International Journal of Bioresource Science
Citation: IJBS: 3(1): 7-15 June 2016
DOI: 10.5958/2454-9541.2016.00002.5

Prospects of developing pre-mature flowering resistant tossa jute (*C. olitorius*) variety for early March and onwards sowing

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Abstract

Jute is generally cultivated during the months of April-July and the crop is followed by aman /kharif paddy cultivation. In most cases jute seed is sown based on onset of nor'westers or westerly winds which are not usually anticipated in time. Therefore, the cultivators have to face a dilemma in regard to pre-mature flowering under early sowing and pre-mature harvesting of his crop before paddy cultivation under late sowing. In such a situation, development of jute crop highly resistant to pre-mature flowering for early March to mid-March sowing without any risk of pre-mature flowering is considered to be a new breeding objective.

Not only this, the issue of fitting the jute crop in a schedule of intercropping with green gram etc., where the latter crops need to be harvested before monsoon break, a jute variety needs to be preferably sown in the 1st week of March .

Keeping all these in mind, an attempt was made to develop tossa jute variety highly resistant to pre-mature flowering in response to early March and onwards sowing. Two advance lines, NJ 7055 (with green stem) and NJ 7050 (with coppery red) have been developed which recorded 20.37 % and 17.70% higher fibre yield than the best check variety JRO 204 under 1st March (early) sowing and 12.97% and 10.60% under 15th March (timely) sowing. Under late sowing (5th April) too, the test entries NJ 7055 and NJ 7050 recorded 4.28% and 6.33% respectively higher yield than the best check variety JRO 524. In the present paper detailed field data (two years data of two locations) have been presented and inferences drawn.

Keywords: Harvesting, NJ 7055, JRO 524

During partition of India in 1947, D 154 & Chinsurah Green were the only varieties available for cultivation. Yield potential of these varieties were 15-18 qtl/ha with crop duration of 150-160 days for fibre production (Karmakar *et al*. 2001). In 1954 JRO 632 was evolved through pureline selection from indigenous collections and released as the 1st notified variety for commercial cultivation in India. Later, it was left necessary to fit jute crop in multiple cropping sequences by early sowing avoiding the risk of premature flowering. In this endeavor Sudan Green, an exotic germplasm from Africa was crossed with JRO 632 and JRO 620 and following pedigree method of selection JRO 878, JRO 7835 and JRO 524 were developed during seventies which could be sown as early as middle of March without induction

Table 1: Year wise release of Tossa jute (*C. olitorius*) varieties in India

Sl. No.	Variety	Year of Release	Pedigree	Centre of Development	Flowering behaviour	Optimum sowing time	Fibre yield (qtl/ha)
1	Chinsurah Green	1915	Selection from a local strain in chinsurah	CRIJAF(ICAR)	Susceptible to premature flowering if sown before mid-April	Mid-april to end-April	20-22
2	JRO 632 (Baisakhi Tossa)	1954	Selection from a indigeneous germplasm	CRIJAF(ICAR)	Susceptible to premature flowering if sown before mid-April	Mid-april to end-April	30-32
3	Sudan Green	1956	Introduction from Sudan, Africa	CRIJAF(ICAR)	-	-	30-32
4	JRO 620	1967	Selection from local type	CRIJAF(ICAR)	Susceptible to premature flowering if sown before mid-April	Mid-april to end-April	30-32
5	JRO 878 (Chaitali Tossa)	1967	JRO 620XSudan Green	CRIJAF(ICAR)	Resistant to premature flowering on mid-March sowing	Mid-March to end-April	30-32
6	JRO 7835 (Basudev)	1971	JRO 632 XSudan Green	CRIJAF(ICAR)	Resistant to premature flowering on mid-March sowing	Mid-March to end-April	32-34
7	JRO 524 (Navin)	1977	Sudan Green X JRO 632	CRIJAF(ICAR)	Resistant to premature flowering on mid-March sowing	Mid-March to end-April	34-36
8	Tanganyika 1	1978	Introduction from Tanganyika	CRIJAF(ICAR)	-	-	30-32
9	JRO 36E	1981	Selection from Tanganyika 1	CRIJAF(ICAR)	-	-	32-34
10	TJ 40 (Mahadev)	1983	Selection from a cross between mutants of JRO 632	BARC, Trombey	Susceptible to premature flowering if sown before mid-April	Mid –April to end end-April	30-35

11	JRO 3690 (Savitri)	1985	Tobaco leaf X Long Internode	CRIJAF(ICAR)	Susceptible to premature flowering if sown before mid-April	Mid –April to end end-April	30-33
12	KOM 62 (Rebati)	1993	Gemma-ray derivate of JRO 878	JRS, OUAT, Kendrapara	Susceptible to premature flowering if sown before mid-April	Mid –March to late-April	30-35
13	JRO 66 (Golden Jubilee Tossa)	1998	Multiple cross involving six parents	CRIJAF(ICAR)	Susceptible to premature flowering if sown before mid-April	Mid-April	35-40
14	JRO 8432 (Shakti)	1999	IC 15901 X Tanganyika 1	CRIJAF(ICAR)	Resistant to premature flowering on mid-March sowing	Mid –March to late-April	35-40
15	JRO 128 (Surya)	2002	TJ 6XTanganyika 1	CRIJAF(ICAR)	Resistant to premature flowering on mid-March sowing	Mid-March to end-April	35-40
16	JRO 2345	2004	Selection from KEN/SM/024C	CRIJAF(ICAR)	Resistant to premature flowering on mid-March sowing	Mid-March to end-April	34-36
17	S-19(Subala)	2005	(JRO 620XSudan green)X Tanganyika 1	CRIJAF(ICAR)	Resistant to premature flowering on mid-March sowing	Mid-March to end-April	35-40
18	JRO 204(Suren)	2007	IND/SU/053 X KEN/DS/060	CRIJAF(ICAR)	Resistant to premature flowering on mid-March sowing	Mid-March to end-April	36-38
19	AAU-OJ-1(Tarun)	2007	Tanganyika 1X JRO 640	AAU, Jorhat	Resistant to premature flowering on mid-march sowing	Mid-March to end-April	34-36
20	JBO 2003H(IRA)	2008	(JRO 632X Sudan Green) X Tanganyika 1	CRIJAF(ICAR)	Resistant to premature flowering on mid-march sowing	Mid-March to end-April	34-36
21	CO 58(Sourav)	2010	TJ 40XTanganyika 1	CRIJAF(ICAR)	Resistant to premature flowering on mid-march sowing	Mid-March	30-34
22	JBO 1	2010	-	CRIJAF(ICAR)	Resistant to premature flowering on mid-March sowing	Mid-March to end-April	34-36

of premature flowering (Karmakar *et al*. 2008). These were accepted by the farmers due to high yield and suitability to fit jute crop in crop rotation with transplanted aman/kharif paddy. Later, in eighties three more varieties i.e., TJ 40, JRO 3690 & KOM 62 were developed for different agro-ecological situations of jute growing states of India.

Recently jute varieties with improved fibre quality are of great demand for production of diversified value added products. In such endeavor, varieties like JRO 66, JRO 8432 & JRO 128 have been released during 1998-2002 for high yield and improved fibre quality. In this group several new varieties namely JRO 2345, S 19 (Subala), JRO 204 (Suren), AAU-OJ-1 (Tarun), JBO 2003 (IRA), CO 58 (Sourav), JBO 1 etc. have been released during 2004-2010 for commercial cultivation. A list of the released varieties with flowering behaviour and suitable sowing time is presented in chronological order in Table 1.

From Table 1 it is evident that superior variety with premature flowering resistance for sowing in 1st half of March is still in demand. The successful development of which can provide enough opportunity to the farmers for sowing of jute seed any time in between early March to mid-March depending upon availability of early showers and harvesting of mature jute crop of 120-125 days duration before kharif paddy cultivation. Not only this, the end of February or early March sowing will help in intercropping jute crop along with other remunerative crops like green gram, amaranthas etc. (Ghorai et al., 2014).Keeping all these in views effort has been directed to develop varieties which may respond to resistance to premature flowering at the same time ensure high economic fibre yield under early sowing.

Materials and Methods

Experiments were conducted at Regional Research Station, Nuziveedu Seeds Limited, Barrackpore (22°46'N , 88°24'E and 7.5 m above MSL, North 24 Parganas, West Bengal during Feb,2012 to Sept, 2013. Multilocation testing was conducted in Murshidabad, an important jute growing district of Central West Bengal. High yielding popular varieties like JRO 524 & JRO 204 were collected from Central Research Institute for Jute and Allied Fibers (ICAR) and used as yield check(for comparing fibre yield). On the other hand, Sudan Green and Tanganyika 1 were collected from Institute of Agricultural Science of Calcutta University and used as flowering checks (for comparing premature flowering duration). Seeds were sown in three splits starting from 1st March to 5th April in a homogeneous piece of land following Complete Block Design with four replications, gross plot size of each plot being 10 sqm (2×5 meter. The mean values of four replications were put in the tables in all cases.

Plants were grown in lines following recommended spacing of 25X5-7 cm (Ghorai 2008). For cultivation of crop including control of weeds, pests, diseases and fibre retting standard package of practices were followed (Saha *et al*. 2008, Mukesh Kumar *et al*. 2013, Ramasubramanyam, T and Ghosh, S.K, 2008, Roy *et al*. 2008 and Majumdar *et al*. 2008). For recording effective plant height, the 1st forking point on the stem were considered following Revised Official DUS Test Guidelines of Jute (PPV & FR Authority, 2008) and for assessment of premature flowering resistance Kumar *et al*. 2008 and Begum and Kumar, 2011 were followed.

During harvesting two border rows (length wise) were removed and data were collected from net plot size of 7.5 sqm only. Before recording plot yield sundried fibre bundles were taken into hot- air ovens for eight hours at 75°C temperatures for uniform drying.

Results and Discussion

Plant height, one of the most important yield attributes in jute, was highly influenced by early sowing (Table 2, 3 & 4). Only NJ 7055 and NJ 7060 had been able to produce tall cylindrical stems without formation of any flower, pods or branches. All other check entries including Sudan Green and Tanganyika 1 had produced premature flowers, pods and profuse branches at differential stem height during 35-65 days of crop growth as a result the effective plant heights as well as fibre yields of the latter's were significantly reduced.

Table 2: Field data recorded at Barrackpore (South Bangal) in kharif, 2012

Date of sowing	Name of Entry	Plants with premature flowers & branches (%)	Plant Height (mt)	Base Diameter (cm)	Green Biomass Yield/plot(kg)	Fibre Yield/ plot(kg)	Fibre Yield (Qtl/Ha)	Superiority over best check (%)
1st March	NJ 7055	00.0	3.41	1.65	47.988	3.023	40.30	20.36
	NJ 7050	00.0	3.32	1.66	46.778	2.942	39.32	17.45
	JRO 524	100	1.90	1.43	45.524	2.396	31.95	
	JRO 204	100	2.16	1.47	46.705	2.511	33.48	Best check
	Sudan Green	100	1.95	1.60	44.662	2.424	32.32	
	Tanganyiaka 1	100	1.78	1.40	41.213	2.277	30.36	
	CD(P=0.05)		0.22	0.13	3.115	0.175	2.03	
15th March	NJ 7055	00.0	3.55	1.68	54.302	3.352	44.70	16.34
	NJ 7050	00.0	3.61	1.60	53.905	3.247	43.29	12.67
	JRO 524	21.6	3.10	1.50	51.263	2.771	36.95	
	JRO 204	7.4	3.22	1.56	52.740	2.882	38.42	Best check
	Sudan Green	11.2	2.95	1.35	45.253	2.433	32.45	
	Tanganyiaka 1	15.6	2.70	1.27	45.086	2.424	32.32	
	CD(P=0.05)		0.27	0.16	4.030		1.95	
5th April	NJ 7055	00.0	3.29	1.71	49.844	2.932	39.09	3.85
	NJ 7050	00.0	3.35	1.68	53.381	2.970	39.61	5.24
	JRO 524	00.0	2.98	1.56	47.991	2.823	37.64	Best check
	JRO 204	00.0	3.15	1.60	43.339	2.656	35.41	
	Sudan Green	00.0	2.87	1.56	40.250	2.300	30.67	
	Tanganyiaka 1	00.0	2.92	1.49	40.792	2.217	29.56	
	CD(P=0.05)		0.31	0.15	3.872		1.87	

Table 3: Field data recorded at Barrackpore (South Bangal) in kharif, 2013

Date of sowing	Name of Entry	Plants with premature flowers & branches (%)	Plant Height (mt)	Base Diameter (cm)	Green Biomass Yield/plot (kg)	Fibre Yield/ plot (kg)	Fibre Yield (Qtl/ Ha)	Superiority over best check(%)
1st March	NJ 7055	00.0	3.65	1.67	50.729	3.056	40.74	18.36
	NJ 7050	00.0	3.46	1.71	50.810	3.006	40.08	16.45
	JRO 524	100	1.87	1.56	45.979	2.472	32.96	
	JRO 204	100	2.19	1.50	46.476	2.582	34.42	Best check
	Sudan Green	100	1.68	1.43	44.973	2.367	31.56	
	Tanganyiaka 1	100	1.53	1.42	39.838	2.201	29.34	
	CD(P=0.05)		0.26	0.17	4.06		1.75	
15th March	NJ 7055	00.0	3.69	1.56	51.492	3.065	40.87	9.34
	NJ 7050	00.0	3.72	1.62	54.944	3.020	40.26	7.69
	JRO 524	15.7	3.10	1.56	49.533	2.607	34.75	
	JRO 204	5.1	3.27	1.60	51.855	2.803	37.38	Best check
	Sudan Green	12.6	3.02	1.52	43.700	2.375	31.67	
	Tanganyiaka 1	9.7	3.11	1.54	42.662	2.357	31.42	
	CD(P=0.05)		0.35	0.14	3.905		1.89	
5th April	NJ 7055	00.0	3.42	1.43	46.712	2.764	36.85	4.65
	NJ 7050	00.0	3.55	1.50	50.978	2.801	37.35	6.07
	JRO 524	00.0	3.24	1.42	44.105	2.641	35.21	Best check
	JRO 204	00.0	3.35	1.44	43.786	2.531	33.75	
	Sudan Green	00.0	3.18	1.36	42.750	2.375	31.67	
	Tanganyiaka 1	00.0	3.27	1.37	44.669	2.351	31.35	
	CD(P=0.05)		0.31	0.18	3.225		2.02	

Table 4: Field data received at Jiaganj, Murshidabad (Central Bengal) in kharif, 2013

Date of sowing	Name of Entry	Plants with premature flowers & branches (%)	Plant Height (mt)	Base Diameter (cm)	Green Biomass Yield/plot (kg)	Fibre Yield/ plot(kg)	Fibre Yield (Qtl/Ha)	Superiority over best check(%)
1st March	NJ 7055	00.0	3.35	1.72	48.986	2.951	39.35	22.40
	NJ 7050	00.0	3.22	1.63	47.725	2.875	38.33	19.21
	JRO 524	100	1.80	1.64	45.171	2.390	31.87	
	JRO 204	100	2.05	1.52	42.192	2.411	32.15	Best check
	Sudan Green	100	1.90	1.40	41.161	2.344	31.25	
	Tanganyiaka 1	100	1.67	0.43	40.986	2.277	30.36	
	CD(P=0.05)		0.25	0.15	3.110		1.95	
15th March	NJ 7055	00.0	3.60	1.65	55.942	3.370	44.93	13.23
	NJ 7050	00.0	3.42	1.62	56.311	3.332	44.22	11.45
	JRO 524	17.2	3.28	1.43	51.368	2.807	37.42	
	JRO 204	7.3	3.41	1.56	54.163	2.976	39.68	Best check
	Sudan Green	10.6	3.10	1.40	43.610	2.450	32.67	
	Tanganyiaka 1	13.5	3.17	1.35	43.133	2.319	30.92	
	CD(P=0.05)		0.28	0.13	4.086		2.11	
5th April	NJ 7055	00.0	3.52	1.72	48.417	2.882	38.43	4.34
	NJ 7050	00.0	3.61	1.60	50.142	2.974	39.65	7.66
	JRO 524	00.0	3.37	1.55	49.163	2.762	36.83	Best check
	JRO 204	00.0	3.42	1.62	47.579	2.559	34.12	
	Sudan Green	00.0	3.15	1.43	45.775	2.422	32.29	
	Tanganyiaka 1	00.0	3.12	1.48	44.928	2.367	31.56	
	CD(P=0.05)		0.36	0.14	2.756		1.78	

The base diameter of stems and green biomass production of the test entries (NJ 7055 & NJ 7050) definitely showed significantly higher value than checks but it was not comparable to the extent registered in plant height, as vegetative growths in the check entries were not hindered even after pod or branch formation. As regards fibre yield again the test entries (NJ 7055 & NJ 7050) recorded significantly higher yield because of their tall-cylindrical stems. Not only this, in the check entries including JRO 524 and JRO 204 fibre extraction by "beat- break-jerk" method (Majumdar *et al*. 2008) had created problem due to numerous branches resulting in recovery of very poor quality fibers. On over all basis (i.e., over years & locations) the test entries NJ 7055 & NJ 7050 had recorded 20.37% and 17.70% respectively higher fibre yield than the best check variety JRO 204 (Suren) under 1st March sowing (Table 5)

Table 5: Pooled data (over kharif, 2012 & 2013 of Brrackpore and kharif, 2013 of Murshidabad)

Date of sowing	Name of Entry	Plants with premature flowers & branches (%)	Plant Height (mt)	Base Diameter (cm)	Mean Biomass Yield/plot (kg)	Mean Fibre Yield/plot (kg)	Fibre Yield (Qtl/Ha)	Superiority over best check(%)
1st March	NJ 7055	00.0	3.49	1.68	49.234	3.011	40.14	20.37
	NJ 7050	00.0	3.33	1.66	48.437	2.944	39.25	17.70
	JRO 524	100	1.85	1.54	45.558	2.420	32.26	
	JRO 204	100	2.13	1.49	45.124	2.501	33.35	Best check
	Sudan Green	100	1.84	1.47	43.598	2.376	31.71	
	Tanganyiaka 1	100	1.66	1.41	40.679	2.251	30.02	
	CD(P=0.05)		0.24	0.15	3.428		2.01	
5th March	NJ 7055	00.0	3.61	1.63	53.912	3.262	43.49	12.97
	NJ 7050	00.0	3.58	1.61	55.053	3.194	42.58	10.60
	JRO 524	18.2	3.16	1.49	50.721	2.728	36.37	
	JRO 204	6.6	3.30	1.56	52.919	2.887	38.49	Best check
	Sudan Green	11.5	3.02	1.42	44.187	2.420	32.26	
	Tanganyiaka 1	12.9	2.99	1.38	43.627	2.366	31.55	
	CD(P=0.05)		0.30	0.14	4.007		1.97	
15th April	NJ 7055	00.0	3.41	1.62	48.324	2.859	38.12	4.28
	NJ 7050	00.0	3.50	1.59	51.500	2.915	38.87	6.33
	JRO 524	00.0	3.19	1.51	47.086	2.742	36.56	Best check
	JRO 204	00.0	3.30	1.55	44.907	2.582	34.42	
	Sudan Green	00.0	3.06	1.45	42.925	2.366	31.54	
	Tanganyiaka 1	00.0	3.10	1.44	43.523	2.311	30.82	
	CD(P=0.05)		0.32	0.15	3.284		1.83	

Under timely (mid-March) sowing the test entries NJ 7055 and NJ 7050 had recorded 12.97 and 10.60% respectively higher fibre yield than the best check entry JRO 204 over years and locations (Table 5). It is remarkable that under this sowing schedule the extent of differences among all the six entries as regards to their plant height, base diameter, fibre yield etc. were observed less when they were compared to early (mid-February) sowing. This is due to on-set of longer day lengths with favorable hot and humid climates in the months of April, May and June.

It is noteworthy to mention here that under mid-March sowing all the check entries, including JRO 204 which has been hitherto considered ever best variety as regard to its resistance to premature flowering, produced variable number (6.6%) of plants with premature flowers and undesirable

branches (Table 5). On the other hand both the test entries being blessed with their tall cylindrical stem, resulting from strong resistance to premature flowering, recorded significantly higher fibre yield than all the check entries.

The overall superiority of the test entries was also recorded under late sowing too, though in a lesser magnitude as compared to early and timely sowing (Table 5). As the late sowing coincides with the most favorable period for vegetative growth of jute crop under longer days coupled with hot and humid weather due to intermittent rains, all the six entries under study had grown normally as per their genetic potential. The resistance or susceptibility to premature flowering of all the six entries seemed not to play any significant role in fibre production under this sowing schedule.

Acknowledgements

The author is indebted to Dr.P. Sateesh Kumar,Director-Research for inspiration in conducting this experiment and Mr. M.Prabhakar Rao, Chairman cum Managing Director of Nuziveedu Seeds Limited for providing financial assistance.

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