

Full Length Research Paper

## Stability and regression analysis in elite genotypes of sugarcane (*Saccharum* spp hybrid complex)

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Experiments were conducted during 2012-2013 with eight sugarcane genotypes along with four commercial checks to study the phenotypic stability and regression of cane yield, and its components under four environments. The  $G \times E$  component of variation was significant for single cane weight, number of millable canes, commercial cane sugar percent, cane yield and sugar yield. The genotypes SNK 07680 and SNK 07337 was found stable for cane yield (132.60 and 105.66 t ha<sup>-1</sup> respectively), sugar yield (14.44 and 12.70 t ha<sup>-1</sup>) its component characters such as sucrose (16.81 and 16.31% respectively), whereas SNK 07680 found stable for CCS (11.98%). Genotype SNK 07658 showed adoptability to unfavorable environment for single cane weight, number of millable canes and sucrose as evident by its deviation from regression and regression coefficient. Regression analysis concluded that 81.13% of total cane yield was contributed by single cane weight and number of millable canes.

**Key words:** Sugarcane, stability,  $G \times E$  interaction, sucrose %.

### INTRODUCTION

Sugarcane (*Saccharum* spp hybrid complex) is one of the most important agro-industrial crop grown in subtropical and tropical parts of the world especially in India. India is the second largest producer of sugarcane next to Brazil. Generally sugarcane is a vegetatively cultivated crop with wide adoptability and diversity. In subtropical India particularly in peninsular zone variation in climatic conditions are wide during the period of its growth and maturity stage. Sugarcane breeding is highly complex because it is highly heterozygous in nature, combined with higher polyploidy (2n=80-120). In multi location trial over the years for yield, sugarcane breeders are aware about the differences of cultivar for yield and quality which varies from location to location. This raises a

question that, do we require different cultivar for different environment or should we select specific cultivar for particular environment. Further the ranks of the genotypes vary from one location to another location, indicating a strong genotype  $\times$  environment interaction. Phenotypically stable genotypes with good cane yield potential under vast array of environmental conditions are of great importance because sugarcane is grown by farmers of all the regions. Different biometrical methods have been used for genotype  $\times$  environment interaction in crop plants by several workers the important ones being Finlay and Wilkinson (1963), Eberhart and Russel (1963) and Perkinson and Jinks (1968). Most of them give information about the genotype, constitution and role of

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environment. Therefore it is necessary to evaluate the genotype x environment interaction for yield and quality parameters in sugarcane.

Stability for cane yield and its parameters has been a neglected research and very limited number of literatures has been reported so far in sugarcane, particularly in the peninsular India (Comprising Parts of Karnataka, Maharashtra, and Tamil Nadu) sufficient information regarding the stability of cane yield parameters are the bottle neck in sugarcane which otherwise could be used in further breeding programs for crop improvement. Keeping these above factors in view, an investigation was planned to evaluate and screen out the elite sugarcane genotypes along with commercially accepted varieties over environments and to select the genotypes on the basis of stability parameters for yield and its important component characters. Although stability analysis provides a clear picture of the stability of genotype, but it cannot construct a prediction equation for cane and sugar yield using its components. Considering this point of view, the multiple linear regression analysis was also done.

## MATERIALS AND METHODS

The materials for the present investigation comprises of 12 genotypes of sugarcane viz., SNK 07337, SNK 07344, SNK 07360, SNK 07342, SNK 07658, SN K 07680, SNK 071013 and SNK 071138 including with four checks viz., Co 94012, Co 86032, Co 92005 and CoM0265. The experiment was carried out at four diverse environments namely E1, (Agriculture research station, Sankeshwar), E2, (S. Nijalingappa Sugar Institute, Belagaum), E3, (Shegunsi, Belagaum), E4, (R&D unit, Nandi Sugars, Hosur, Bijapur), in randomized block design with 3 replications during the crop season 2012-2013. Each treatment plot comprised 6 rows of 6 m length spaced with 90 cm apart. The crop received 150:60:40 kg of NPK per hectare. The total quantity of phosphorus and potassium was applied at basal and nitrogen was split into three dose: at germination, tillering and final earthing up. All the cultural practices were adopted during the entire cropping season to ensure good crop. Observation were recorded for characters namely, cane height (m), cane girth (cm), single cane weight (kg), number of millable canes, sucrose (%), commercial cane sugar (%), cane yield ( $t\ ha^{-1}$ ), sugar yield ( $t\ ha^{-1}$ ). Five randomly selected canes were used to record cane height, cane girth, single cane weight, sucrose and commercial cane sugar. The data were analysed for stability parameters, viz., mean ( $\mu$ ), regression coefficient ( $b_i$ ) and deviation from regression ( $S^2_{di}$ ) using the model proposed by Eberhart and Russell (1966). The soil properties of different locations were presented in Table A and weather parameters have been presented in Table B.

## RESULTS AND DISCUSSION

### Stability analysis

The pooled analysis of variance (ANOVA) (Table 1) revealed that environments, genotypes, genotype x environment interaction components of variation was significant for all the characters indicating the presence of

substantial amount of variation among the genotypes over environments. Genotypes also exhibited significant interaction with environments for all the traits studied which indicates that genotypes behaved differently under each environment for the expression of the characters of interest. It means the particular variety may not exhibit the same phenotypic performance under different environment or different variety may respond differently to a specific environment. Queme et al. (2005) also reported that variance due to environment, genotype and G x E interactions were highly significant for cane yield, sucrose (%) and sugar yield. Environment (linear) showed highly significant variances for all the traits, signifying unit changes in environmental index for each unit change in environmental conditions.

The G x E (linear) as well as pooled deviation mean squares were found significant for single cane weight, number of millable canes, cane yield, sucrose% and sugar yield, indicating the presence of both predictable and non predictable components. The importance of both linear and non-linear sensitivity for the expression of these traits was thus evident. However linear component was significantly higher than the non-linear portion of the G x E interaction supporting the earlier findings of Kumar et al. (2004); Tiawari et al. (2011) and Sanjeevkumar et al (2007). As linear component is higher for all the characters, performance prediction of genotypes based on these traits would be more accurate across the environments. Eberhart and Russell (1966) discussed stability of genotypes in terms of three parameters namely, genotypic mean ( $\mu$ ), regression or linear response ( $b_i$ ) and deviation from the linearity ( $S^2_{di}$ ). According to this model an ideally stable variety is one that confirms high mean values, unit regression or linear response and no deviations from the linearity.

The genotypes SNK 07360, SNK 071138 and CoM 0265 were unpredictable interms of their significant deviation from regression coefficient for cane height (0.187 0.239 and -0.190 respectively) and cane girth (0.392 and -0.324 respectively) whereas the rest all genotypes were predictable as they exhibited non significant deviation from regression for both the characters (Table 2). Genotypes SNK 07680 and SNK 07658 showed high mean coupled with non significant regression coefficient greater than unity for cane height and cane girth indicating these genotypes do better in favorable environment, whereas SNK 07337 exhibited high mean with non significant regression coefficient less than unity for cane girth indicating its adoptability in unfavorable environment. The genotypes SNK 07342 and SNK 071138 showed significant deviation from regression for single cane weight (-0.213) with regression coefficient more than unity indicating their unpredictability over environment. Whereas genotypes SNK 07337 and SNK 07680 were stable across the environment for single cane weight as indicated by their high mean (1.31 and 1.53 kg respectively) coupled with no. significant regression coefficient close unity (1.01 and 1.02 respectively).

**Table 1.** Pooled analysis of variance for stability analysis (Eberhart and Russell, 1966) for cane and jaggery parameters in clonal-VII over four locations.

Source of variation	df	Cane height (cm)	Cane girth (cm)	Single cane weight (kg)	Number of millable canes ('000/ha)	Sucrose %	CCS %	Sugar yield (t/ha)	Cane yield (t/ha)
Genotype	11	373.39**	0.101*	0.247**	14397.9**	3.94**	1.39**	16.86**	837.5**
Environment + (G × E)	36	2388.41**	0.217*	0.049	1902.2*	0.79**	2.02	3.94	321.8
Environments	3	75.48**	0.118*	0.212*	2418.3**	0.86*	6.75*	9.01*	846.5**
Genotype × Environment (G × E)	33	2484.78**	0.125**	0.034**	1855.3**	0.78**	1.82**	3.48**	274.1**
Environments (Lin.)	1	150.97*	0.531*	0.637	7254.8**	2.57**	13.51*	27.04	2539.5**
Genotype × Environment (linear)	11	2644.80	0.014	0.017*	1960.4**	1.55**	2.38*	3.71*	307.9*
Pooled deviation	24	2231.77**	0.026	0.039**	1652.6**	0.36**	1.21	3.08**	235.8**
Pooled error	88	442.2	0.018	0.013	602.2	0.73	0.43	1.77	92.9

Stability of all the genotypes for number of millable canes is predictable except SNK 07360, SNK 07342, SNK 071013, SNK 071138, Co 92005 and CoM 0265 as they exhibited significant deviation from regression, whereas SNK 07658 was adoptable to unfavorable environment as indicated by its high mean with non significant regression coefficient lesser than unity. Based on stability parameters SNK 07337 and SNK 07680 were found most stable for number of millable canes. Similar results were reported for single cane weight and number of millable canes.

All the genotypes were linearly predictable for sucrose % (Table 3) because of non significant deviation from regression except SNK 071013 and SNK 071138 which recorded significant deviation from regression (1.121 and -1.400 respectively) and significant regression coefficient (1.994 and 2.213 respectively). Genotypes SNK 07337, SNK 07680, Co 94012 and Co 86032 were stable across the locations for sucrose %. SNK 07658 showed high mean with non significant deviation from regression and regression coefficient close to unity indicating its adoptability to unfavorable environment. Commercial cane sugar

% (CCS %) and CCS yield being important quality (sugar yield) parameters for which genotypes like SNK 07342, SNK 07360, SNK 071013 and SNK 071138 were unpredictable as they exhibited significant deviation from the regression. Whereas SNK 07337, SNK 07680 and SNK 658 were stable and superior as compared to popular standard check Co 86032 for quality parameters. The same genotypes (SNK 07337 and SNK 07680) recorded significantly superior cane yield (111.92 and 120.41 t ha<sup>-1</sup> respectively) compared to popular check Co 86032 (97.37 t ha<sup>-1</sup>). These genotypes are stable across the generation for cane yield as indicated by their high mean coupled with non significant deviation from regression and regression coefficient close to unity (Table 3). In a study (Tahir et al., 2013) similar reports were made for cane yield whereas rest characters were not stable across locations.

The genotypes SNK 07680 and SNK 07337 were stable across locations for cane yield because their high mean and also they are significantly superior (population mean) compared to commercial check Co 86032 which is most popular variety cultivated and occupied major

area in peninsular India. These genotypes SNK 07680 and SNK 07337 also have commercially acceptable CCS% (11.98 and 11.31 respectively) and CCS yield (14.44 and 12.70 t ha<sup>-1</sup> respectively).

#### Mean performance for cane and sugar yield in clonal VII

The mean data on cane yield (t ha<sup>-1</sup>) and commercial cane sugar yield (CCS) (t ha<sup>-1</sup>) at four locations are presented in Table 4. Out of 8 genotypes studied, SNK 07680, SNK 07337 and SNK 07658 recorded significantly maximum cane yield (t ha<sup>-1</sup>) (120.41, 111.92 and 109.35 respectively) over the best available check Co 86032 (97.37).

Out of all the four locations, highest cane yield (t ha<sup>-1</sup>) has been observed in ARS Sankeshwar (106.13 t ha<sup>-1</sup>) followed by SNSI Belgaum and Nandi sugars Hosur (98.54 and 97.23 t ha<sup>-1</sup>, respectively) and the lowest was recorded at Shegunsi (92.68 t ha<sup>-1</sup>). The mean cane yield (t ha<sup>-1</sup>) over four environments was 98.64. Similarly

**Table 2.** Stability parameters for cane height, cane girth, single cane weight and number of millable canes over four locations.

Clone	Cane height (cm)			Cane girth (cm)			Single cane weight (kg)			Number of millable canes ('000/ha)		
	$\mu$	$b_i$	$S^2di$	$\mu$	$b_i$	$S^2di$	$\mu$	$b_i$	$S^2di$	$\mu$	$b_i$	$S^2di$
Snk 07337	171.86	0.99	0.007	2.66	1.01	0.009	1.31	1.01	0.009	85.44	1.08	12.021
Snk 07344	204.05	1.13	-0.011	2.24	2.23*	0.392*	1.38	1.19	-0.046	65.51	1.3	103.30*
Snk 07360	197.56	1.43	0.187*	2.88	2.11*	0.123	1.41	1.13	0.098	64.52	3.70*	117.67*
Snk 07342	186.38	1.68	-0.017	1.99	2.37*	0.383*	1.06	1.27	-0.869*	75.68	4.32*	98.67*
Snk 07658	183.81	1.04	0.015	2.56	1.39	0.044	1.53	0.98	0.023	71.47	0.96	31.04
Snk 07680	227.19	1.01	0.003	2.75	1.11	0.005	1.42	1.02	0.003	84.80	1.09	24.02
Snk 071013	204.44	-1.91*	0.075	1.89	-2.88*	0.432*	0.98	2.10*	0.034	79.72	3.59*	141.77*
Snk 071138	189.44	1.32	0.239*	1.68	-1.54	-0.324*	1.17	1.14	-0.213*	84.57	1.3	121.50*
Co 94012	198.08	1.24	0.08	2.2	1.21	0.211	1.07	1.24	0.032	94.83	2.11*	24.22
Co 86032	189.78	1.19	0.021	2.37	0.89	0.001	1.09	1.1	0.006	89.33	1.06	38.02
Co 92005	170.56	1.23	0.024	2.14	1.29	0.021	1.13	1.24	0.005	88.80	0.66	111.94**
CoM 265	215.06	-1.84*	0.190*	2.81	1.33	0.211	1.61	2.31*	0.008	64.72	1.57	24.48*
Mean	194.85			2.35			1.26			79.12		
C.D.@ 5%	11.29			0.12			0.08			9.86		
CV	5.56			4.68			9.94			11.08		

**Table 3.** Stability parameters for sugar yield parameters.

Clone	Sucrose %			Commercial Cane Sugar (CCS) %			CCS Yield (t/ha)			Cane Yield (t/ha)		
	$\mu$	$b_i$	$S^2di$	$\mu$	$b_i$	$S^2di$	$\mu$	$b_i$	$S^2di$	$\mu$	$b_i$	$S^2di$
Snk 07337	16.31	1.012	0.011	11.31	0.989	0.052	12.70	1.011	0.007	111.92	1.011	5.003
Snk 07344	16.24	1.093	-0.192	11.56	1.321	0.310*	10.42	1.831*	-1.041*	90.40	-1.313*	-121.61*
Snk 07360	15.93	1.312	0.124	11.36	1.421	-0.660*	10.38	1.043	0.061	90.98	1.594	82.21*
Snk 07342	16.78	1.382	-0.793	11.97	1.321	-0.105	9.61	1.612*	0.083	80.22	1.897*	90.34*
Snk 07658	15.28	0.997	0.029	10.90	1.021	0.033	11.97	1.019	0.006	109.35	0.905	5.003
Snk 07680	16.81	1.002	0.011	11.98	1.011	0.020	14.44	1.016	0.008	120.41	1.005	3.001
Snk 071013	16.58	1.994*	1.121*	11.74	0.769	0.601*	9.22	-2.210*	-1.052*	78.13	1.254*	101.18*
Snk 071138	15.13	2.123*	1.400*	10.80	-1.830*	-4.370*	10.65	-2.650*	-1.153*	98.95	-2.344*	-91.23*
Co 94012	18.32	1.003	0.005	13.15	1.130	-0.390	13.36	1.014	0.042	101.47	1.113	8.08
Co 86032	15.89	1.029	0.011	11.24	1.020	-0.355	10.97	1.015	0.002	97.37	1.044	9.04
Co 92005	16.27	1.212	-0.027	11.64	1.933*	0.320	11.68	1.042	0.002	100.34	-1.197*	90.29*
CoM 265	16.35	1.193	0.053	11.73	1.784*	-0.286	12.26	1.234	1.133*	104.20	-1.102	10.10
Mean	16.23			11.62			11.05			98.65		
C.D. @ 5 %	0.56			0.35			2.26			11.15		
CV %	4.93			5.26			10.24			12.58		

the mean data on commercial cane sugar yield (CCS) ( $t\ ha^{-1}$ ) for four locations indicated that, SNK 07680, and SNK 07337 recorded significantly maximum commercial cane sugar yield ( $t\ ha^{-1}$ ) (14.44 and 12.70 respectively) over the best available check Co 86032 (10.97). Among all the four locations, highest commercial cane sugar yield ( $t\ ha^{-1}$ ) has been observed in ARS Sankeshwar ( $12.75\ t\ ha^{-1}$ ) followed by Nandi sugars Hosur and SNSI Belgaum (11.52 and 11.34 respectively) and the lowest was recorded at Shegunsi ( $10.28\ t\ ha^{-1}$ ). The mean

commercial cane sugar yield ( $t\ ha^{-1}$ ) over three environments was 11.47.

#### Mean performance for juice quality parameters in clonal VII

The mean data on sucrose percentual content at harvest for four locations are presented in Table 5. Out of 8 genotypes SNK 07680 and SNK 07342 recorded

**Table 4.** Mean performance of top productive clones along with checks for cane and sugar yield parameters over four locations.

Clone number	Cane yield (t/ha)					CCS yield (t/ha)				
	Env-1	Env-2	Env-3	Env-4	Pooled	Env-1	Env-2	Env-3	Env-4	Pooled
Snk07 337	109.57	102.7	106.21	129.23	111.92	12.82	11.01	11.5	15.48	12.70*
Snk07 344	81.4	77.7	77	125.52	90.4	9.03	9.33	9.04	14.29	10.42
Snk07 360	117.09	88	80.33	78.5	90.98	13.89	9.8	8.66	9.16	10.38
Snk07 342	90.01	71	86	73.86	80.22	12.11	8.25	8.84	9.25	9.61
Snk07 658	119.02	114.3	107.67	96.39	109.35	13.59	13.22	11.56	9.52	11.97
Snk07 680	129.57	112.7	114.67	124.74	120.41	15.95	13.5	13.6	14.71	14.44*
Snk07 1013	89	79.7	70.67	73.18	78.13	11.17	9.77	7.58	8.35	9.22
Snk07 1138	89	99.3	102	105.46	98.95	10.12	11.74	10.35	10.41	10.65
<b>Checks</b>										
Co 94012	90.81	110.2	101	103.85	101.47	11.76	15.18	12.69	13.81	13.36
Co 86032	124.26	92.3	85.67	87.22	97.37	14.25	10.53	9.03	10.08	10.97
Co 92005	101.33	102.5	91	106.49	100.34	12.06	12.51	10.32	11.83	11.68
CoM 0265	132.5	116.3	90	77.98	104.2	16.3	13.37	10.24	9.15	12.26
μ	106.13	97.23	92.68	98.54	98.64	12.75	11.52	10.28	11.34	11.47
C.D.@ 5%	16.23	13.85	12.22	18.58		1.96	1.87	1.6	2.3	1.14
C.D.@ 1%	22.9	19.55	17.24	26.22		2.76	2.63	2.26	3.25	1.61

Env-1 = ARS Sankeshwar, Env-2 = Nandi Sugars, Hosur, \* - Significant at 5% probability level, Env-3 = Shegunsi, \*\* - Significant at 1% probability level, Env-4 = SNSI Belagum.

**Table 5.** Mean performance of top productive clones along with checks for juice quality parameters over four locations.

Clone number	Sucrose % at harvest					CCS % at harvest				
	Env-1	Env-2	Env-3	Env-4	Pooled	Env-1	Env-2	Env-3	Env-4	Pooled
Snk 07337	17.08	16.53	14.96	16.69	16.31	11.70	10.73	10.83	11.98	11.31
Snk 07344	16.05	16.78	16.32	15.79	16.24	11.09	12.02	11.74	11.39	11.56
Snk 07360	17.06	15.41	14.96	16.29	15.93	11.86	11.14	10.78	11.67	11.36
Snk 07342	19.27	16.17	14.14	17.53	16.78*	13.45	11.62	10.28	12.53	11.97*
Snk 07658	16.29	15.99	14.87	13.96	15.28	11.42	11.57	10.73	9.87	10.90
Snk 07680	17.63	16.74	16.40	16.47	16.81*	12.31	11.98	11.86	11.79	11.98*
Snk 071013	18.14	17.43	14.87	15.88	16.58	12.55	12.26	10.73	11.41	11.74
Snk 071138	16.17	16.32	14.18	13.86	15.13	11.37	11.81	10.15	9.87	10.80
<b>Checks</b>										
Co 94012	18.76	19.07	17.01	18.44	18.32	12.95	13.77	12.56	13.30	13.15
Co 86032	16.52	16.24	14.63	16.18	<b>15.89</b>	11.47	11.40	10.54	11.56	<b>11.24</b>
Co 92005	17.06	16.82	15.72	15.47	16.27	11.91	12.20	11.34	11.11	11.64
CoM 0265	17.21	15.94	15.86	16.40	16.35	12.30	11.49	11.38	11.73	11.73
<b>Mean</b>	<b>17.27</b>	<b>16.62</b>	<b>15.33</b>	<b>16.08</b>	<b>16.23</b>	<b>12.03</b>	<b>11.83</b>	<b>11.08</b>	<b>11.52</b>	<b>11.62</b>
C.D.@ 5%	0.92	0.84	0.83	1.16	0.73	0.63	0.68	0.64	0.86	0.55
C.D.@ 1%	1.29	1.18	1.17	1.64	1.04	0.89	0.96	0.90	1.22	0.78
CV	5.90	5.59	6.00	8.03	5.01	5.85	6.37	6.44	8.35	5.26

Env-1 = ARS Sankeshwar, Env-2 = Nandi Sugars, Hosur, \* - Significant at 5% probability level, Env-3 = Shegunsi, \*\* - Significant at 1% probability level, Env-4 = SNSI Belagum.

significantly maximum sucrose percentual content at harvest (16.81 and 16.78 respectively) compared to the best commercial check Co 86032 (15.89), whereas SNK

07337 and SNK 071013 (16.31 and 16.58) recorded sucrose per cent at harvest on par with Co 86032. Among all the four locations, highest sucrose percent at

**Table 6.** Multiple linear regression model to explain cane yield variation using some its related characters.

Regression parameter for cane yield	Regression coefficient (b)	Standard Error (SE)	Probability level (P-value)	Variance inflation factor (VIF)
Single cane weight (SCW)	2.75 **	0.680	000	5.42
Cane height (CH)	-0.007	0.002	0.10	4.06
Cane girth (CG)	0.122	0.318	0.47	5.45
No. millable canes (NMC)	1.423 **	0.066	000	4.20
Intercept		-12.75		
Model sig.		000		
R <sup>2</sup>		81.13		
Adjusted R <sup>2</sup>		76.3		
R <sup>2</sup> of eliminated traits		3.10		

**Table 7.** Multiple linear regression model to explain sugar yield variation using some its related characters.

Regression parameter for sugar yield	Regression coefficient (b)	Standard Error (SE)	Probability level (P-value)	Variance inflation factor (VIF)
CCS %	3.015 **	0.518	001	6.21
Purity % (P)	-0.007	0.007	0.21	3.87
Brix %	0.198	0.411	0.48	6.22
Juice Extract (JE)	0.047	0.077	0.27	2.88
Sucrose % (S)	1.784 **	0.101	000	3.97
Intercept		-8.99		
Model sig.		000		
R <sup>2</sup>		88.73		
Adjusted R <sup>2</sup>		84.63		
R <sup>2</sup> of eliminated traits		2.22		

harvest has been observed in ARS Sankeshwar (17.27) followed by Nandi sugars Hosur and SNSI Belgaum (16.62 and 16.08 respectively) and the lowest was recorded at Shegunsi (15.33). The mean sucrose per cent at harvest over four environments was 16.23.

The mean data on CCS per cent at harvest for four locations are presented in Table 3. Out of 8 genotypes SNK 07680 and SNK 07342 recorded significantly maximum CCS percent at harvest (11.98 and 11.97 respectively) compared to the best commercial check Co 86032 (11.24), whereas SNK 07337 and SNK 071013 (11.31 and 11.74) recorded sucrose per cent at harvest on par with Co 86032. Among all the four locations, highest CCS percent at harvest has been observed in ARS Sankeshwar (12.03) followed by Nandi sugars Hosur and SNSI Belgaum (11.83 and 11.52 respectively) and the lowest was recorded at Shegunsi (11.08). The mean sucrose percent at harvest over four environments was 11.62.

### Multiple linear regression analysis

Regression coefficients and their significance for some

quantitative traits in predicting cane yield (CY) (Table 6) and sugar yield (SY) (Table 7) using full model regression, the prediction equation for cane yield and sugar yield was formulated as follows:

Cane Yield

$$= -12.75 + 2.75(SCW) - 0.007(CH) + 0.122(CG) + 1.423(NMC)$$

Sugar Yield

$$= -8.99 + 3.015(CCS\%) - 0.007(P) + 0.198(Brix\%) + 0.047(JE\%) + 1.784(S\%)$$

In addition to the high significance of the used model ( $P < 0.01$ ), it successfully accounted for 81.13% of the total variation of cane yield expressed as  $R^2$ . The residuals content (18.87 %) may be attributed to unknown variation (random errors), human errors during measuring the studied traits and/or some other traits that were not in account under the present investigation. Furthermore, results showed that the single cane weight, number of millable canes, cane girth and cane height significantly contributed towards cane yield while the other traits did not (negligible contribution of 3.10). A contribution of 88.73% to sugar yield was made by CCS% alone expressed as  $R^2$ , residual was to the tune of 11.27%

which is because of the random errors, so this indicated that CCS% and Sucrose % are the important traits contributing to the sugar yield while a contribution of other traits for sugar yield was only 2.22.

On the other hand, the values of variance inflation factor (VIF) for all studied characters were less than ten for both cane and sugar yield, indicating trivial influence of multi co linearity problem. The present results ensured the goodness of fit for the proposed model of regression (Hussein et al., 2012).

The present study revealed that SNK 07680 and SNK 07337 were stable for most of the characters namely, single cane weight, number of millable canes, sucrose%, CCS yield and cane yield. Similarly SNK 07658 is stable for cane eight, CCS% and CCS yield. Overall the outstanding genotypes were SNK 07680, SNK 07337 for cane yield and sugar yield and genotype SNK 07658 for sugar yield. These genotypes were superior to other genotypes and checks by their per se performance and stability. Regression coefficients and their significance for both cane and sugar yield indicates that, SCW and NMC are major contributors for cane yield, where as Sucrose% and CCS % are major contributors for sugar yields.

### Conflict of Interest

The authors have not declared any conflict of interest.

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