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Path Coefficient Analysis for Some Fibre Yield Related Traits in White Jute (*Corchorus capsularis* L.)

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Abstract: Eleven genotypes of white jute were grown in 1997, 1998 and 1999 to study the genotypic and phenotypic variances, correlations and path coefficients for plant height, base diameter, fresh weight, stick weight, number of pod per plant, number of seed per pod, 1000 seed weight, seed yield per plant and fibre yield per plant. Highly significant differences were observed among the genotypes for all the characters. Substantial amounts of genotypic variance were also obtained for all characters. Fibre yield per plant was significantly and positively correlated with plant height, base diameter, fresh weight and stick weight. Path coefficient analysis revealed maximum contribution of plant height to fibre yield per plant and this was followed by the contribution of base diameter.

Key words: Path coefficient, Correlation, White jute

Introduction

Yield by itself may not be the best criterion for selection (Yassin, 1973). It is quantitatively inherited and influenced by genetic factors as well as environments. Rao *et al*. (1990) reported that yield is a complex character and is the resultant of many factors, which are relatively and simply inherited. Hence, genetic improvement of yield in any crop, it is important to know the nature and extent of association of various components characters with yield. The correlation and path analysis provides information about the association between two characters and partitioning of the relationship into direct and indirect effects showing the relative contribution of each of the causal factors towards the yield. In these regards, a good number of research works in jute has been reported by many workers (Ahmed *et al*., 1994; Khatun and Sobhan, 1992; Saradana *et al*., 1990a; Chaudhury *et al*., 1981). The objectives of this work were to investigate correlations among the yield component characters and to find out the extent of direct and indirect effects of fibre yield components. Because knowledge of these correlations may help in planning efficient breeding programme (Johnson *et al*., 1955).

Materials and Methods

Eleven white jute genotypes such as accession 892, 2765, 2846, 2858, 3630, 3660, 3872 collected from Bangladesh, accession 4619 and 4620 collected from Brazil and var. CVL - 1 and CC - 45 (developed from Bangladesh Jute Research Institute) were used in this experiment. Plants were grown in fields at Central Station, Dhaka in 1997 and at Central Research Farm, Manikganj in 1998 and 1999 of Bangladesh Jute Research institute. Randomized complete block designs with three replications were used. A plot for each genotype was represented by 3 rows of 5 m length with a spacing of 30 cm × 5 cm. The middle row of each plot was harvested during average flowering stage for fibre yield. Rest of rows was harvested at the time of ripening the pod for seed yield performance. Data were recorded on ten randomly selected plants from each replication for nine characters namely, plant height (cm), base diameter (mm), fresh weight per plant (g), stick weight per plant (g), fibre weight per plant (g), number of pod per plant, number of seed per plant, 1000 seed weight (g) and seed yield per plant (g). Each location within each year was considered as an environment in all replication.

Combined analysis of variance was performed for all characters according to Yassin (1973). Simple correlation coefficients were obtained between all possible combination of characters related to fibre yield. These correlations were further analyzed using Wright (1921) path coefficients as illustrated by Dewey and Lu (1959). Fibre yield was considered as the resultant (dependent) variable.

Results and Discussion

Significant difference was observed among the genotypes for all the characters studied (Table 1). Genotypes ranged from 275.3 to 345.6 cm for plant height (Table 2). Genotype 3872 showed highest values while genotype 2858 showed lowest means for plant height. In case of base diameter mean values ranged from 17.48 to 27.77 mm for genotype 3630 and 3872, respectively. Genotypes 3872 showed the highest mean values for fresh weight and stick weight. While genotype 2846 showed lowest mean values for fresh weight and genotype 3630 showed lowest mean values for stick weight. Highest number of pod was produced by the genotype 3872 closely followed by CVL - 1. Lowest number of pod was produced by the genotype 892. Maximum seed per pod was obtained from the 4620 and minimum in 892. In case of 1000 seed weight genotype 3872 gave the maximum weight of 4.09 g. Highest seed yield per plant was produced by the genotype 3872. Lowest seed yield per plant was produced by the genotype 892. The highest fibre yield per plant was recorded by the genotype 3872. The genotype 2858 showed the lowest fibre yield per plant. The ratios of genotypic, genotype x environment interaction and error variances to the total phenotypic variance are shown in Table 3. The large ratios of genotypic to phenotypic variances among the genotypes for all characters indicate that these characters were highly inherited and the differences among the genotypes are real. Considerable variation in number of pod per plant and 1000 seed weight were due to environmental effects and the interactions with the genotypes.

Simple correlation coefficients between different pairs of characters are presented in Table 4. Fibre yield per plant was positively and significantly correlated with plant height, base diameter, fresh weight and stick weight. Similar relationship was also reported by Khatun (1998), Zhegh *et al*. (1985), Chaudhury *et al*. (1981) and Sasmal and Chakraborty (1978). Plant height, base diameter, fresh weight and stick weight

Table 1: Mean squares from the combined analysis of variance for traits of white jute

Source of variation	DF	Plant height	Base diameter	Fresh weight	Stick weight	No. of pod/ plant	No. of seed/pod	1000 seed weight	Seed yield/plant	Fibre yield/ plant
Environments	2	0.77	0.26	2.69	2.44	7.94	0.08	0.001	0.32*	0.14
Replications within environments	6	7.20	0.55	0.42	0.62	2.91	0.57	0.05	0.06	0.29
Genotypes	10	5076.55**	114.46**	5731.32**	666.82**	496.98**	279.01**	0.45**	16.23**	82.05**
Genotypes x environments	20	7.27	0.51	3.08	1.24	15.48	0.84	0.05	0.13	1.80
Error	6	4.57	0.41	2.29	0.87	19.97	0.70	0.04	0.09	1.45

*,** significant at $p<0.05$ and $p<0.01$, respectively

Table 2: Mean performance for different characters of white jute genotypes

Genotypes	Plant height	Base diameter	Fresh weight	Stick weight	No. of pod /plant	No. of seed /pod	1000 seed weight	Seed yield/ plant	Fibre yield/ plant
892	294.7g	23.59c	184.2e	35.20e	46.13f	22.10h	3.48ef	3.79g	15.47df
2785	285.5h	20.01e	174.4g	31.07f	63.82a	32.96d	3.78b-d	6.86b	12.27g
2846	293.19	18.64f	170.0i	34.74e	38.819	32.98d	3.84b	4.73ef	14.40f
2858	275.31	21.53d	172.4h	37.64d	53.29d	37.38h	3.46ef	6.71 b	9.37h
3630	303.7e	17.489	167.3j	27.96g	53.39d	36.20c	3.41f	6.04c	15.20ef
3660	308.7e	19.57e	178.9f	36.69d	57.61c	30.88e	3.83bc	6.67b	16.62c-e
3872	345.6a	27.77a	232.4a	51.77a	64.58a	36.33bc	4.09a	8.42a	19.44a
4819	319.9d	21.49d	190.3d	44.38c	49.92e	37.10hc	3.37f	5.36d	16.96cd
4620	330.1c	23.88c	195.1c	48.08b	59.92b	41.14a	3.56d-f	5.09de	18.49ab
CVL - 1	337.6b	27.04ab	229.2b	50.98a	63.72a	26.28g	3.71b-e	6.98b	19.02a
CC -45	338.1b	268.4b	228.5b	50.68a	46.78f	28.77f	3.58c-f	4.64f	17.21 be
CV (%)	4.9	3.09	8.49	2.23	7.37	2.52	2.53	5.29	5.05

Table 3: Ratios of genotypic (δ^2_{gn}), genotypes x environments interaction (δ^2_{gn}) and error (δ^2_e) variance to phenotypic variance (δ^2_{ph}) for nine characters in white jute

Characters	$\delta^2_{gn}/\delta^2_{ph}$	δ^2_g/N (δ^2_{ph})	δ^2_g/RN (δ^2_{ph})
Plant height (cm)	99.85 %	0.05 %	0.09%
Base diameter (mm)	99.56 %	0.08 %	0.36%
Green weight (g)	99.95 %	0.01 96	0.04 %
Stick weight (g)	99.32 %	0.55 %	0.13%
No. of pod/plant	93.70 %	1.42 %	4.88 %
No. of seed/pod	99.70 %	0.05 %	0.25 %
1000 seed weight (g)	88.90 %	2.20 %	8.89 %
Seed yield/plant	99.20 %	0.25 %	0.55 %
Fibre yield/plant	97.80 %	0.43 96	1.77 %

Table 4: Correlation coefficients among nine characters in white jute

Characters	Base diameter	Fresh weight	Stick weight	No. of pod/plant	No. of seed/pod	1000 seed weight	Seed yield/plant	Fibre yield/plant
Plant height	0.744**	0.882**	0.856**	0.336	0.015	0.281	-0.03	0.926**
Base diameter		0.942**	0.893**	0.331	-0.252	0.26	-0.084	0.5864*
Fresh weight			0.911**	0.353	-0.215	0.353	0.036	0.721**
Stick weight				0.286	0.033	0.238	-0.019	0.682**
No. of pod/plant					0.099	0.294	0.151	0.265
No. of seed/pod						0.053	0.27	-0.099
1000 seed weight							0.342	0.294
Seed yield/plant								-0.151

*,**significant at $p<0.05$ and $p<0.01$, respectively

Table 5: Direct (bold) and indirect effects of various traits on fibre yield in white Lute

Characters	Plant height	Base diameter	Fresh weight	Stick weight	No. of pod/plant	No. of seed/pod	1000 seed weight	Seed yield/plant	Fibre yield/plant
Plant height	1.9344	0.4714	-1.6429	0.1116	-0.0022	-0.0059	0.0612	-0.0015	0.9261**
Base diameter	1.4392	0.6337	-1.7547	0.1184	-0.0023	0.1002	0.0566	-0.0032	0.5859*
Fresh weight	1.7062	0.5969	-1.8627	0.1188	-0.0024	0.0855	0.0768	0.0018	0.7209**
Stick weight	1.6559	0.5659	-1.6969	0.1304	-0.0019	-0.0131	0.0519	-0.0097	0.6825**
No. of pod/plant	0.6499	0.2097	-0.6575	0.0373	-0.0068	-0.0393	0.0640	0.0077	0.2650
No. of seed/pod	0.0290	-0.1596	0.4004	0.00430	-0.0007	-0.3977	0.01154	0.0137	-0.0990
1000 seed weight	0.5436	0.1647	-0.6575	0.0310	-0.0020	-0.0210	0.2178	0.0174	0.2940
Seed yield/plant	-0.0580	-0.0405	-0.0670	-0.0024	-0.0010	-0.1074	0.0744	0.0510	-0.1509

Residual effect: 0.2740

showed highly significant positive association among themselves. It indicates that, taller and thicker the plant the higher is its fibre yield. This association may be due to an increase in general vigor of the plants. All other correlation were unimportant and of no predictive value.

The results of path coefficient analysis are given in Table 5. Plant height (1.9344) had highest positive direct effect on fibre yield per plant. Other higher positive direct effect on fibre yield per plant were contributed by base diameter (0.6337), 1000 seed weight (0.2178) and stick weight (0.1304) and therefore direct selection based on these characters would be feasible Chaudhury *et al*. (1981). Das and Rakshit (1988) and Saradana *et al*. (1990b) reported high positive and direct effects of plant height and base diameter on fibre yield per plant. Fresh weight per plant exhibited high and negative direct effects (-1.8627) towards fibre yield. But its significant positive correlations with fibre yield per plant indicated that the indirect selection could be made for high yielding white jute genotypes through most of the characters having positive indirect effects. The residual effect (R) was 0.2740, indicating there were also some other characters which although not studied but influenced the yield of fibre per plant and about 83% of variability in yield of fibre was contributed by the characters studied in path analysis. The results of this investigation indicate that *a* selection index giving proper weightage to different characters such as plant height, base diameter, fresh weight and stick weight seems to be best method to produce jute varieties with acceptable yield.

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