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Stability for fibre yield and its attributing traits in white jute (*Corchorus capsularis* L.)

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ABSTRACT

A study was conducted in two years (2005 and 2006) to evaluate promising white jute to identify suitable genotypes for fibre yield. The evaluation carried out by All India Network Project on Jute and Allied Fibres under Initial Evaluation Trial (IET) and Advanced Varietal Trial-I (AVT-I). Genotype × Environment interactions in 6 white jute (Corchorus capsularis L.) genotypes including two checks were studied over ten environments for plant height, basal diameter, green weight and fibre yield. The six entries in the IET and AVT-I res ponded differentially to the ten environments as indicated by their non-significant difference for the different traits in the different environments. On the basis of stability parameters Wi (Wricke's Ecovalence) and Di (Hanson's genotypic stability) the genotypes NDC-2008 and NDC-2001 were identified as stable for fibre yield and its attributing traits, over the environments.

Key words: Stability,white jute, Wricke's ecovalence

Jute (*Corchorus olitorius* L. and *Corchorus capsularis* L.) is one of the major bast fibre cash crops in the world and the second most importance textile fibre next to cotton. In India, jute is grown over an area of 0.8 million hectare producing around 10 million bales (1bale = 180 kg) of fibre which is about 40 percent of the world production (Chaudhury *et al.*, 2004). Being a labour intensive crop around 12 million farm families derive their sustenance from jute. About 0.25 million people directly and 2.5 million people are indirectly employed in the jute industry and jute based ancillary sector. Besides supporting the domestic consumption, India earns annually approximately ₹ 10,000 million as foreign exchange by exporting various jute products. The enhancement in white jute fibre yield requires information on the Genotype × Environment interactions which are usually present under all conditions including purelines, single cross or double cross hybrids, top crosses or any other material used for breeding (Eberhart and Russel, 1966). This interaction has great impact in evaluating crop varieties over a wide range of environmental conditions. The information on genotype × environment interaction leads to successful evaluation of stable genotypes which could be used either for general cultivation or in future breeding programme (Prabhakar *et al.*, 2010).

MATERIALS AND METHODS

Data in the present study belongs to IET and AVT-I with six white jute entries conducted by AINP on Jute and Allied Fibres over five locations and two pre-*kharif* seasons of 2005 and 2006, respectively. The materials used for the present study included four white jute (*Corchorus capsularis* L.) entries namely NDC-2001, Cb-1, NDC-2008, RRPS-27-C-3 and two standard checks *viz.*, JRC-698 and JRC-321. These were tested over five locations for two consecutive years. The five different locations were Cooch Behar and Nadia in West Bengal, Baharaich in Uttar Pradesh, Nagaon in Assam and Kendrapara in Orissa, each of which represented a situation differing in edaphoclimatic factors. However, five locations over two years (2005 and 2006) in this study were considered to be ten different environments such as Environment-1 (E_1) and Environment-2 (E_2) being Cooch Behar, E_3 and E_4 being Nadia, E_5 and E_6 being Baharaich, E_7 and E_8 being Nagaon and E_9 and E_{10} being Kendrapara in the years 2005 and 2006, respectively. The entries were raised in Randomized Block Design with four replications. The observations were recorded on four characters namely plant height (cm), basal diameter (cm), green weight (q ha^{-1}) and fibre yield (q ha^{-1}). For the traits plant height and basal diameter data was recorded from five randomly selected plants in each replication whereas, the green weight and fibre yield were recorded on total plot basis in each replication and then transformed into quintal $hectare^{-1}$. The stability parameters were computed as per Wricke (1962) and Hanson (1970).

RESULTS AND DISCUSSION

The analysis of variance for the four different traits revealed that the six entries did not differ significantly in all the ten environments (Table 1).

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Table 1: Analysis of variance for fibre yield and its attributing traits in white jute (*C. capsularis*) for the 10 environments

Characters	Mean squares of the genotypes for the individual ten environments									
	Cooch Behar		Nadia		Baharaich		Nagaon		Kendrapara	
	E_1 (2005)	E_2 (2006)	E_3 (2005)	E_4 (2006)	E_5 (2005)	E_6 (2006)	E_7 (2005)	E_8 (2006)	E_9 (2005)	E_{10} (2006)
Plant height (cm)	2040.57**	2178.27**	1791.47	636.98	400.04**	1091.04	455.64	168.18	1518.64**	722.47
Basal Diameter (cm)	0.0165	0.0286	0.0612	0.0148	0.3558*	0.0448*	0.0032	0.0095	0.0153	0.0557*
Green Weight (q ha^{-1})	22380.25**	6925.61	7930.11	1876.72	17676.28**	4654.64**	5237.94	4106.09	4905.52**	3836.71**
Fibre yield (q ha^{-1})	50.70**	18.61	24.54	8.90	5.18	22.85**	30.04*	22.75**	83.16**	15.59**

*, ** *Significant at 5% and 1% probability level, respectively.* E_1 *to* E_{10} *= Environment-1 to Environment-10*

Table 2: Mean performance and stability parameters in white jute for four characters in ten environments

Entry	Plant height (cm)			Basal diameter (cm)			Green weight (q ha^{-1})			Fibre yield (q ha^{-1})		
	Mean	Wi (%)	Di	Mean	Wi (%)	Di	Mean	Wi (%)	Di	Mean	Wi (%)	Di
NDC-2001	264.68	8.67	164.17	1.68	13.29	1.40	482.57	15.12	398.23	25.71	10.36	16.77
CB-1	262.13	39.58	174.93	1.69	22.67	1.55	451.32	23.42	406.92	25.86	41.03	19.50
NDC-2008	280.73	17.63	168.15	1.68	19.73	1.44	497.83	11.41	391.59	27.17	6.76	16.27
RRPS-27-C-3	259.85	8.09	164.31	1.57	16.43	1.39	476.12	18.68	400.12	26.10	17.16	17.38
JRC-698 (Check)	263.45	9.03	164.85	1.64	15.05	1.40	462.46	22.40	405.35	25.31	13.87	17.13
JRC-321 (Check)	269.18	16.99	167.21	1.63	12.83	1.36	471.00	8.97	391.37	24.76	10.82	16.83
Mean	**266.67**			**1.65**			**473.55**			**25.82**		

Note: Wi (%) = Wricke's Ecovalence expressed as percentage, Di = Hanson's stability parameter

When experimental error variances are homogeneous, pooled error mean square is obtained simply as average of error mean squares over all the environments, provided the error degrees of freedom are also identical (Cochran and Cox, 1957). A preliminary analysis of the data using Barlett's chi-square test for the homogeneity of error variance of the ten environments confirmed, that the error variances of the environments for the four characters differed significantly which did not permit pooled analysis of the data over the five environments. Log transformed data also exhibited significant chi-square test further confirming that the error mean square of the individual environments can not be pooled for the four traits studied. Thus simple stability models which do not require pooling of error mean squares over the environments, as those proposed by Wricke (1962) and Hanson (1970) were used to observe the stability of the aforesaid traits. The six white jute strains raised in different locations over different years exhibited significant difference for plant height in the environments E_1, E_2, E_5 and E_9; for basal diameter in the environments E_5, E_6 and E_{10}; for green weight in the environments E_1, E_5. E_6, E_9 and E_{10} and for fibre yield in the environments E_1, E_6, E_7, E_8, E_9 and E_{10}.

The mean performance, Wricke's Ecovalence (Wi) as percentage and Hanson's composite measures of genotype stability (Di) were calculated from the data over ten environments (Table 2). As percentage of ecovalence (Wi) is universally associated with phenotypic stability, hence a low percentage of Wi indicated high stability of performance (Wricke, 1962). Similarly on the other hand lower Di values indicated smaller departure from stable mean (Hanson, 1970). Out of the six genotypes NDC-2008 and JRC-321 (standard check) exhibited mean values for plant height which was greater than the population mean (266.67cm) but Wi (%) and Di values were moderate and indicated that it may be recommended for the high input conditions of cultivation. In case of basal diameter JRC-321 (standard check) exhibited lowest Wi and Di values followed by NDC-2001 and JRC-698 (standard check). But however, the mean basal diameter of only NDC-2001 (1.68cm) was higher than the population mean (1.65cm) indicating that only NDC-2001 had the desired stability for basal diameter over the locations. The entry JRC-321 (standard check) exhibited the lowest Wi and Di values for green weight followed by NDC-2008 and NDC-2001. But among these three entries only NDC-2008 (497.83 q ha^{-1}) and NDC-2001 (482.57 q ha^{-1}) out yielded the population mean (473.55 q ha^{-1}) and so they could be considered as stable for green weight over the ten environments. The entry NDC-2008 exhibited the lowest Wi and Di values for fibre yield followed by NDC-2001, JRC-321 (standard check), JRC-698 (standard check) and RRPS-27-C-3 but among these only NDC-2008 (27.17q ha^{-1}) and RRPS-27-C-3 (26.10q ha^{-1}) exhibited fibre yield performance better than the population mean (25.82 q ha^{-1}), indicating their stable performance for the aforesaid trait over the environments.

In the present study, overall performance of NDC 2008 and NDC 2001 for all the fibre yield and its attributing characters together can be broadly considered stable over all the environments except plant height and basal diameter due to greater green weight and fibre yield over population mean along with simultaneous lower Wi (%) and Di values and hence are the desired one. There was one more genotype namely RRPS-27-C-3 which performed better than the population mean for fibre yield along with low Wi (%) and Di values and may be considered as stable for fibre yield.

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