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Study of Harvest Index and Genetic Variability in White Jute (*Corchorus capsularis*) Germplasm

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Abstract: Studies on harvest index, genetic parameters, variability and correlation among different characters of 23 germplasms along with three control variety of *Corchorus capsularis* were conducted. The highest plant height (3:37m), base diameter (23: 33mm) and harvest index (32: 79) were found in the control variety VCL-1. Dry weight of leaf (12:45gm), dry weight of stick (64:13gm) and total dry matter were the highest in acc. no. 2271. Genetic variations were observed among the germplasms for plant height, base diameter, total dry matter and harvest index. Higher harvest index was found in the control variety CVL-1. No high yielding germplasm having higher harvest index could be identified from the germplasms studied. For all characters, phenotypic coefficient of variation was higher than genotypic coefficient of variation. Plant height, base diameter and dry weight of bark were positively correlated with harvest index.

Key words: Harvest index, genetic parameters, variability, correlation, white jute

Introduction

Jute (*Corchorus* sp.) is the main cash crop of Bangladesh and plays a vital role in the economy of the country. Commercial fibre is obtained from the bark of jute stem. Bark is an important part of jute for calculation of harvest index. Harvest index may be defined as the ratio of economic yield and biological yield (Khandakar, 1985).

Harvest index = X 100

Dry weight of fibre is considered as economic yield. Total dry weight of biological product includes dry weight of leaf, stick and bark (Khandakar, 1985). Bark production has been used to represent the economic product because bark dry matter content is known to maintain a very close correlation with dry fibre content $r=0.99^{**}$ (Khandakar, 1985) and $r=0.91^{**}$ (Sobhan, 1982). Roy (1967) suggested that plant height and base diameter may be considered in selecting jute plant for better fibre yield. Eunus and Salam (1969) reported that base diameter of jute plant is a good indicator of fibre yield potential. Khandakar (1985) reported that harvest index is an indicator of productivity and higher yield. Kawano and Jenninger (1983) stated that harvest index is the most important yield determinant under lower as well as higher yield environment. Sharma *et al.* (1987) suggested that harvest index would be a sound and reliable selection criterion while practicing selection for better yielding genotypes in a segregating generation. Begum and Sobhan (1991) found that the nature of inheritance of harvest index in 6-parent wild and 8-parent elite diallel crosses of *C. capsularis*. Chaudhury *et al.* (1985) found that the collection and maintenance of germplasm and its evaluation for traits of economic importance is an essential prerequisite for success in systematic breeding programme. Although the importance of harvest index as a selection criterion has been emphasized by many workers. Scanty experimental evidence is available for use in jute breeding. With a view to assess the higher harvest index, some local and exotic *C. capsularis* germplasms were collected from the gene bank of Bangladesh Jute Research Institute (BJRI). Therefore, this study was undertaken to find out superior genotypes having higher harvest index for selection and their possible use in the breeding programme and to determine the genetic variability and correlation among the characters.

Materials and Methods

The experiment was conducted at Jute Research Sub-Station, Monirampur, Jessore during 1993-95. Total of 23 exotic and indigenous germplasms along with 3 variety of *C. capsularis* were used from the gene bank of Bangladesh Jute Research Institute. A rod row trail was planted in a randomized complete block design. Each germplasm was grown in 3.5m long row. The experiment was sown on 22.4.93, 24.4.94 and 15.4.95 through successive years. Usual agronomic practices were done properly. Fertilizers were applied @ of kg ha^{-1}: 100N, 50 P_2O_2 90 K_2O and 11 S. The experimental plots were laid out in high land of gangetic alluvial soil which was loamy and brown in colour. These plots were located at $22^0 55'$ and $23^0 06'$ N latitude and $89^0 22'$ E longitude. Monthly average rainfall in years was 137.07mm and monthly average maximum temperature was 30.40°C and minimum temperature was 21.0°C for the years. Soil pH ranges from 5.6-7.6. Organic matter of the soil was 1.30-2.70%. Five plants were harvested after 120 days form each line randomly. Leaves, sticks, bark and roots were separated and dried in constant temperature at 100°C for three days. At harvest plant height and base diameter were recorded. Separate and combined data were statistically analyzed according to Zaman *et al.* (1982). Genotypic variance (S^2g) and phenotypic variance (S^2p) were calculated as suggested by Johnson (1955). Heritability in broad sense (Hb) and genetic advance in percentage of mean (GAPM) were estimated by using the formula given by Hanson *et al.* (1956). Genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV) were worked out following the formula given by Burton and Devan. (1993). Simple correlation coefficients were determined according to Panse *et al.* (1957).

Results and Discussion

The control variety CVL-1 gave higher harvest index (32.79) which also produced the highest plant height (3.37m) and base diameter (23.33 mm). None of the germplasm could out yield the control variety CVL-1 in respect of plant height, base diameter and harvest index. Dry weight of leaf was maximum in the accession no. 2271(12.45gm). Dry weight of bark was in the accession no. D-154. (34.60gm). Dry weight of stick was maximum in the accession no. 2271 (64.13 gm). Total dry matter was the highest in the accession no. 2271 (108.88 gm). Combined analysis of variance (total sum square) for plant height, base diameter, dry weight of leaf, dry weight of stick, dry weight of bark, total dry matter and harvest index of white jute are presented in the Table 2. A significant difference were found among the characters of germplasm. The interaction of varieties and years indicates that some genotypes yielded better in some years whereas others were less productive in different years so any recommendation can not be made for any one variety for all year. However, when

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Table 1: Mean data of yield contributing characters and harvest index of 26 *C. capsularis* L. germplasms

Accession number	Plant height (m)	Base diameter (mm)	Dry weight of leaf (gm)	Dry weight of stick (gm)	Dry weight of bark (gm)	Total dry matter (gm)	Harvest Index (%)
JRO-321	3.24	23.39	11.45	59.43	33.84	104.72	32.31
JRC-212	3.13	21.36	10.84	50.27	28.05	89.16	31.46
JRC-7447	3.20	22.57	11.09	54.82	31.05	96.96	32.02
2128	3.22	22.17	11.33	59.48	29.42	100.23	29.35
2142	.23	23.40	10.31	59.19	30.49	99.99	30.49
2162	3.26	22.60	10.65	58.51	32.92	102.08	32.24
CVL-1	3.37	23.33	11.53	56.79	33.39	101.81	32.79
2210	3.18	21.83	11.11	54.11	27.23	92.45	29.45
2218	3.22	21.60	10.27	54.14	27.15	91.56	29.65
2223	3.30	22.34	10.97	59.27	29.77	100.01	29.76
2228	3.12	20.24	10.74	53.77	27.01	91.52	29.51
2271	3.31	23.02	12.45	64.13	32.30	108.88	29.66
2300	3.27	23.19	10.30	56.57	32.27	99.14	32.54
CVE-3	3.13	20.82	10.24	49.90	27.40	87.45	31.29
2489	3.29	23.00	9.60	52.98	27.87	90.45	30.81
2510	3.18	22.73	10.92	52.75	26.08	89.75	29.05
2512	3.18	21.45	11.79	53.05	26.07	90.91	28.67
2528	2.97	21.57	11.35	49.80	24.48	85.63	28.58
2530	3.16	22.30	11.90	56.77	27.67	96.34	28.72
2538	3.19	22.62	11.80	51.57	27.70	95.07	31.17
2554	3.23	21.60	11.32	57.87	29.77	98.96	30.08
2593	3.17	22.33	11.30	55.33	27.53	94.16	29.23
2672	3.15	22.80	11.13	59.37	30.30	100.80	30.05
2630	3.33	22.27	11.49	60.53	30.50	102.52	29.75
2815	3.20	22.67	10.40	56.93	28.77	96.10	29.93
D-154	3.28	22.92	11.88	60.80	34.60	106.98	32.06
LSD(0.05)	NS	0.09*	0.051*	0.97*	0.66*	0.75	0.15*
CV(%)	0.10	0.74	0.04	11.30	0.23	0.23	0.16*

NS = No significant,* = Indicates significant at 0.05 level of probability.

Table 2: Combined analysis of variance (sum of squares)

Source of variation	df	Plant height	Base diameter	Dry wt of leaf	Dry wt. of stick	Dry wt. of bark	Total dry matter	Harvest index
Replication	3	0.73	3.46	26.97	1310.16	197.10	423.29	0.22
Variety(V)	25	1.56	237.50**	85.30**	5527.09**	1679.75**	8655.14**	397.26**
Year(Y)	2	1.21	9.11	803.97	4961.60	211.16	1008.02	3.61
VX Y	50	2.83	2.01	151.08	9753.66	1514.10	2453.96	165.31
Error	80	8.87	298.22	26.03	5035.42	1305.77	5522.25	242.13

** = Significant at P=0.01 level of probability.

Table 3: Estimates of genetic parameters for seven characters of *C. capsularis*

Characters	S^2g	S^2p	Hb(%)	GCV(%)	PCV(%)	GAPM(%)
Plant height(m)	0.001	0.02	5.00	1.30	4.43	0.45
Base diameter(mm)	0.83	2.84	29.22	0.15	0.28	0.20
Dry wt. of leaf (gm)	0.58	0.75	77.33	0.08	0.10	0.15
Dry wt. of stick (gm)	19.56	53.58	36.50	0.98	1.62	1.21
Dry wt. of bark (gm)	6.48	15.30	42.35	0.96	1.47	1.27
Total dry matter(gm)	34.32	71.63	47.91	0.23	0.33	0.32
Harvest index	1.52	3.21	49.22	0.15	0.22	0.23

S^2g = Genotypic variance, S^2p = Phenotypic variance, Hb(%) = Heritability in broad sense, GCV = Genotypic coefficient of variation, PCV = Phenotypic coefficient of variation, GAPM = Genetic advance in percentage of mean.

Table 4: Correlation coefficient for seven agronomic characters in *C. capsularis*

Characters	PH	BD	DWL	DWB	DWS	TDM	Harvest Index
Plant height		0.633**	0.344	0.598**	0.624 **	0.766**	0.3 65
Base diameter			0.155	0.605**	0.474*	0.606**	0.390
Dry weight of leaf				0.161	0.338*	0.601*	0.413
Dry weight of bark					0.695 **	0.848**	0.772**
Dry weight of stick						0.528*	0.293
Total dry matter							0.362

* = Significant at P=0.05, ** = Significant at P=0.01, PH = Plant height, BD = Base diameter, DWD =Dry weight of leaf, DWB =Dry weight of bark, DWS = Dry weight of stick, TDM = Total dry matter

Phenotypic variance was higher than genotypic variance for all the characters. The differences between GCV and PCV not very close. the total sum square for varieties is significantly greater than the some square for varieties x years some varieties may be considered superior to others.

The highest genotypic variance (34.32) and phenotypic variance (71.63) were observed in the total dry matter (Table 3). Heritability in board sense was maximum (77.33) in dry weight of leaf. GCV was maximum (1.30) in plant height. PCV was maximum in plant height (4.43%). GAPM (1.27) was maximum in dry weight of stick. It was observed that the plant height has got positive significant correlation with base diameter, dry weight of bark, dry weight of stick and total dry matter (Table 4). Base diameter has positive insignificant correlation with dry weight of leaf and harvest index which also showed positive significant correlation with dry weight of bark and dry weight of stick. Dry weight of bark has got positive and significant correlation with dry weight of stick, total dry matter and harvest index.

The results of this study investigation showed significant variation among the germplasms for the characters studied. Harvest index ranged from 28.58 to 32.79%. Similar results were reported by Khandakar (1985). Phenotypic coefficient of variation for all the characters were higher than genotypic coefficients of variation. Findings of this study agreed with the findings of Joseph (1974) and Sukla and Singh (1967). Plant height has got positive correlation with base diameter. Findings of the study are in agreement with the findings of Begum and Sobhan (1991), Eunus and Salam (1969), Roy (1967) and Sobhan (1982). In view of strong positive association between bark dry matter and harvest index would produce high yielding genotype in a particular set of environment. This will, however, depend on the extent and nature of genetic variation for harvest index in the base population. But unfortunately no genotypes containing higher harvest index better than CVL-1 could be identified from the germplasms studied. However, plant height and base diameter have been used as the chief criteria for selections in *C. capsularis* since these two characters have positive correlation with fibre yield (Khatun and Sobhan, 1986). In addition to these two characters harvest index can be used as a selection for improvement in fibre yield. However, this will depend on the extent and nature of genetic variation for harvest index in he base population.

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