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Path Analysis in Intervarietal Crosses of Sugarcane

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ABSTRACT

Path coefficient analysis was done for yield per clump (YPC) and 12 other economic yield contributing characters in 20 intervarietal crosses of sugarcane. Yield per clump showed higher significant positive correlation with tiller per clump (TC), number of millable cane per clump (NMC), single stalk weight (SSW) and stalk density (SD). Path analysis (phenotypic and genotypic) revealed positive direct effect of NMC, SSW on YPC. Higher negative direct effect of SD on YPC via cane diameter (SD), stalk volume (CV), SSW, NMC and NI were established. Thus, yield improvement could be achieved by practising selection for number of millable cane and single stalk weight.

Key words : Path analysis, sugarcane, intervarietal crosses.

INTRODUCTION

Sugarcane yield is a complex quantitative character governed by many yield contributing characters. As improved yield as a major objective, so the knowledge of association of the characters contributing to yield are of important to plant breeder. The path coefficient provides an efficient tool in finding out direct and indirect contributions of different yield contributing characters towards yield.

Brown *et al.* (1968) and James and Miller (1971) considered the character stalk weight as one of the main components of cane yield. However, stalk weight in turn is determined by diameter, stalk length and stalk density (James, 1971). But much was not known at present on the association of stalk weight with its component character. Hence, the path analyses is therefore undertaken with yield per clump in 20 intervarietal crosses of sugarcane.

MATERIALS AND METHODS

The material comprised of 117 seedlings in each of 20 intervarietal crosses, at the first clonal generation. The seedling in randomised complete block design with three replications were planted in the experimental field of Bangladesh Sugarcane Research Farm (BSRI), Ishurdi, Pabna in 1994. Necessary intercultural operations such as mulching, weeding and irrigation were done as and when necessary. From growing phase to harvest data on different parameters like, tiller / clump (TC), number of internode (NI), length of five internode (LI), stalk volume (SV), stalk density (SD), leaf area (LA), leaf number (LN), yield per clump (YPC) and Hand Refractrometer Brix (%) were collected from ten clumps selected randomly in each plot. Canee volume was determined by using the average length of 10 randomly selected stalk samples by the formula, $SV = \pi\ (CD/2)\ L$ (James, 1971). Stalk density was calculated as weight divided by volume. Path coefficient analysis was carried out in accordance with Wright (1921), Dewey and Lu (1959).

RESULTS AND DISCUSSION

Path coefficient analysis which measure the direct as well as indirect effect of one variable through another on the end product was worked out for 13 characters at both phenotypic and genotype levels. The direct and indirect effects of the component characters on yield per clump (YPC) was estimated for each contributing character. Partitioning of the correlation into path coefficients (Tables 1 and 2) has rightly projected the importance of components viz. stalk density (SD), NMC, TC, CD, CL, and SSW. Single stalk weight had positive correlation with cane yield but with CL, NI showed no association. Stalk density showed significant positive correlation with cane yield per clump and negative direct effect was balanced by positive indirect effect via CD, SV, SSW, NMC, NI. At phenotypic level significant positive correlation of YPC with SD was due to positive indirect effect via SSW, CD and CL. As density was calculated on weight divided by volume as a product of diameter and length, this also account for negative indirect effects of cane length and diameter on stalk weight via stalk density. Groves *et al.* (1991) reported on the basis of path coefficient analysis that stalk volume was the major factor determining stalk weight.

The significant positive correlation between cane yield per clump and tiller per clump was primarily due to the result of positive indirect of millable cane and diameter. In the same way, the positive significant association between YPC and NMC was due to positive direct effect of millable cane and positive indirect effect of SSW, CD, SV and negative indirect of stalk density and tillers. The phenotypic direct effect of NMC on YPC was balanced via positive indirect of CD. Further, the positive and highly significant association of stalk weight with yield per clump was due to positive direct effect of stalk weight and positive indirect of CD, NMC, LI, SV and negative indirect of stalk density. These observation, in most cases confirm the finding of Miller and James (1974); Khairwal and Babu (1975); Mannan and Ghafur (1983); Chauhan, *et al.* (1991), Gajera. *et al.* (1991), Nair and Sreenivasan (1991) and Gravois *et al.* (1991). Ramana Reddy (1988) also reported through path analysis that stalk diameter and stalk density were equally important for stalk weight. But strong negative relationship existed between stalk diameter and stalk density.

Thus, a more definite and realistic picture of the relationship may be obtained by partitioning the correlation coefficient into direct and indirect effects through path coefficient analysis. This permitted identification of effective components and application of suitable methods for the better variety. Large positive direct effect of single stalk weight and number of millable cane on yield were established.

Table 1. Result of path coefficient analysis showing direct and indirect effect per clump (YPC) versus yield contributing characters ate genotypic level in sugarcane.

TC	NMC	SSW	CL	NI	LI	CD	Brix	SD	LN	SV	LA	YPC (rg)
-.668	.907	.088	-.005	.224	-.120	.504	.043	-.472	-.142	.186	.155	.70
-.566	1.071	.694	.010	.275	-.092	.803	.032	-1.749	-.295	.730	-.029	.88
-.053	.668	1.112	.017	-.194	.165	.523	-.035	-1.544	-.101	.540	-.199	.90
-.071	-.242	-.454	-.042	-.083	-.093	-.180	.030	1.546	.464	.715	.031	.19
.312	-.607	.644	-.007	-.485	.119	-.568	.002	.922	.361	-.631	-.061	-.20
-.277	.339	-.631	-.013	.199	-.291	.309	.004	.224	.146	-.019	.078	.07
.419	-1.071	-.723	-.009	-.343	.112	-.803	-.014	1.402	.615	-.570	-.015	-1.0
.353	-.421	.480	.016	.010	.014	-.139	-.081	-.368	-.199	.192	-.068	-.21
-.162	.961	.881	.033	.230	.033	.577	-.015	-1.950	-.534	.805	.049	.91
-.150	.457	.177	.031	.277	.067	.781	-.026	-1.651	-.633	.842	-.048	.13
.148	-.928	-.714	-.036	-.364	-.007	-.544	.019	1.866	.633	-.842	.044	-.73
-.287	-.085	.614	-.004	.082	-.063	.034	.015	-.265	.083	-.104	.361	.38

Underlined figures indicate direct effect. Residual effect = -.26824.

Table 2. Result of path coefficient analysis showing direct and indirect effect per clump (YPC) versus yield contributing characters at phenotypic level in sugarcane.

TC	NMC	SSW	CL	NI	LI	CD	Brix	SD	LN	SV	LA	YPC (rg)
.005	.196	.048	-.035	.068	-.006	.179	.019	-.107	-.011	-.046	.008	.32
.001	-.733	-.066	.042	.051	-.002	.205	.008	-.158	-.011	-.097	-.001	.71
.001	-.056	.852	.083	-.037	.005	.097	-.007	-.440	-.007	-.066	.007	.43
.001	-.065	-.148	-.475	-.029	-.005	-.080	.016	.427	.040	.213	.004	-.11
-.001	-.164	.139	-.059	-.229	.007	-.217	.001	.235	.029	.162	-.004	-.10
.001	.084	-.202	-.131	.072	-.021	.117	.003	.069	.007	.011	.005	.01
-.002	-.301	-.166	-.077	-.099	.005	-.499	.004	.428	.042	.212	-.001	-.46
-.001	-.101	.103	.126	.003	.001	-.032	-.060	-.076	-.017	-.048	-.004	-.11
.001	.173	.596	.303	.080	.002	.320	-.007	-.668	-.043	-.244	.003	.52
.001	.084	.056	.188	.065	.001	.208	-.010	-.283	-.101	-.157	-.002	.05
.001	-.244	-1.94	-.347	-.127	-.001	.364	.010	.559	.054	.291	.003	-.36
.001	-.032	.200	-.027	.029	-.004	.009	.008	-.066	-.008	.026	.029	.18

Underlined figures indicate direct effect. Residual effect = .254278.

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