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CORRELATION AND PATH ANALYSIS IN SOME INDIGENOUS AND EXOTIC PROMISING CLONES OF SUGARCANE

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ABSTRACT

A study on the character association and relative contribution of different characters on cane yield in sugarcane was conducted using 25 promising clones and two standard varieties. The characters considered were number of tiller, number of millable cane per hectare, number of millable cane per clump, stalk height, stalk girth, single stalk weight, number of green leaf, leaf length, leaf breadth, cane yield and sucrose percentage. In general, the genotypic correlations were higher than the corresponding phenotypic correlation. In most cases, there was a strong inherent relationship between the characters. The correlation coefficients between the number of millable cane per hectare, number of millable cane per clump, single stalk weight and cane yield were highly positive significant, but sucrose percentage, stalk girth, leaf length, leaf breadth and number of green leaf had significant negative correlation with cane yield. The path coefficient studies indicated that number of millable canes per hectare and single stalk weight were the most important contributors to cane yield per hectare. Hence, these two characters could be chosen as the most important selection criteria for the improvement of cane yield in sugarcane.

Key words: character association, correlation, path analysis and sugarcane

INTRODUCTION

Path analysis is a powerful tool for partitioning the correlation co-efficient into direct and indirect effects and drawing a conclusion regarding the application of suitable selection pressure on them for an overall improvement of cane yield. It is obvious that yield from a cane crop is a complex character governed by a number of contributing factor, which are interrelated and interdependent. All the component factors are not contributing equality to the yield and, before going into the selection process respective contribution to the yield should be determined. Under such circumstances path analysis (Wright, 1921) helps to determine direct and indirect causes of association. Direct selection for cane yield could be misleading since it is a complex qualitative character and is largely influenced by many dependent variables. Knowledge of interrelationship among the yield components and their contribution towards yield is useful in an effective breeding programme. Therefore, it is needed to estimate the correlation between cane yield and yield components as well as to estimate the direct and indirect effects of different yield components on cane yield in different sugarcane varieties where lays the importance of this experiment.

MATERIALS AND METHODS

The experiment was conducted at the Bangladesh Sugarcane Research Institute (BSRI), Ishurdi, Pabna during the cropping season of 2005-2006.

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The experiment was comprised of twenty seven (27) sugarcane clones/varieties as experiment materials of which two (Isd 16 & Isd 36) were considered as standard varieties (Table 1). The soil was sandy loam in texture with pH 7.5. The experiment was laid out in RCBD with three replications and plot size was 6m x 5m where row to row distance maintained 1 meter. The planting was done on the 8th December 2005 through conventional sett placement in the trences with three eyed buds. Recommended rates of fertilizers were used in the experiment. Intercultural operations were done as and when required. Different data were recorded and the cane was harvested in the second week of December, 2006.

Table 1. List and sources of clones/varieties used in the experiment

No.	Name of the clones/varieties	Parentage	Source of materials	Remarks
1	I 13-02	Isd 19 x I 36-91	BSRI	BSRI Bred
2	I 18-02	Isd 24 x CPI 96-80	BSRI	BSRI Bred
3	I 20-02	Isd 19 x LCP 86-454	BSRI	BSRI Bred
4	I 26-02	COL 33 x Isd 28	BSRI	BSRI Bred
5	I 27-02	CP 44-155x LCP 86-454	BSRI	BSRI Bred
6	I 52-02	I 8-92 x Co 642	BSRI	BSRI Bred
7	I 54-02	CP 85-1439 x Isd 28	BSRI	BSRI Bred
8	I 55-02	Phill 48-15 x B 34-231	BSRI	BSRI Bred
9	I 65-02	Co 1148x I 101-66	BSRI	BSRI Bred
10	I 81-02	POJ 2878 x Co 642	BSRI	BSRI Bred
11	I 84-02	POJ 2878 x Co 642	BSRI	BSRI Bred
12	I 85-02	POJ 2878 x Co 642	BSRI	BSRI Bred
13	I 87-02	Co 630 x I 2880	BSRI	BSRI Bred
14	I 100-02	Co 630 x I 2880	BSRI	BSRI Bred
15	I 140-02	L-5 x BO 43	BSRI	BSRI Bred
16	I 145-02	CO 1158 x CP 55-30	BSRI	BSRI Bred
17	I 163-02	I 174-93 x CO 642	BSRI	BSRI Bred
18	I 191-02	Isd 28 x B 34-231	BSRI	BSRI Bred
19	I 193-02	Isd 28 x B 34-231	BSRI	BSRI Bred
20	K 88-65	Exotic germplasm	Thailand	Exotic
21	K 84-69	Exotic germplasm	Thailand	Exotic
22	K 88-87	Exotic germplasm	Thailand	Exotic
23	K 88-92	Exotic germplasm	Thailand	Exotic
24	VMC 71-234	POJ 3016 x Phil 56-226	Philippine	Exotic
25	VMC 84-549	PR 1059 x CB 45-3	Philippine	Exotic
26	Isd 16	CP 36-13 x BO. 32	BSRI	Commercial varieties used as standard
27	Isd 36	CP 70-1133 x ? ? = Poly cross	BSRI	Commercial varieties used as standard

I, Isd = Ishurdi
BSRI = Bangladesh Sugarcane Research Institute
K = Kasetsart (Breeding station, Kasetsart University, Thiland)
VMC = Victorias Milling Company

Correlation co-efficients between different characters were estimated following standard formula (Hays *et al.,* 1955). The co-efficient of path analysis was obtained by solution of simultaneous evaluations as reported by Dewey and Lu (1959).

RESULTS AND DISCUSSIONS

Correlation: Genotypic and phenotypic correlation co-efficients between cane yield and its component characters are presented in Table 2.

Table 2. Genotypic and phenotypic correlation coefficients among yield and yield contributing characters in sugarcane

Characters		Number of tillers ($x10^3ha^{-1}$)	No.of millable canes ($x10^3ha^{-1}$)	No. of millable canes/ clump	Stalk height (m)	Stalk girth (cm)	Single stalk weight (kg)	No. of green leaf	Leaf length (m)	Leaf breadth (cm)	Cane yield (t/ha)	Sucrose percentage
Number of tillers ($x10^3ha^{-1}$)	G	1										
	P	1										
Number of millable cane ($x10^3ha^{-1}$)	G	0.9738**	1									
	P	0.6353**	1									
Number of millable canes/clump	G	0.4556*	0.5943**	1								
	P	0.4127*	0.4290*	1								
Stalk height (m)	G	0.3757	0.6233**	0.2348	1							
	P	0.3705	0.3966*	0.2202	1							
Stalk girth (cm)	G	-0.4921**	-0.5691**	-0.7966**	-0.5237**	1						
	P	-0.2208	-0.1443	-0.2681	-0.2429	1						
Single stalk weight (kg)	G	-0.1594	-0.1160	-0.1973	-0.0112	0.4600*	1					
	P	-0.1519	-0.0396	-0.1765	-0.0083	0.2380	1					
No. of green leaf	G	-0.0273	0.1514	0.3010	0.0305	-0.4342*	-0.2230	1				
	P	-0.0288	0.1020	0.2877	0.0283	-0.2006	-0.2161	1				
Leaf length (m)	G	-0.2652	-1.0743	-0.1383	-0.0029	0.3335	0.2957	-0.4864*	1			
	P	-0.0398	-0.0719	0.0189	-0.0163	-0.0156	0.0605	-0.0630	1			
Leaf breadth (cm)	G	-0.1268	-0.2450	-0.4694*	0.0305	0.7402**	0.6095**	-0.5590**	0.1392	1		
	P	-0.1122	-0.1324	-0.3842*	0.0173	0.3298	0.5348**	-0.4659**	0.0520	1		
Cane yield (t/ha)	G	0.6628**	0.7284**	0.3277	0.4974**	-0.2085	0.5884**	-0.0369	-0.6413**	0.1907	1	
	P	0.4778*	0.8309**	0.2706	0.3531	-0.0222	0.4959**	-0.0254	-0.0303	0.1554	1	
Sucrose percentage	G	-0.0044	-0.3596	0.2174	-0.0300	-0.4525*	-0.3482	0.2493	0.5677**	-0.2852	-0.590**	1
	P	0.0163	-0.1106	0.0598	-0.0076	-0.0796	-0.1711	0.1246	0.1268	-0.1668	-0.198	1

P= Phenotypic correlation coefficients ** Significant at 1% level of probability
G = Genotypic correlation coefficients * Significant at 5% level of probability

Correlation analysis among cane yield and its contributing characters indicated that the genotypic correlation coefficient in most cases were higher than their phenotypic correlation coefficient indicating the association in largely due to genotypic reason. In some cases phenotypic correlation coefficient where higher than genotypic correlation indicating suppressing effect of the environment which modified the expression of the characters at phenotypic level. However, magnitude of genotypic correlation revealed a good extent of strong inherent association between characters. It was revealed that number of tillers, number of millable canes per hectare, stalk height and single stalk weight were showed highly significant positive correlation's with cane yield. It indicates the effectiveness of these characters for direct selection for the genetic improvement of cane yield in sugarcane. Significant positive correlation between the number of millable canes and cane yield was reported by Mannan and Ghafur (1983); Singh *et al.,*1984; Chauhan *et al.,* 1987; Reddy and Reddy (1988) and Gajera *et al.,* 1991. Significantly negative correlation was found in leaf length and sucrose percentage. Similar negative correlation between the sucrose percentage and cane yield was also reported by Khairwal and Babu (1975) and Reddy (1986).

Stalk girth showed significant positive correlation with the leaf breadth and single stalk weight. Singh *et al.,* (1981) and Rai *et al.,* (1988) also reported significant positive correlation between stalk girth and single stalk weight. Lu (1984) observed significant correlation's both for single stalk weight and cane yield with stalk girth. Single stalk weight was significantly and positively associated with leaf breadth and cane yield. Similar results were found by Khairwal and Babu (1975) and Mannan and Ghafur (1983). Number of green leaf had highly significant negative correlation with leaf length and leaf breadth.

Path analysis: The correlations were further analyzed by path coefficient method, which involve partitioning the correlation co-efficients into direct and indirect effects through alternate pathways (Table 3). Cane yield was considered as resultant variable and number of tillers per hectare, number of millable canes per hectare, stalk height, stalk girth, single stalk weight and sucrose percentage as casual variables. Path analysis revealed that number of tillers per hectare had negative direct effect on cane yield and high indirect positive effect via number of millable cane per hectare. According to Chauhan *et al.,*(1987*)* number of tillers had positive direct effect on cane yield but it affected cane yield indirectly in positive direction via number of millable cane. Number of millable canes per hectare showed highly positive direct effect on cane yield per hectare. The results indicated that increased in number of millable canes per hectare increased the cane yield. Similar direct positive effect of number of millable canes on cane yield was reported by Khairwal and Babu (1975); Mannan and Ghafur (1983) and Chauhan *et al.,* (1987). Number of millable cane per clump was positive direct effect on cane yield. Hence, selection should be practiced for those clone, which have large number of millable canes/clump in order to improve cane yield. Almost all traits on number of millable cane per clump had direct effect on sucrose content (Sharma and Singh, 1984). Stalk height had negative direct effect on cane yield. The direct effect of stalk girth on cane yield was positive. The positive direct effect indicated that varieties with high stalk girth could be developed without sacrificing cane yield per hectare. The direct effect of single stalk weight on cane yield was highly positive. Positive direct effect of the single stalk weight on cane yield was also reported by Khairwal and Babu (1975) and Lu (1984) and Kang *et al.,* (1990). Direct effect of number of green leaf, leaf length and leaf breadth on cane yield was negative Sucrose percentage had negative direct effect on cane yield. Khairwal and Babu (1975) also reported negative direct effect of sucrose percentage on cane yield. The results of path coefficient studies indicated that number of millable canes per hectare and single stalk weight were the most important contributors to cane yield per hectare. These characters could be chosen as selection criteria for the improvement of cane yield in sugarcane.

Table 3. Path coefficient analysis of yield and yield contributing characters based on genotypic correlation coefficients of cane yield per hectare

Characters	Number of tillers ($x10^3ha^{-1}$)	No.of millable canes ($(x10^3ha^{-1})$)	No. of millable canes/ clump	Stalk height (m)	Stalk girth (cm)	Single stalk weight (kg)	No. of green leaf	Leaf length (m)	Leaf breadth (cm)	Sucrose percentage	Genotypic correlation coefficient of cane yield /ha
Number of tillers ($x10^3ha^{-1}$)	**-0.173682**	0.760481	0.034719	-0.011935	-0.093586	-0.129772	0.001777	0.000318	0.009429	0.000128	0.662
Number of millable cane($x10^3ha^{-1}$)	-0.169132	**0.780940**	0.045286	-0.019802	-0.108220	-0.094428	-0.009843	0.001287	0.018226	0.010355	0.728
Number of millable canes/clump	-0.079136	0.464122	**0.076199**	-0.007460	-0.151481	-0.160646	-0.019566	0.000166	0.034912	-0.006260	0.328
Stalk height (m)	-0.065251	0.486803	0.017895	**-0.031768**	-0.099572	-0.009122	-0.001985	0.000003	-0.002269	0.000865	0.497
Stalk girth (cm)	0.085479	-0.444448	-0.060702	0.016635	**0.190154**	0.374439	0.028224	-0.000399	-0.055048	0.013032	-0.209
Single stalk weight (kg)	0.027688	-0.090588	-0.015037	0.000356	0.087466	**0.814045**	0.014493	-0.000354	-0.045333	0.010027	0.588
No. of green leaf	0.004747	0.118256	0.022936	-0.000970	-0.082563	-0.181496	**-0.065004**	0.000583	0.021215	-0.007180	-0.037
Leaf length (m)	0.046067	-0.838956	-0.010538	-0.031768	0.063408	0.240694	0.031619	**-0.001198**	0.041573	-0.016349	-0.641
Leaf breadth (cm)	0.022019	-0.191380	-0.035770	0.016635	0.140747	0.496186	0.36336	-0.000167	**-0.074373**	0.008215	0.191
Sucrose percentage	0.000774	-0.280789	0.016563	0.000954	-0.086045	-0.283424	-0.016207	-0.000680	0.021215	**-0.028800**	-0.590

Underlined figures indicate direct effects.

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