Academic Journal of Plant Sciences 5 (4): 119-122, 2012
ISSN 1995-8986

DOI: 10.5829/idosi.ajps.2012.5.4.1910

Correlation Pattern among Morphological and Biochemical Traits in Relation to Tillering Capacity in Sugarcane (*Saccharum* Spp)

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Abstract: The present study was carried out during 2005-2006 at the Sugarcane Research Centre, (14, 48 N^0), Sudan, to study pattern of correlation among eleven morphological and biochemical traits in sugarcane (*Saccharum* spp) clones.. The results indicated that number of tillers at 60 days plant age showed positive association with number of millable cane at harvest and cane yield. It was found that cane yield had non significant positive association with juice pol and purity. The association among tiller counts, cane formed tillers at 180 days and number of millable cane at harvest was found positive and the strength of correlation was higher when the time interval between any of the two stages was less.Stalk height showed positive association with cane yield and number of internode per stalk, where it's association with juice brix and juice pole percentages was negative.

Key words: Cane characters · Cane yield · Juice quality · Simple correlation · Plant cane

INTRODUCTION

Sugarcane (*Saccharum* spp) is a complex polyploid derived through interspecific hybridization and back crosses involving the three major species namely, *Saccharum officinarum* L., *Saccharun spontaneum* L. and *Saccharum sinensis*. It is an important source of sugar produced worldwide in over 120 countries. The total world sugar during the 2008-2009 is estimated to be 161 million tones. Nearly 80 % of sugar produced is from sugarcane, while the remaining 20% is contributed by sugar beet [1]. Yield is a complex, quantitatively inherited character, involving various traits. Therefore, selection based on a single trait might often be misleading, Stevenson [2] reported there may not be specific genes controlling the complex characters, but the sum total of their components might be influencing the important economic characters namely*;* cane and sugar yield.

Correlation coefficient is statistical measure that denotes the degree and magnitude of association between any two casually related variables [3]. This association is due to peliotropic gene action or linkage or more likely both [4]. In plant breeding correlation coefficient analysis measures the mutual relationship between two characters and it determines characters association for improvement of yield and other economic traits. Since the association pattern among yield components help to select superior genotype from divergent population based on more than one interrelated characters. Thus, information on the degree and magnitude of association between characters is of prime important for the breeder to initiate any selection plan. The present study was therefore carried out to know the nature and extend of association among the morphological and biochemical traits in sugarcane.

MATERIALS AND METHODS

Experimentation: The experimental materials consisted of twelve sugarcane clones (BBZ8210, BBZ 92167, BB Z95869, BJ 7555, BJ 8805, BJ 82103, BJ 84111, BJ 88105, BR 913005, BT 83186, BT 83339 and B911421) along with the check variety Co 6806. The tested material were introduced during 2003 season from West Indies Central Sugarcane Breeding Station at Barbados for local selection program at the Sugarcane Research Centre-Gunied (14, 48-15.00° N) and (33, 13-32, 22°E) where the soil is of Suliem series with clay content of 42-61%, calcareous and mildly to strongly alkaline in reaction. The material was laid during 2005 in randomized complete block design with four replicates with plots each contained four rows of 10 meters long each and 155 cm inter-row spacing.

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Crop Nutrition and Maintenance: The standard cultural practices such as irrigation, fertilizers and pesticide application were carried out as recommendations. Nitrogen in the form of urea and phosphorous fertilizers as P_2O_5 were applied as ful doses at planting as at a rate of 465 kg/ha and at 116kg/ha, respectively. All agronomic practices were kept normal for genotypes through the growing season. At 14 months of age the crop was harvested manually.

Collection of Data: Data were recorded on eight morphological and three biochemical characters as follows:

Ten guarded plants were selected at random from each plot considering the two inner rows in each plot to record observations on different morphological characters namely; tillers count at 60 days of age, cane formed tillers at 180 days of age, stalk height, stalk diameter, single stalk weight, number of millable cane and number of internode per stalk, as well as biochemical traits namely, juice brix percent, juice pol percent and juice purity percent. The biochemical traits were estimated following the method suggested by Schneider [5].

Data Processing: Data were collected on different characters and were statistically analyzed using Excel spread work sheet. Analysis of variance, test of significance of difference of means was worked out by referring to the F- table given by Snedecor and Cochran [6]. Estimation of standard error and critical difference were carried out as per Panse and Sukhatme [7].

Assessment of Correlation: Using simple correlation between any two characters, y and x andthe formula adopted by Phundan Singh and Naryanan [3], correlation coefficient was estimated as follows:

$$r_{xy} = \frac{Cov(x, y)}{\sqrt{Var\ x} \times \sqrt{Var\ y}}$$

Where, Var x, Var y: variance of x variable, variance of y variable respectively

r_{xy}: Correlation coefficient betweenany two different characters

Cov (x.y): Covariance between any two characters

Test of significant of correlation coefficient (r) was carried out by referring to (t) table given by Snedecor and Cochran [6] using (n-2) degree of freedom.

RESULTS AND DISCUSSION

Analysis of variance results revealed significant differences between genotypes with regard to morphological and biochemical traits indicated sufficient genetic variations among the genotypes. The *inter se* correlation among population characters namely, tiller counts at 60 days, cane formed tillers at 180 days of age and number of millable cane at harvest was found positive (Table 1). It is noticed that the strength of correlation between the above three traits was higher when the time interval between two stages was less indicated that each sequent stage was dependent on the previous one. The association of tillers counts with all biochemical traits was found positive. Won-Chon and Martin [8] reported tillering in sugarcane was desirable for maximum yield of millable cane and sucrose content at harvest. Therefore, selection for tiller capacity might be effective to attain clones with high yield.

Singh and Singh [9], reported among the cane yield components affecting the final yield of sugarcane are the number of millable cane, stalk weight and stalk diameter, stalk height and number of internodes per stalk. These characters were found to associate in different ways. Number of millable cane showed significant positive association with cane yield. Hence selection should be practiced for clone that gave higher number of millable cane at harvest in order to improve cane yield. High and positive correlation coefficient between number of millable cane and cane yield was previously reported by James [10].

On the other hand, stalk height showed positive association with cane yield and number of internode per stalk. Hogarth [11] obtained a positive correlation between stalk height and cane yield. However the associations of stalk height with juice brix and juice pole percentages were negative, indicated that selection for high cane yield through stalk height should be rational since stalk height is negatively associated with these juice quality traits, because selection for tall cane might result in negative response ofthese quality trait.

Srivastava *et al* [12] reported cane was mainly governed by initial growth phases *i.e.,* germination which affect the production of tillers and finally number of millable stalk one of the main yield contributing characters.Tillering capacity at 60 days showed positive association with number of millable cane and cane yield indicated the importance of tillering to dictate the final cane yield. According to Thanagavellu [13] tillering phase

Table 1: Correlation pattern among eleven morphological and biochemical traits in tested sugarcane clones

Character	TLC	CFT	STH	INN	STD	SSW	BRX	POL	PUR	CYD	NMC
TLC 60	1.000	.682**	-.121	-.183	.068	-.333	.089	.159	.189	.176	.517
CFT	.682**	1.000	.116	-.261	-.135	-.347	-.125	.096	.059	.587*	.842**
STH	-.121	.116	1.000	.611	.078	.697**	-.468	-.096	.069	.740**	.283
INN	-.183	-.261	.611*	1.000	.463	.737**	-.177	.303	.476	.381	-.126
STD	.068	-.135	.078	.463	1.000	.421	.161	-.028	.200	.102	-.103
SSW	-.333	-.347	.697**	.737	.421	1.000	-.123	-.231	-.009	.372	-.323
BRX	.089	-.125	-.468	-.177	.161	-.123	1.000	.346	.209	-.432	-.343
POL	.159	.096	-.096	.303	-.028	-.231	.346	1.000	.904**	.003	.198
PUR	.189	.059	.069	.476	.200	-.009	.209	.904**	1.000	.151	.229
CYD	.176	.587*	.740**	.381	.102	.372	-.432	.003	.151	1.000	.629*
NMC	.517	.842**	.283	-.126	-.103	-.323	-.343	.198	.229	.629*	1.000

*Significant at 5%level of significance **Significant at 1%level of significance

Where, TLC60:Tillers count at 60 days of age CFT: Cane formed tiller 180 days STH - Stalk height (cm)
INN: Internode number per stalk STD: Stalk diameter (cm) SSW:Single stalk Weight (kg)
NMC - Number of millable cane at harvest. CYD:Cane yield (Ton/ha) BRX:Juice brix (%)
POL: Juice pol (%) PUR: Juice purity (%)

largely determine the productivity of the sugarcane crop. Walker [14] reported that tillering is most important tonnage component and tillering could be improved by selection for individual with high number of side buds. Therefore, selection should be paid for high tillering variety to secure high cane yield at havest, Parathatharthy [15] reported germination and subsequent tillering are important factors for deciding the final population of millable cane at harvest. Kamat and Singh [16] reported positive association between millable cane and number of tillers at 60 days of age where it's association with biochemical traits is found non significant. In this study association of tillers count to the biochemical traits namely, juice purity, juice brix and juice pole percent was non significant, this might be due to the varieties difference in maturity date. As per Sastri and Venkatachari [17], quality of cane juice depends upon many factors like variety and age of the crop. The association of cane yield character with biochemical traits namely, juice pol percent and juice purity percent was found non significant, indicated these characters are independent. Anshuman *at al*. [18] reported that cane yield had non significant association with juice brix and juice purity and sucrose. Therefore, simultaneous improvement of these characters might be possible.

Number of millable cane at harvest showed negative association with stalk diameter. However, both characters are positively associated with cane yield. Therefore, indirect selection for cane yield through millable cane should be balanced because the negative correlation between stalk number and stalk diameter.

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