Bangladesh J. Environ. Sci., Vol. 43, 13-16, 2022 @ BAED ISSN 1561-9206

PRELIMINARY YIELD TRIAL FOR HIGH YIELDING BREEDING LINES OF DESHI JUTE (*Corchorus capsularis* L.) AT DIFFERENT LOCATIONS IN BANGLADESH

A. Miah[1]*, M. Kamrujjaman[2], Sayeeduzzaman[3], M. I. Hossain[4] and S. M. M. Hossain[5]
[1]GRS Division, [2]FQI Division, [5]PTC Divison; BJRI, Dhaka-1207
[3]Dept. of Soil Science, [4]Dept. of Plant Pathology; BAU, Mymensingh-2202
*Corresponding author's email: arjumia146@gmail.com

ABSTRACT

The experiment was conducted in 2015 at Jute Agriculture Experiment Station (JAES), Manikgonj and four regional stations (Rangpur, Faridpur, Chandina and Kishoregonj) of Bangladesh Jute Research Institute. Both qualitative (stem color, leaf color, stipule color, bud color, branching habit, leaf shape etc.) and quantitative (plant population, plant height, green weight with and without leaves, fibre wt., stick wt. etc.) types of data were recorded. In this experiment, comprising three potential breeding lines namely, BJC-5002, BJC-5050 and BJC-5105 were tested for higher yield and adaptability. Seeds were sown in randomized complete block design (RCBD) with three replications. The variety CVL-1 was used as check. The significant differences were observed among the breeding lines in respect of fibre yield, stick yield, green weight with and without leaves at Rangpur. The fibre yield (4.23 tha^{-1}), the stick weight (9.43 tha^{-1}), and green weight with and without leaves (73.67 and 61.78 tha^{-1}) of BJC-5002 observed as the highest at Rangpur region. The mean performance of the breeding line BJC-5002 (3.53 tha^{-1}), compatible with the check variety CVL-1 (3.55 tha^{-1}) in respect of fibre yield.

Key words: Deshi jute, breeding line, variety.

Introduction

Jute (*Corchorus spp.* L. 2*n* = 14) breeding is a challenge to plant breeders as selection of better genotype is cumbersome as generation advancement of selections requires two growing seasons compared to one season in other field crops. Moreover, hybridization is also a tedious process. In spite of these difficulties, a number of high-yielding varieties of both *C. olitorius* and *C. capsularis* have been developed in India, Bangladesh and China using different breeding methods. During the last 50 years, the improvement of fibre yield potential has almost doubled. Advanced plant breeding methods along with genomic tools are only way to bring next quantum jump by breaking yield plateau. But due to the narrow genetic base of *Corchorus* species, lack of suitable transformation protocol using tissue culture and lack of high-throughput phenotyping technology, the pace of jute crop improvement is slow. The use of genomic tools and advanced breeding methods like marker aided selection, speed breeding and transgenic research and the use of genome editing tools may open a new avenue in future in crop improvement in jute to establish it as a climate-smart crop by imparting biotic and abiotic stress resistance along with better fibre quality (Kar *et al.,* 2022). Despite the lower yield potential and inferior fibre quality of *Corchorus capsularis* (white jute) compared to *C. olitorius* (tossa jute), the former with fibre having fineness below 10 deniers has great demand in the diversified and 'value-added' jute markets (Ghosh, 1983). Mainly white jute is used for preparing 100% food-grade mineral oil-free jute bags, shopping and handbags, floor coverings, decorative and household fabrics, geo-textiles, composites, and reinforcements. In recent years, jute yields have plateaued or even declined, although production technology has advanced (Khatun *et al.*, 2010). Hence, there is a need for improving fibre yield and fibre quality of white jute varieties. Many Scientists were experimented to evaluate the preliminary yield performance of their newly developed lines (Sanjoy *et al.*, 2018; Hassan *et al.*, 2018 and Hossain *et al.*, 2015). To develop new varieties of white jute suitable for two main regions early and late sowing and varieties with higher yield potential than the existing cultivars. Keeping these objectives in mind eight new promising breeding lines were derived through ten parent diallel crosses and subsequent selection and tested for assessment of their yield and other attributes under different agro-ecological conditions.

Selected three advanced breeding lines viz. BJC-5002, BJC-5050 and BJC-5105 derived through diallel crosses among the parents Acc-1515, Acc-1831, Acc-1832, Acc-1833, Acc-2146, Acc-4087, Acc-3695, A-38, CC-45 and CVL-1 of diverse geographical origin. These materials were isolated from eight breeding lines in respect of higher yield as well as distinct qualitative character in 2009. During 2010-2014 these lines were evaluated under different locations for evaluate their yield and adaptability. The objective of the experiment was to derive new varieties with higher yield of white jute production in Bangladesh.

Materials and Methods

This experiment was conducted three potential breeding lines namely, BJC-5002, BJC-5050 and BJC-5105 were tested for higher yield and adaptability at Jute Agriculture Experiment Station (JAES), Manikganj and four regional stations viz. Rangpur, Chandina, Faridpur, Kishoreganj of BJRI under different agro-ecological zones in 2015. Pigmentation of selected breeding lines of deshi jute (*C. capsularis*) along with check variety CVL-1 is shown in Table-1.

Table 1. Pigmentation of high yielding breeding lines of *Corchoru scapsularis* along with check variety CVL-1

Variety/lines	SC	LC	VC	PC	St	StC	BC	BH	LS
C-1546	G	G	G	R	+	R	G	Non branch	Ovate
C-1548	G	G	G	G	+	G	G	Rudimentary	Ovate
C- 4311	G	G	G	G	+	G	G	Non branch	Ovate
C-4328	G	G	G	G	+	G	G	Non branch	Ovate-lanceolate

G= Green, R= Red, LR= Light Red, "+" = Present, ***** Check variety, SC= Stem color; LC= Leaf color; VC= Vein Color; PC= Petiole color; St= Stipule; StC= Stipule color; BC= Bud color; FC= Fruit Color; BH= Branch habit; LS= Leaf shape

The seeds were sown in a randomized complete block design (RCBD) with three replications having unit plot size of 4.5 m x 3.0m. The variety CVL-1 was used as check. Proper intercultural operations, standard agronomic practices, recommended dose of fertilizer and pesticide were applied for better growth and fibre yield. The quantitative (plant height, base diameter, green weight with and without leaves, fiber weight, stick weight and plant population) data were recorded at harvesting time. Location specific one year average data of yield and yield attributing characters were analyzed with the help of computer statistical package (MSTAT). The mean differences among the treatments were adjusted as per Least Significant Difference (LSD) and T-test at 0.05 levels (Gomez and Gomez, 1984).

Results and Discussion

This experiment comprising three potential breeding lines namely, BJC-5002, BJC-5050 and BJC-5105 were tested by qualitative and quantitative parameters. The significant differences were observed among the treatments in plant population and plant height at Manikganj; plant population, green weight with leaves and green weight without leaves, fibre and stick weight at Rangpur and plant population at Faridpur (Table 2). The breeding line C-5002 produced significantly higher fibre yield (4.99 tha^{-1}) than check variety CVL-1 (4.87 tha^{-1}) at Manikganj. On the other hand, the breeding line BJC-5105 was recorded for the lowest fibre yield (1.67 tha^{-1}) at Kishoregonj. The breeding line BJC-5002 (13.41 tha^{-1}) followed by the check CVL-1 (11.23 tha^{-1}) showed the higher yield of stick weight at also Manikganj. Conversely, the lowest yield of stick was recorded from BJC-5050 (4.46 tha^{-1}) at Kishoregonj. There is a consistent relationship between jute fibre yield and plant height. As the height of the plant increases, so does the fibre yield. In respect of mean performance of plant height, the line C-5002 was (3.23 m), compatible with the check variety CVL-1 (3.24 m). The plant height of C-5002 (3.88 m) observed highest from Check variety CVL-1 (3.66 m) at Faridpur regional station. On the other hand, the plant height of BJC-5105 (2.46 m) observed lowest at Kishoregonj regional station. The base diameter is considered as an important parameter for fibre yield. As the base diameter increases, the fibre yield also increases. The mean performance of base diameter of BJC-5002 (20.02 mm) observed lower from the check variety CVL-1 (20.31 mm). The base

diameter of BJC-5002 (23.31 mm) observed highest from Check variety CVL-1 (22.42 mm) at Chandina regional station. On the other hand, the base diameter of BJC-5105 (17.67 mm) observed lowest at Faridpur regional station.

Table 2. Performance of three high yielding breeding lines of white jute along with the check variety CVL-1 at different location in Bangladesh

Stations	Varieties/ line	PP (mha^{-1})	PH (m)	BD (mm)	GWL (tha^{-1})	GWtL (tha^{-1})	FW (tha^{-1})	SW (tha^{-1})
Manikganj	BJC-5002	0.265	3.42	21.13	53.53	48.85	4.99	13.41
	BJC-5050	0.214	3.14	19.55	25.45	20.78	2.78	6.65
	BJC-5105	0.214	3.24	20.25	51.87	48.98	4.67	10.87
	CVL-1	0.265	3.31	20.67	46.43	38.43	4.87	11.23
	LSD (5%)	0.231	0.21	NS	NS	NS	NS	NS
Rangpur	BJC-5002	0.267	3.35	21.13	73.67	61.78	4.23	9.43
	BJC-5050	0.221	3.11	20.43	53.35	44.34	2.56	7.24
	BJC-5105	0.268	3.15	19.68	68.32	56.87	3.87	9.15
	CVL-1	0.295	3.21	19.78	71.45	60.86	4.11	9.24
	LSD (5%)	0.067	NS	NS	14.15	15.53	0.455	1.843
Chandina	BJC-5002	0.215	3.88	23.31	56.78	46.13	3.34	8.56
	BJC-5050	0.242	3.56	21.67	51.34	42.23	3.37	8.35
	BJC-5105	0.263	3.63	21.63	55.78	44.67	3.54	8.26
	CVL-1	0.224	3.66	22.42	56.87	45.87	3.67	8.75
	LSD (5%)	NS	NS	NS	NS	NS	NS	NS
Faridpur	BJC-5002	0.437	3.12	19.76	67.66	58.67	4.43	9.67
	BJC-5050	0.256	3.54	17.67	54.57	42.56	3.25	8.63
	BJC-5105	0.454	3.12	19.23	55.45	46.78	3.67	8.45
	CVL-1	0.446	3.32	19.54	62.23	51.32	3.87	9.26
	LSD (5%)	.0067	NS	NS	NS	NS	NS	NS
Kishoreganj	BJC-5002	0.241	2.78	21.25	20.35	16.43	2.17	5.76
	BJC-5050	0.244	2.72	20.74	21.65	17.23	1.78	4.46
	BJC-5105	0.211	2.46	18.56	24.45	19.34	1.67	4.48
	CVL-1	0.245	2.64	20.24	22.68	18.23	1.88	5.56
	LSD (5%)	NS	NS	NS	NS	NS	NS	NS

Table 3. Performance of three advanced lines of white jute (Pooled mean over stations) along with check variety

Varieties/ strains	Parentage	PN	PP (mha^{-1})	PH (m)	BD (mm)	GWL (th^{-1})	GWtL (th^{-1})	FW (th^{-1})	SW (th^{-1})
BJC-5002	Var.CVL-1 x Acc.1831	993-1-5002	0.285	3.23	20.02	54.40	46.37	3.53	8.32
BJC-5050	Accs.2146 x 4087	9961-1-5050	0.235	3.21	20.43	41.27	33.43	2.75	6.67
BJC-5105	Vars.CVL-1 x A-38	998-1-5105	0.282	3.24	20.56	51.17	43.33	3.46	8.35
CVL-1	Variety	-	0.295	3.23	20.31	51.93	42.94	3.55	8.33
LSD (5%)	..	..	NS	NS	NS	NS	NS	0.49	0.92
LSD (1%)	..	..	NS	NS	NS	NS	NS	0.82	1.57

PN= Pedigree number; PP= Plant population; PH= Plant height; BD= Base diameter; GWL= Green weight with leaves; GWtL= Green weight without leaves; FW= Fiber weight; SW= Stick weight

In respect of mean performance of fibre yield, the check variety CVL-1 (3.55 tha^{-1}) over yielded from the breeding line of deshi jute BJC-5002 (3.53 tha^{-1}), BJC-5050 (2.75 tha^{-1}), BJC-5105 (3.46 tha^{-1}), respectively. The breeding line BJC-5002 (4.99 tha^{-1}) produced highest fibre yield from the Check variety

CVL-1 (4.87 tha^{-1}) at Manikganj station. On the other hand, the breeding line BJC-5105 (1.67 tha^{-1}) produced lowest fibre yield at kishoregonj regional station. In respect of the mean performance of stick yield, the check variety CVL-1 (8.33 tha^{-1}) over yielded from the breeding lines of deshi jute BJC-5002 (8.32 tha^{-1}) and BJC-5050 (6.76 tha^{-1}), respectively. The breeding line BJC-5002 (13.41 tha^{-1}) produced the highest stick yield from the Check variety CVL-1 (11.23 tha^{-1}) at Manikganj station. On the other hand, the breeding line BJC-5050 (4.46 tha^{-1}) produced lowest stick yield at kishoregonj regional station. The above results for plant hight, base diameter, fibre yield and stick yield were also similar with (Sanjoy *et al.*, 2018; Hassan *et al.*, 2018 and Hossain *et al.*, 2015).

Conclusion

It could be concluded that the line BJC-5002 was more efficient in respect of whole growth, fibre yield and yield attributing traits . So, we strongly recommend this BJC-5002 line of white Jute would be more successful productive variety in the regional condition in Bangladesh.

References

Ghosh. T. 1983. Handbook on jute, FAO, Rome. 29- 31.

Gomez. A. K. and Gomez. A. A. 1984. Statistical procedure for agric. res. Second edition, International Rice Research Institute, Manila. Philippines. 139- 207.

Hassan. K. M. M., Bhuyan. M. I., Islam. M. K., Hoque. M. F., Islam. M. M., Islam. M. S., Ferdous. M. and Proshad. R. 2018. Performance of some jute & allied fiber varieties in the southern part of Bangladesh. *Intl. J. Advan. Geosci.*, 6 (1): 117-121.

Hossain. M. S., Islam. M. M., Ahmed. I., Rahman. M. S. and Rahman. M. L. 2015. Effect of sowing dates on fibre yield and yield attributes of white jute breeding line BJC-5003 at different locations of Bangladesh. *Intl. J. Sustain.Agril. Tech.*, 11(8): 01-06.

Kar. C. S., Satya. P. and Kar G. 2022. Jute breeding. Fundamentals of Field Crop Breeding. Springer, Singapore.

Khatun. R., Sarkar. R. H. and Sobhan. M. A. 2010. Diallel analysis in seven quantitative traits in deshi jute (*Corchorus capsularis* L.). *Bd. J. Bot*., 39(2): 137-141.

Sanjoy. S. and Jiban M. 2018. JRC 9057 (Ishani): a newly developed white jute (*Corchorus capsularis* L.) variety for enhanced fibre yield and improved quality textile fibre. *Pha. Inn. J.*, 7(7): 164-167.