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Impact of Stem-water Ratio and Separately Retting the Top and Basal Parts of Jute on the Quality of Fibre

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Abstract: An experiment was conducted in laboratory condition maintaining the ratio of plant stems and water at the range of 1:5, 1:10, 1:15, 1:20, 1:25 and 1:30 at a temperature 30°C. The best retting phenomena was observed at the ratio of 1:20. After the completion of retting in each ratio, fibre properties were measured and the best fibre was obtained at the ratio of 1:20. In the Retting top and bottom parts of the jute plants separately and malleting 40 cm of the basal part improved the fibre quality and showed more or less uniform retting. The cutting was completely eliminated through malleting and separately retting top and the bottom parts of the jute plants.

Key words: Jute fibre, retting, ratio, quality, top and basal part

Introduction

The bark of the plants contain the fibre and the fibre is separated from the woody core of the stem by steeping the bundles of harvested and defoliated plants, in water of various sources (Saha and Banerjee, 1955). The microorganisms mostly bacteria of the retting enter the plant tissues through the stomata or the cut end and through their enzymatic action loosens the fibre strands from the woody core. The fibers are then mechanically extracted, washed, dried and marketed. The whole process is known as retting (Ghosh and Dutta, 1980). In Bangladesh the retting is carried out in water of rivers, canal lakes, ditches and ponds. Thus the importance of water in retting can hardly be overstated (Miah *et al.*, 1977).
In the production of quality fibre, retting plays an important role. If the retting is not conducted properly the fibers of the basal parts of the plant remain hard. The hard basal parts of the fibers is called the cuttings (Saha and Banerjee, 1955). The more is the percentage of cuttings, less is the fibre quality. Again if the retting is stopped when the top portion is retted, the bottom remains unretted and produced huge quantity of cuttings. So during customary retting practices the end point of retting is determined when the middle portion of the jute plants are well retted. But in this case a certain portion of the bottom parts remain unretted and gives rise to cuttings (Paul and Bhattacharyya, 1975). Further, due to the absence of adequate retting water, the quality of fibre produced becomes very inferior. This implies the necessity of determination of the optimum amount of retting water for proper retting for the production of quality fibre.
The present *In vitro* investigation is therefore, undertaken to determine the optimum amount of retting water for the production of quality fibre of jute and allied fibre (JAF) and to explore the possibility of eliminating the cuttings through separately retting the top and bottom parts of jute plants, so that uniform retting of entire jute plants could be accomplished.

Materials and Methods

The project was conducted at Central Research Station of Bangladesh Jute Research Institute, during 1998-2000. The JAF varieties of CVL-1 for *Corchorus capsularis*, O-9897 for *C. olitorius*, HS-24 for Mesta (*Hibiscus sabdariffa*) and HC-95 for kenaf (*H. canabinus*) were grown at jute experimental station of Bangladesh Jute Research Institute (BJRI). All recommended intercultural operations were done and the plants were harvested at 120 days maturity for jute and 130 days for kenaf and Mesta. After natural defoliation, the stems of the plants and ribbons were cut into 3" pieces. Uniform pieces of stem and ribbon weighing 60 g and 30 g respectively were used in experiment. Pieces of stem and ribbon were put into 250-ml conical flask and pond water was added to each flask at 1:5, 1:10, 1:20 and 1:30 stem-water ratio. Initial temperature, pH of the retting waters and subsequent change of temperature and pH were recorded at every alternate days till the completion of retting. There were three replications for each treatment. The end point of retting was determined by examining the degree of separation of the fibre strand with the help of needles and forceps.
In another investigation, the plants were retted in following way: a) sixty Kg of jute plants were retted directly in the retting pond of BJRI and was treated as control, b) sixty Kg of plants were malleted about 40 cm from the bottom and retted; and c) sixty Kg of plants were cut at the middle. The top and the bottom parts were retted separately in the same pond.
All the ret was covered with water hyacinth. Ten days after steeping the plants under water, the progress of retting was examined. The end point of retting was determined by extracting the fibre from a single plant from the ret and looked for fibre separation. If the fibers were well separated it was assumed that the end point was reached. After extraction the fibers were washed and dried. Each treatment was replicated thrice. Retting time was recorded and fibre quality was determined.

Results and Discussion

Retting did not progress at all in the treatment 1:5 and 1:10. It took 10, 14, 16 and 18 days in treatment with 1:30, 1:20, 1:10 and 1:5 straw-water ratio respectively. But quality fibre was produced from treatment with 1:30 straw-water ratio (Table 1). There was no significant difference in retting period of jute, kenaf and Mesta. However, the colour of jute fibre was rendered dark-creamy and that of kenaf and Mesta brownish at lower waters ratio. In all the treatment with ribbon retting period was almost half than that of stem of the same variety. The pH of the retting water decreased to 4.5-5.50 from the initial pH value of 7.5 in all treatments on the 4^{th} day of retting. From there it showed a rise as the retting progressed and it reached pH 7.0-7.5 at the completion of retting (Table 2).
Development of acidity in the retting water is not desirable since it retard the growth of the retting bacteria and weakens

Table 1: Effect of straw-water ratio on the retting time and fibre quality*.

Treatment	Retting period (days)	Fibre colour				Fibre grade
		CVL-1	O-9897	HS-24	HC-9551:5	
1:5	18	Dark Cream	Dark Cream	Brownish	Brownish	C^-
1:10	16	Dark Cream	Dark Cream	Brownish	Brownish	C
1:20	14	Cream	Golden	Yellow	Whitish Yellow	B
1:30	10	Cream	Golden	Yellow	Whitish	B+

*Average of three replications.

Table 2: pH changes of the retting water during the retting of CVL-1, O-9897, HS-24 and HC-95 in different proportion of straw-water ratios.

Retting progress (days)	Average pH values															
	CVL-1				O-9897				HS-24				HC-95			
	1:5	1:10	1:20	1:30	1:5	1:10	1:20	1:30	1:5	1:10	1:20	1:30	1:5	1:10	1:20	1:30
1-2	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5	7.5
3-4	4.5	4.5	5.5	6.0	4.5	5.5	5.5	6.5	4.5	5.0	5.5	6.0	5.0	5.0	5.6	6.0
5-6	5.0	5.5	6.0	6.0	5.0	5.5	5.5	5.5	5.0	5.5	5.5	5.5	5.5	5.5	5.6	6.0
7-8	5.5	5.5	6.0	6.5	5.0	5.5	5.5	6.0	5.0	5.5	6.0	6.0	5.5	5.5	6.0	6.0
9-10	6.0	6.0	6.0	7.0	5.6	5.6	5.6	7.0	6.0	6.0	6.0	7.0	5.5	5.5	6.5	7.0
11-12	6.5	6.5	6.5	RC	6.0	6.0	6.5	RC	6.5	6.5	6.5	RC	6.5	6.0	6.5	RC
13-14	6.5	6.5	7.5	-	6.0	6.5	7.5	-	6.5	6.5	7.5	-	6.5	6.5	7.0	-
15-16	6.5	7.0	RC	-	6.5	7.5	RC	-	6.5	7.0	RC	-	6.5	7.0	RC	-
17-18	7.5	RC	-	-	7.0	RC	-	-	7.5	RC	-	-	7.0	RC	-	-

RC= Retting Completed.

Table 3: Effect of separately retting top and the bottom parts on retting period and fibre quality *.

Treatment	Retting time (days)	Percent cutting	Fibre grade
Bottom	15	5	B+
Top	10	0	A
Whole Plant	16	30	B

*Average of three replications.

Table 4: Effect of malleting on retting time and fibre quality *.

Treatment	Retting period (Days)	Percent cutting	Fibre grade
Malleting	12	0	A
Whole Plant	17	38	B

* Average of three replications.

the fibre (Roy and Mandal, 1979; Ali *et al.*, 1972; Ali *et al.*, 1973). Thus, in treatment with lower straw-water ratio the retting did not progress satisfactorily. The decrease of the pH value of the retting water in primary phase of retting process might be due to the fermentation of the soluble carbohydrate leached out of the stem and ribbon of jute, kenaf and mesta (Ali *et al.*, 1973; Nandi and Basu, 1938). The subsequent rise in pH value might be due to the formation of keto-glutamic compound, normally produced in the retting water (Ali *et al.*, 1978).

The proportion of stem and water during retting influenced the colour of fibre (Table 1). At stem water proportion below 1:20 the jute fibre rendered dark cream and those of kenaf and Mesta brownish. Perhaps at lower proportion of water more fermentation acids were accumulated and the acids changes the fibre colour unfavorably (Stocker, 1960). The fibre produced in the northern part of Bangladesh is usually brownish to dark (Shamla). Proportion of water also influenced the fibre grade. At the lower proportion of water (1:5 and 1:10) the fibre grade was "C^-" and "C", respectively, whereas in 1:20 and 1:30 proportion of water, the fibre grade was "B" and "B+", respectively. The retting water is also very scarce in those areas. Perhaps it is for this reason that the fibre of those areas is of such undesirable colour. It can therefore, be said that provision of adequate retting water in those areas may improve the fibre quality of those areas. A large scale trial to substantiate the present findings would be a fruitful field for further investigation in this regard.

There was significant difference in retting time, percent cutting and fibre quality in whole plant retting and separately retted top parts. However, there was no significant difference in retting time and fibre quality in case of whole plant retting and bottom retted separately. The top retted faster than whole plant and bottom parts. Retting took 10, 15 and 16 days in top, bottom and whole plant respectively. Cutting was 0%, 5%, 30% in case of top parts, bottom parts and whole plant retting respectively. Top parts produced "A" grade, bottom parts produced "B+" grade and whole plants produced "B" grade fibre (Table 3). Malleting 40 cm from the bottom eliminated the production of cutting (Table 4).

Significant difference in retting time in whole plant retting and separately retting top and the bottom parts was due to the fact that the top parts are thinner than the bottom parts and the bottom of the whole plants (Debsarma, 1946; Paul and Bhattacharyya, 1974). Bottom parts contained more non-fibrous matter than the top parts and it took longer enzymatic action for the complete separation of the fibre strands (Ghosh and Dutta, 1980; Mohiuddin *et al.*, 1978, 1984, 1983; Chowdhury and Ahmed, 1968). When top parts and the bottom parts were separately retted uniform retting could be achieved because of the fact that the "ret" of the top and "ret" of the bottom parts contained plant parts of more or less uniform physical characters which eliminated the production of cutting (Ghosh and Datta, 1980, 1983; Saha and Banerjee, 1955; Salam, 1976). But in case of whole plant retting, uniform retting could not be achieved due to non-uniform physical characters of the jute plants. The whole jute plants are thicker at the bottom and gradually tapering to-words the top. Due to the not uniform character of the whole plants it produced more cutting and hence the fibre quality also deteriorated (Mohiuddin, 1984). During whole plants retting the top portion retted earlier then the bottom portion due to its thin-physical property. If the retting was continued till the fibre of the bottom portion were well separated then the fibers of the top portion became over-retted. In the whole plant retting the end point of retting is determined when the fibre strands in the middle portion of plants were well separated. In such condition certain fibre-strands in the bottom of the pants always-remained unretted and produced cutting.

When the bottom portion was malleted the cutting was completely eliminated. Due to malleting the thick non-fibrous portion of the bottom became crushed which facilitated the retting action and reduced the retting time as compared to the whole plant retting. Malleting and retting top and bottom parts separately produced beneficial effect on the production of quality fibre but it involved more labours during cutting the plants at the middle and in malleting. The process seemed costlier. Whether the benefits yielding as results of cutting jute plants at the middle and malleting the bottom parts of the whole plants could compensate the additional expenses would be a fruitful field for further investigation. It should be ascertained first before the technologies were taken to the farmers for mass adoption.

Reference

Ali, M. M., S. Alam and A. K. M. Eshaque, 1973. Effect of different pH values on jute retting. Bangla. J. Bot., 2: 19-23.

Ali, M. M., S. Alam, A. K. M. Eshaque and A. L. Khandaker 1972. Effect of bacterial flora, acidity and total nitrogen of jute retting water. Nucleus, 6: 85-87.

Ali, M. M., S. M. Alam and A. K. M. Eshaque, 1978. Influence of leaves, urea and quantity of water on the retting of jute. Bangla. J. Jute Fib. Res., 3: 17-20.

Allen, L. A., 1946. Recent developments in the microbiology of jute retting. I and II. J. Soc. Chem. Ind., 63: 365, 373.

Chowdhury, S. D. and Q. A. Ahmed, 1968. Softening of jute cuttings by bacterial and fungal organisms and its commercial feasibility. Jute Fabrics, Pakistan, 7: 230-232.

Debsarma, G. D., 1946. Biochemical investigation on jute retting. Ind. J. Agric. Sci., 16: 453-458.

Ghosh, B. L. and A. K. Dutta, 1980. The enzymatic softening and upgrading lignocellulosic fibers. J. Tex. Inst., 71: 108-116.

Ghosh, B. L. and A. K. Datta, 1983. The softening and cleaning of barky root ends of jute and mesta for their better utilization in the industry. J. Text. Inst., 74: 83-91.

Miah, A. B. M. A. S. and M. T. Ahmed, 1977. Some constraints of jute production in Bangladesh. Bangla. J. Jute Fib. Res., 2: 109-123.

Mohiuddin, G., S. Akhter and M. M. Mia, 1978. Softening of jute cuttings using *Bacillus subtilis*. Bangla. J. Jute Fib. Res., 3: 21-26.

Mohiuddin, G., A. M. Bhuiyan and S. A. Hasib, 1983. Softening of jute cuttings by using chemicals in the form of nutrient. Bangla. J. Jute Fib. Res., 8: 37-41.

Mohiuddin, G., 1984. Softening of jute cuttings and effect of different concentration of urea in piling bin. Bangla. J. Jute Fib. Res., 9: 31-36.

Mohiuddin, G., M. I. Chowdhury, H. Rahman and S. A. Hasib, 1982. Softening of jute cuttings using *Bacillus magaterium*. Bangla. J. Microbiol., 1: 61-65.

Nandi, H. K. and J. N. Basu, 1938. Structure and development of jute fibre and the factors determining yield and quality. Science and Culture, 3: 397-401.

Paul, N. B. and S. K. Bhattacharyya, 1974. Upgrading of hard barky root cuttings of jute and mesta by a fungal culture. Ind. J. Microbiol., 14: 61.

Roy, A. B. and A. K. Mandal, 1976. Retting and quality of jute fibre. Jute Bull., July, 2-10.

Stocker, O., 1960. Physiological and Morphological changes in plants due to water deficiency. Plant water relationships in arid and semiarid condition. UNESCO Arid Zone Res., 15: 63-104.

Saha, P. K. and S. K. Banerjee, 1955. Softening hard jute cuttings. Fibers, October, 352-359.

Salam, M. A., 1976. Brightening of jute cuttings. Bangladesh J. Jute Fib. Res., 1: 53-55.

Shah, P. K. and S. K. Banerjee, 1955. Softening of hard jute cuttings. Fibers, 352-358.