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Dry matter production at different growth phases and its variability in *Corchorus capsularis* L.

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Abstract

Pattern of dry matter distribution within different plant parts in 15 genotypes of *Corchorus capsularis* jute was estimated. Significant differences for distribution of dry matter were observed. Linear increase in dry weight of root, leaf and stem was recorded following the progress of growth period in most of the genotypes. Consistent superiority with respect to dry matter production in root, leaf , stem and bark with high bark to stick ratio was shown by CEX 040. On the other hand, CEX 048 had highest dry seed and pod weight. CEX 040 and CEX 048 can be recommended for commercial production of fibre and seed respectively. Least environmental influence was observed in partitioning of dry matter. Various components for fibre yield was predominantly controlled by additive gene action and that for seed by both additive and non additive gene actions. Dry matter in bark showed significant positive correlations with that of root at 120 days, leaf at 60 days, stem at 90 and 120 days whereas seed weight showed similar relationship with pod weight, leaf dry weight at 90 days and stem dry weight at 60 and 90 days.

Key words: Dry matter, *Corchorus capsularis*, coefficient of variation, heritability, genetic advance, correlation coefficient.

Dry matter in jute (*Corchorus capsularis* L.) is proportionately distributed to different parts like root, stick, bark, leaf, pod and seed. Present investigation was laid out to identify the potential genotypes with well-built source-sink relationship as estimated on the basis of total dry matter production and its distribution to different plant parts at different stages of growth. Variation between genotypes, broad-sense heritability, genetic advance and correlation coefficient were estimated to understand genetic nature of dry matter accumulation.

The experiment was carried out during 2010 following randomized block design with three replication. The genotypes namely, JRC 698, CIN 159, CEX 040, CEX 048, CIJ 042, CIN 177, CEX 008, CIN 144, CIJ 065, CIJ 078, CEX 009, JRC 212, CIN 063, CIN 117 and CIN 149 were considered in the experiment. Data were recorded on different characters *viz.*, dry weight of root, leaf and stem and weight (wt), of dry stick, bank, pod and seed were taken from ten randomly selected plants from each replication at different stages of growth. Dry matter was estimated per plant basis from different parts and different growth phases like from root at 60, 90, and 120 days, stick at 120 days, pod and seed at 150 days. Different plant parts were separated from the collected samples and kept in hot air oven at 40-45 ^{0}C for 10 days and dry weight of sample were recorded. Statistical analysis was done following Gomez and Gomez [1]; genetic parameters and correlation coefficient were estimated following Panse and Sukhatme [2] and Johson . [3] respectively.

Significant difference among genotypes for accumulated dry matter in different parts was revealed which provided ample scope for selection of elite genotype with higher economic yield on the basis of distribution pattern of dry matter (Table 1). Similar

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observations were also recorded earlier [4]. Differential dry matter accumulation in different plant parts of kenaf among genotypes was recorded earlier in a different set of genotypes [5]. Fibre yield of mesta was found to be dependent on fresh biomass as well as on dry stalk yield showing variation in dry matter accumulation among the genotypes in different component parts in different stages of growth [6].

Root dry weight at 60 days were found to be highest in CEX 048 which showed no significant difference with the genotypes CEX 040, CIJ 042, CEX 048, CIN 117 and CIN 149; at 90 days it was highest in JRC 698, CIJ 159 AND CIJ 078 and at 120 days the highest value was recorded in CEX 040. Consistently highest root dry weight was observed in CEX 040.

Highest leaf dry weight at 60 days was observed in CEX 048 and CEX 040 along with CIN 149 which showed no significant variation with it. At 90 days of growth CIN 159 had the highest leaf dry weight with CIJ 042 and CEX 048. Whereas the genotypes JRC 698, CIJ 042 and CEX 048 revealed highest value at 120 days of growth. Leaf dry weight continued to increase through the progress of growth period in most of the genotypes except CIN 159, CEX 040, CEX 048, CIJ 042, CIN 177 which attained the maximum dry weight within 90 days.

Highest stem dry weight was revealed by CEX 040 with the genotype CEX 048 and JRC 698 at 60 days and superiority of CEX 040 over other genotype also observed in the following growth stages. Stick dry weight in 120 days was highest in CEX 040 and JRC 698. The ratio between dry stick weight and dry stem weight ranged between 0.72 in CIN 149 to 0.82 in CIN 117. The low ratio was also observed in CEX 040. The genotype CIN 149 can be used for further improvement of CEX 040 to gain maximum stem weight with low stick weight to enhance weight of bark. Dry bark weight was found to be highest in CEX 040 followed by JRC 698, dry bark weight: dry stick weight was found to be highest in CEX 040 and CIN 149 and these genotypes can also be considered in breeding for economic improvement of bark yield in JRC 698.

Dry pod weight was found to be highest in CIJ 063 followed by CEX 048 and CIN 159 whereas highest seed weight was shown by CEX 048 with no significance difference with CIJ 065, CIJ 063, JRC 968, CIN 189, CEX 040 and these genotypes can be recommended for commercial seed production. [5] and [6] observed linear growth rate following the progress of developmental period as was observed in the present investigation.

The total dry matter production was highest in CEX 040 followed by JRC 212 and JRC 698 but percent of dry matter accumulated in dry bark was found to be higher in CEX 040 followed by CIN 149 with concomitant lowest distribution in its stick which proved the importance of CIN 159 in crop improvement for fibre yield. Percent of dry matter distributed to seed was found to be highest in CEX 048 with highest dry seed weight followed by CIJ 063 and CIJ 065. Seed production in CEX 048 may be further improved through hybridization with CIJ 065 by increasing the size of pod. Among the genotypes CEX 040 was found to be potential for fibre production and CEX 048 for seed production and JRC 698 for dual purposes provided its potentiality is substantially improved with the help of CIN 149 and CIJ 063 for fibre and seed respectively.

The genetic parameters for different characters shown in Table 2 depicted minimum difference between PCV and GCV for dry matter accumulation in component parts which suggested least environmental influence in controlling the pattern of distribution of

Table 1. MSS along with mean, CV and C.D. of the genotypes of tossa jute for distribution of dry matter in different component parts

	Root dry wt			Leaf dry wt			Stem dry wt			Dry stick wt	Dry bark wt	Dry pod wt	Dry seed wr
	60	90	120	60	90	120	60	90	120	120	120	150	150
MSS	8.802*	1.562*	4.518*	1.453*	1.42*	2.776*	15.44*	63.20*	159.12*	97.11*	12.72*	3.542*	0.006*
Mean	1.613	3.349	6.198	3.051	4.088	4.516	7.992	17.649	37.398	29.254	8.144	3.055	0.174
CV	14.887	8.973	5.115	9.735	10.587	8.037	8.446	4.475	3.285	4.122	5.652	14.768	18.841
C.D at 5%	0.402	0.503	0.530	0.491	0.724	0.607	1.129	1.321	2.055	2.017	0.770	0.755	0.055

Table 2. Estimated genetic parameters of different characters in tossa jute

S.No.	Characters	Days	GCV	PCV	h^2 broad sense	Genetic advance (GA)	Genetic advance % of mean (at 5%)
1.	Root dry wt	60	27.047	30.874	0.768	0.784	48.81
		90	20.913	22.757	0.845	1.326	39.591
		120	19.578	20.235	0.936	2.419	39.021
2.	Leaf dry wt	60	22.391	24.415	0.841	1.275	42.300
		90	15.570	18.828	0.684	1.084	26.523
		120	20.790	22.290	0.870	1.804	39.947
3.	Stem dry wt	60	27.972	29.219	0.917	4.409	55.162
		90	25.879	26.263	0.971	9.271	52.531
		120	19.382	19.658	0.972	14.722	39.365
4.	Dry Stick wt	120	19.303	19.738	0.956	11.376	38.887
5.	Dry Bark wt	120	25.076	25.705	0.952	4.104	50.393
6.	Dry pods wt	150	34.063	37.127	0.842	1.967	64.379
7.	Dry Seeds wt	150	24.009	30.519	0.619	0.068	38.909

GCV=Genotypic coefficient variation; PCV=Phenotypic coefficient variation; h^2 =Heritability (broad sense); GA= Genetic advance

Table 3. Significant correlation of dry matter accumulation in bark with other characters in tossa jute.

Characters	Days	Dry bark	Dry pod	Dry Seeds
Root dry wt	90	0.371* (0.392**)	0.367* (0.367*)	-
	120	0.667** (0.685**)	0.443** (0.466**)	(0.321*)
Leaf dry wt	60	0.399** (0.412**)	0.297* (0.304*)	-
	90	- (0.644**)	0.588** (0.558**)	0.463**
Stem dry wt	60	0.674** (0.700**)	0.472** (0.502**)	0.427** (0.475**)
	90	0.821** (0.831**)	0.504** (0.525**)	0.354* (0.391**)
	120	0.864** (0.873*)	-	-
Dry stick wt	120	0.716**	0.027**	-
Dry Bark wt	120	- (0.444**)	0.428** (0.363*)	0.334**
Dry pods wt	150	-	-	0.965** (0.999**)

Genotypic Correlation in parenthesis. **Significant at 1% level, *Significant at 5 % level

dry matter in different parts except in seed. Heritability for dry matter accumulation was also found to be high in different growth period except in leaf at 90 days growth and seed .High heritability accompanied by high genetic advance was noticed for dry bark weight, dry pod weight and stem dry weight at 60and 90days which suggested influence of predominant additive gene action on dry matter accumulation in these parts and simple breeding method may be followed to enhance dry matter accumulation in these parts. On the other hand, for improvement of seed yield a relatively complex breeding method accompanied by recurrent selection should be practiced due to additive and non additive gene influences were behind dry matter accumulation in it as being predicted for presence of comparatively low magnitude of heritability and genetic advance.

Significant positive correlation of high magnitude at phenotypic and genotypic levels were observed for dry matter accumulation in bark with that in root at 120 days, leaf at 60 days, stem at 90 days and 120 days and high fibre yielding genotype may be selected on the basis of accumulated dry matter on these component parts at appropriate growth stages (Table 3) Significant correlation between fibre weight and stem weight was also observed by Maiti . [7]. Seed weight was found to be highly correlated with dry pod weight, leaf dry weight at 90 days and stem dry weight at 60 and 90 days and the potential lines with high seed yield may be selected on the basis of dry matter accumulation at specific stages of growth in those plant parts.

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