101666) maximum average millable cane ha^{-1} followed by HoTh-404, HoTh-430 and HoTh-402 which produced similar quantity of millable canes ha^{-1} (100000 each). Minimum average millable canes ha^{-1} (88334) were recorded in the genotypes HoTh-406 and HoTh-432.

Maximum average cane yield (91.33 t ha^{-1}) was recorded for the genotype HoTh-414 followed by the genotypes HoTh409 and HoTh-430 which produced similar cane yield (82.33 t ha^{-1} each) and by HoTh-408 (80.33 tha^{-1}), Th-10 (75.00 t ha^{-1}), HoTh-402 (73.00 t ha^{-1}), HoTh-404 (71.66 t ha^{-1}), and BL-4 (69.00 t ha^{-1}). Minimum average cane yield (58.00 t ha^{-1}) was obtained from HoTh-438.

Maximum average CCS (14.77%) was recorded in genotype HoTh-402followed by Th-10 (14.74%), HoTh414 (14.58%), HoTh-409 (14.39%), HoTh-408 (14.12%) and HoTh-404 (14.07%). Minimum average CCS (11.79%) was obtained from HoTh-406.

Maximum average sugar yield (13.31 t ha^{-1}) was recorded in genotype HoTh-414 followed by HoTh-409(11.79 t ha^{-1}), HoTh-430 (11.72 t ha^{-1}), HoTh-402 (11.32 t ha^{-1}) Th-10 (11.13 t ha^{-1}) HoTh-408 (10.37 t ha^{-1}) and HoTh-404 (10.00 t ha^{-1}). Minimum average sugar yield (7.46 t ha^{-1}) was obtained from HoTh-406.

Insect pest infestation (%) in plant and ratoon crop: No viral, bacterial and fungal diseases attack was observed in all the genotypes, while less than 2% whip smut disease attack was observed in the local check variety (BL-4) in both the plant and ratoon crops. The data for plant crop depicted in Table-4 revealed that two genotypes HoTh-434 and HoTh-424 were remained highly susceptible to the sugarcane borer complex infestation accounted (13.63 and 11.24 % attack, respectively) followed by the local check variety BL-4 which fall in the susceptible category with 10.54% attack. While the genotype HoTh-438 (8.75%) and HoTh-419 (8.73%) remained less susceptible. The rest genotypes remained resistant to borer complex attack. The results for ratoon crop revealed that three genotype HoTh-434, HoTh-424 and HoTh-419 were remained highly susceptible to the sugarcane borer complex infestation (16.66, 15.60 and 12.50 % attack respectively). The genotype HoTh-406 fall in susceptible category with 10.81 % attack and the local check BL-4

was remained moderately susceptible with 9.56 % attack. While the Thatta-10, HoTh-432 and HoTh-438 showed 8.73, 8.32 and 8.18% infestation respectively, and remained less susceptible to borer attack respectively. The rest of the genotypes remained resistant to borer attack.

Table-4. Infestation (%) of different sugarcane genotypes by borer complex in 4th stage plant and ratoon crop

Genotype	Infestation %						Combine Mean	
	Plant Crop			Ratoon Crop			Plant Crop	Ratoon Crop
	Top Borer	Stem borer	Root borer	Top borer	Stem borer	Root borer		
HoTh-402	1.04 e	9.37 d	6.52 b	1.35 g	13.51 cd	8.10 bc	5.64 R	7.65 R
HoTh-404	8.94 b	8.94 d	1.62 def	8.82 a-d	9.80 def	2.94 def	6.5 R	7.18 R
HoTh-406	5.88 bcd	10.58 cd	00 f	7.31 cde	20.2 abc	4.87 de	5.84 R	10.81S
HoTh-408	4.38 cd	10.52 cd	4.38 bc	5.83 def	15.00 cd	0.83 f	6.42 R	7.22 R
HoTh-409	8.77 b	10.52 cd	00.0 f	11.19 ab	9.70 def	2.23 ef	6.43 R	7.70 R
HoTh-414	8.00 b	14.6 bcd	1.33 c-f	4.05 efg	16.2 bcd	2.70 ef	7.99 R	7.65 R
HoTh-419	7.52 bc	16.52 bc	2.15 a	11.44 a	19.95 bc	6.12 cd	8.73 LS	12.5 HS
HoTh-424	12.23 a	9.35 d	12.15 a	11.85 a	24.74 ab	10.22 ab	11.24 HS	15.6 HS
HoTh-430	6.56 bcd	11.67 cd	0.72 ef	11.45 a	7.20 ef	3.12 def	6.31 R	7.93 R
HoTh-432	8.10 b	11.71 cd	2.70 c-f	7.14 de	15.17 cd	2.67 ef	7.50 R	8.32 LS
HoTh-434	8.53 b	21.39 ab	10.97 a	11.1 abc	26.38 a	12.5 a	13.63 HS	16.6 HS
HoTh-438	6.25 bcd	16.25 bc	3.7 cde	5.26 def	14.03 cd	5.26 cde	8.75 LS	8.18 LS
Th-10	4.54 cd	14.5 bcd	2.72 c-f	7.54 b-e	13.98 cd	4.71 de	7.26 R	8.73 LS
BL-4	3.87 de	24.51 a	3.2 cde	3.20 fg	21.64 ab	3.84 def	10.53 S	9.56 MS
Over all Mean	6.75 b	13.61 a	4.45 c	7.68 b	15.54 a	5.00 bc	8.05 LS	9.69 MS
LSD 0.05	3.17	6.87	2.71	3.85	5.28	3.22	--	--
SE	1.07	3.34	1.32	1.87	3.10	1.57	--	--

Means within same columns followed by different letters are significantly different at 0.05 probability levels, according to Least significant difference (LSD) Test. SE = Standard Error, R = Resistant, LS = Less susceptible, MS = Moderate susceptible, S = susceptible ,HS = Highly susceptible

DISCUSSION

The traits i.e. cane girth, cane height and millable canes are most important yield contributing parameters and play major role in increasing cane yield (Junejo *et al.* 2010, Bhatti *et al*., 2008). Under good growth performance the clones showing cane thickness more than 25.0 mm are considered to promote towards next selection (Panhwar *et al*. 2006; Ramdoyal 1999). Amaya *et el.* (1996) reported that the clones with thick stalk canes that resist lodging may have great potential to be the high yielding varieties in future. Jackson and Mc Rae (2001) and Panhwar *et al*., (2006) reported that under good growing conditions, individual seedling clones produce up to about 2.0 m of cane height that can be selected for further evaluation and adaptation. The high number of millable cane is another important character contributing directly to higher cane and sugar yield (Kazi *et al.*, 2010 and Chohan *et al.* 2002). Important objective of this study was to determine the relationship between yield and traits. Positive relationship was found between cane yield and traits (Table-2 & 3). The contribution of traits like cane height and millable canes (7.23 and 15.84 % respectively) for plant crop while, cane girth and millable canes (22.84 and 19.1%, respectively) for ratoon crop, showed strong significant relationship for enhancing cane yield. The accounted regression in cane height (Y= 47.05+0.15x) and millable cane (Y=43.42+0.0005X) of plant crop and cane girth (Y= 4.63+2.73X) and millable cane (Y= 12.36+0.001X) of ratoon crop, is curve linear and best fit for prediction of cane yield (Y). Sugar yield tha^{-1} is directly related with cane yield so the high relationship (≥ 89 % in both crops) is associated with increasing or decreasing of cane yield. The previous research work carried out by Chohan *et al.* (2002); Amaya *et al.* (1996) and Singh *et al.*, 1985 stated that the cane girth, cane height, millable canes, CCS% and sugar yield are positively associated with cane yield.

The variation in cane yield might also be the results of differences in genetic makeup of various varieties. Glaz *et al.*, (2002) and Nazir *et al.*, (1997) stated that higher cane yield is the function of high potential varieties. The differential genetic behavior among newly developed sugarcane genotypes for cane yield and yield contributing traits have also been reported by (Chohan *et al*., 2007 and Keerio *et al*., 2003). Miller *et al.* (1978) reported that sugar yield tha^{-1} is based on stalk length, stalk diameter, stalk number and CCS% declaring it the most important character for selection. Panhwar *et al*. (2006) reported that the search of varieties that,

besides having desirable characteristics, exhibit high sugar content is an important aspect in sugarcane breeding. Sugar recovery stands as a factor of prime importance both from sugar millers and breeding point of view.

The comparative performance of plant crop vs ratoon crop of genotypes stated that cane yield, CCS% and sugar yield of plant crop was increased by 6.14, 1.19 and 7.37% over ratoon crop respectively. Genotype performance suggested that high yielding genotype HoTh-409 of plant crop accounted 20.44% more cane yield and 2.17% less CCS% than top genotype of ratoon crop i.e. HoTh-414. The results further indicated that genotype HoTh-414 accounted 11.37 and 12.99 % more cane yield and sugar yield in ratoon crop than the HoTh-409. So it can be said that the genotype HoTh-414 will be the best ratooner.

The results for insect pest infestation stated that attack in ratoon crop was remained 20.32% higher than plant crop. Stem borer accounted high infestation followed by top and root borer among the genotypes. The results are in accordance with Bhatti *et al*., (2008). Gupta *et al*. (1959) estimated that losses as a borer attack to varying from 14 to 40 ton of sugarcane acre-^{1} and Ishtiaq, (2005) accounted the losses (0.25 to 1.25%) in sugar recovery. Their studies showed that granular insecticide to be the most promising treatment against the sugarcane borer complex.

Conclusion: Out of 12 sugarcane genotypes tested, six genotypes i.e HoTh-402, HoTh-404, HoTh-408 HoTh409, HoTh-414 and HoTh-430 were selected on the basis of relatively better cane girth, cane height, millable canes ha^{-1}, cane yield tha^{-1}, CCS% , sugar yield t ha^{-1}, resistance to insect pest diseases and their ratooning ability. The selected genotypes were thought to have great promise to be good commercial varieties in future and were advanced for further testing and progression.

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