EUROPEAN ACADEMIC RESEARCH
Vol. IX, Issue 10/ January 2022

Impact Factor: 3.4546 (UIF)
DRJI Value: 5.9 (B+)

ISSN 2286-4822
www.euacademic.org

Comparative Study on Fiber Yields of Non-Fiber Plants

Md. AMINUL ISLAM
Bangladesh Sugar and Food Industries Corporation, Dhaka, Bangladesh
Md. ZAKIR HOSSAIN[1]
Bangladesh Agricultural Research Institute, Bangladesh
SAYEDA BODRUN NESA
Barendra College, Rajshahi, Bangladesh
NOWRIN ISLAM TOMA
Exim Bank Agricultural University Bangladesh, Bangladesh
ABU HENA FAISAL FAHIM
Bangladesh Agricultural Research Institute, Bangladesh
MOSHARAF HOSSAIN
Bangladesh Agricultural Research Institute, Bangladesh
Md. AKTARUL ISLAM
Bangladesh Institute of Nuclear Agriculture, Mymensingh, Bangladesh
MOHAMMAD JOYEL SARKAR
Bangladesh Institute of Nuclear Agriculture, Mymensingh, Bangladesh

Abstract

Fibers are in great demand today not only for textile purpose, but also for diverse uses like paper making, cloth, rope, hard and soft board manufacture, insulation, bio-composite etc. A comparative study was conducted on fiber yield of some minor fiber cropsat the workshop of Farm Power and Machinery Department, Bangladesh Agricultural University, Mymensingh, Bangladesh.The minor fiber crops were Dhaincha (Sesbaniaaculeata), Lady's finger (Abelmoschusesculentus), Banana pseudo stem (Musa indica), Pineapple leaf (Ananascomosus) and Sisal leaf (Agave sisalana). The main objectives of the study were to compare the yields of fiber among these crops. Fermentation, mechanical extraction method (Scraping for leaf fiber) was conducted to extracted fiber from thesecrops. Percent of fiber was highest (3.94%) in lady's finger among the five samples while and lowest in banana pseudo stem was 2.66%. The estimated fiber production of dhainchawas the highest 1900 kg/ha and then sisal leaf, pineapple leaf, lady's

[1] Corresponding author: zakzuberi@gmail.com

finger and banana pseudo stem, was 1817 kg/ha, 1459 kg/ha, 220 kg/ha and 197 kg/ha, respectively. Study revealed thatDhainchafiber will be better among the observed samples.

Keywords: fiber, production, extraction, fermentation, yield

INTRODUCTION

Fiber may be defined long narrow tapering cell, dead and hollow at maturity, thick cell wall composed mostly of cellulose and lignin, rigid, for support mainly in vascular tissue (D. D. Straney*et al*. 2008). Plants with fibers that can be used for the manufacture of engineering materials include flax, hemp, jute, coconut and nettles. The choice of fiber type depends on the desired fiber properties and also on other factors such as price and availability. Plant fiber properties, in turn, are influenced by a number of factors including plant variety, climate, harvest time and method, maturity, retting and method of decortications and fiber separation (Goyal *et al*. 2007).The principal fiber crops grown in Bangladesh are jute, mesta, cotton, and sunhemp. Jute, and mesta are the major cash fiber crops of Bangladesh. Mesta is more stress-tolerant than jute. Fiber crops are grown for their fibers, which are traditionally used to make paper, cloth, or rope. The fibers may be chemically modified, like in viscose or cellophane. In recent years material scientists have begun exploring further use of these fibers in bio-composite materials (Banglapedia, 2008). Bangladesh is facing acute shortage of fiber for cloth, paper and other composite materials. Recently the demand for fiber is increasing exponentially in fiber making industries. Every year the government of Bangladesh is importing huge amount of fibers from abroad (M. Sarwar Jahan *et al*., 2008).Among bast (stem) fibers, jute is commercially the most important, one required in the preparation of burlap, gunny and many other articles. Since jute cultivation is restricted to the eastern parts of India and Bangladesh, owing to its peculiar edapho-climatic requirements, it has been felt necessary to study other fiber-yielding crops, which could be grown profitably and with less care under varied climatic and weather conditions. Vegetable fibers are in great demand today not only for textile purpose, but also for diverse uses like paper making, hard and soft

board manufacture, insulation, fillers and the like (Md. ShamsulAlam*et al*. 2007).Some non-wood plants may be the sources of natural fibers in Bangladesh and they would be environmental and health friendly. These are Lady's finger (okra), Pineapple, Banana, Dhaincha, Sisal etc. These crops can be grown almost all over the country except in saline and hilly areas.Fibers may occur in almost any part of a plant: stems, leaves, fruits, seeds, etc of economic importance in many different plant families, especially those from the tropics. Some of the important families are- Palmaceae, Gramineae, Tiliaceae, Musaceae, Luguminosaeetc(Goyal *et al.,* 2007).Different major fiber producing plants are available in our country with their commercial importance. Besides that fiber plants, there are many minor fiber crops present which are not used for producing fiber. So, it is needed to be thoroughly searched out. The main objective of this work was to comparative study on fiber yield from non-fiber agricultural crops for commercial usages.

MATERIALS AND METHODS

Description of the study area

The study was conducted at the workshop of Farm Power and Machinery Department, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Raw materials of the fiber plants/crops

Different Major fiber producing plants are available in our country with their commercial importance. Besides that fiber plants, there are many minor fiber crops present which are not used for producing fiber. Both bast and leaf fiber plant were selected which have no the fiber yielding value at present. These are:

i. Lady's finger plant (*Abelmoschusesculentus* L.)(shown in Fig. 1)
ii. Dhaincha plant (*Sesbania aculeate)*(shown in Fig. 2)
iii. Sisal leaf (*Agave sisalana)*(shown in Fig. 3)
iv. Pineapple leaf (*Ananascomosus*)(shown in Fig. 4) and
v. Banana pseudo stem (*Musa indica*)(shown in Fig. 5)

Fig.1: Lady's finger plant

Fig.2: Dhaincha plant

Fig. 3: Sisal plant

Fig. 4: Pineapple plant

Fig. 5: Banana pseudo stem

The unnecessary portion was separated by cutting then the weight of the plants was taken before they are processed through the fermenter. After weighed the samples were binding tightly by using plastic rope. A specific identifier was added with the rope for identification of different samples. The samples were taken for fermentation and the fermenter was filled up by water. The amount of water is depends on the amount of samples which need to ferment. Then the samples were submerged under water (for anaerobic fermentation) or kept floating on water (for aerobic fermentation). Dhaincha and Lady's finger's fiber is attached with its stem. By stripping process, the fibers removed from the stem. Pineapple and Sisal leaf fiber were extracted

by retting.Retting process was also used for extracting the fiber from Banana pseudo stem.Extracted fibers were washed in clean water. Removed all the unnecessary parts from fiber, because this portion decrease the demand and price of fiber in market. Since, the extracted fiber contained some moisture, so, the fiber is needed to squeeze by hand for removing this moisture. After squeezing excess water the fibers were spread on the railing for sun drying for 2-3 days.

Moisture content determination of dried fiber and stick

After drying and before weighing all the extracted dried fiber and dried stick were needed to measure its moisture contents. That is why; the extracted fiber and stick were dried by using oven dry method. By this process the moisture was measured content of extracted dry fiber and stick for finding the actual percentages of fiber and stick.

The moisture content can be calculated simply, as follows:

$$\text{Moisture Content (\%)} = \frac{\text{Initial weight} - \text{Oven dry weight}}{\text{Oven dry weight}} x100 \dots\dots\dots\dots\dots\dots (i)$$

Determination of percentages of fiber and stick:

Fiber percentage is considered as an essential pre-requisite in breeding programme. It is also assumed to be an index offiber yielding capacity of a particular variety.

Different methods are followed to find out the fiberpercentage of jute and allied fibers.

Fiberpercentage on green weight basis

In this method, stems along with total foliage are weighed just after harvest and then ratted for fiber extraction. Then, percentage of dry fiber is calculated on the basis of green weight.

$$\text{Fiber \%} = \frac{\text{Weight of dryfiber after extraction (gms)}}{\text{Weight of stem along with total foliage (gms)}} x100 \dots\dots\dots\dots\dots\dots\dots\dots (ii)$$

$$\text{Fiber \%} = \frac{\text{Weight of drystick after extraction (gms)}}{\text{Weight of stem along with total foliage (gms)}} x100 \dots\dots\dots\dots\dots\dots\dots\dots (iii)$$

This method gives us a ready-made idea about the possible yield of fiber of a particular area before extraction.

Fiber percentage on stripped weight basis

In this method, leaves and branches are stripped off just after harvest and weighed immediately. The stripped plants after weighing are sent for retting. The fiber % is calculated on the basis of stripped weight.

$$\text{Fiber \%} = \frac{\text{Weight of sun dryfiber (gms)}}{\text{Weight of stripped stem (gms)}} x100 \dots\dots\dots\dots\dots\dots\dots\dots (iv)$$

$$\text{Fiber \%} = \frac{\text{Weight of sun drystick (gms)}}{\text{Weight of stripped stem (gms)}} x100 \dots\dots\dots\dots\dots\dots\dots\dots (v)$$

Fiber percentage on dry weight basis

In this method, fiber percentage is calculated on the basis of total dry weight of fiber and stick after extraction.

$$\text{Fiber \%} = \frac{\text{Weight of sun dryfiber (gms)}}{\text{Weight of (strick + fiber) (gms)}} x100 \dots\dots\dots\dots\dots\dots\dots\dots (vi)$$

$$\text{Fiber \%} = \frac{\text{Weight of sun dried stick (gms)}}{\text{Weight of (strick + fiber) (gms)}} x100 \dots\dots\dots\dots\dots\dots\dots\dots (vii)$$

RESULT AND DISCUSSION

Dhaincha, lady's fingerplants, Banana pseudo, Pineapple and Sisal leaves were collected from different fields for measuring the various parameters which are shown in Table-1. The result of table-1 shows that Dhaincha plant contained, average 3.74% fiber (green wet basis) and 5.83% (dry stick basis); average 63.81% stick; fiber-wood ratio was 0.006; and fiber yield/plant 12.26 gm.

Lady's finger plant contained, average 3.94% fiber (green wet basis) and 14.01% (dry stick basis); average 24.84% stick; fiber-wood ratio was 0.16; and fiber yield/plant 1.57 gm.

Banana pseudo stem contained, average 2.66% fiber (green wet basis) and fiber yield/pseudo 59.11 gm.

Pineapple leaf contained; average 3.31% fiber (green wet basis) and fiber yield/leaf 1.99 gm.

Sisal leaf contained; average 2.71% fiber (green wet basis) and fiber yield/leaf 18.18gm.

Table 1: Various parameters for different samples:

Crops	Length of average 11 samples (cm)	Green wt. before retting, (gm)	extracted fiber/plant(gm)	Wt. Loss, (gm)	% Loss	%fiber (wet basis)
Dhaincha	452.88	325.67	12.26	105.86	32.45	3.74
Lady's finger:	98.14	39.72	1.57	3.94	71. 22	3.94
Banana Pseudo stem	86.55	2231.51	59.11	2172.40	97.34	2.66
Pineapple Leaf	90.98	59.73	1.99	57.74	96.69	3.31
Sisal Leaf	100.73	670.00	18.18	651.82	97. 29	2.71

The obtained fibers of different samples were shown in Fig. 6

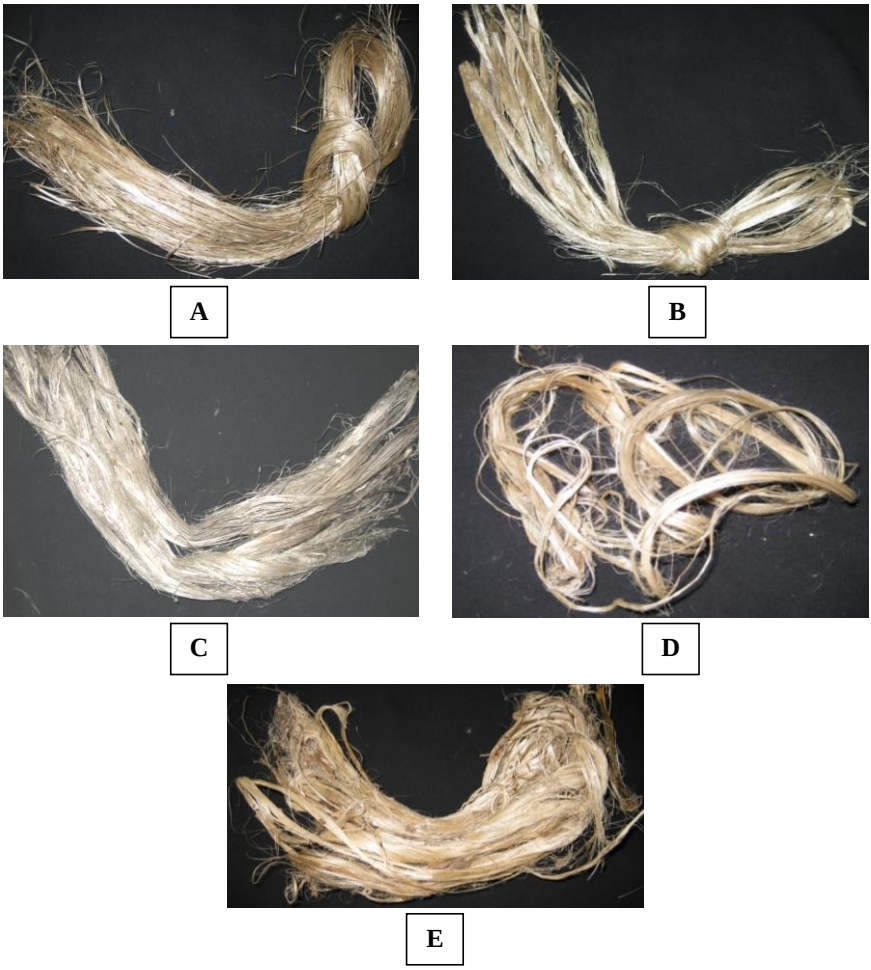

Fig. 6: Obtained fiber of (A) Dhaincha, (B) Lady's finger, (C) Banana pseudo stem, (D) Pineapple leaf and (E) sisal lea

Comparison of percent fiber yield among different plant sample

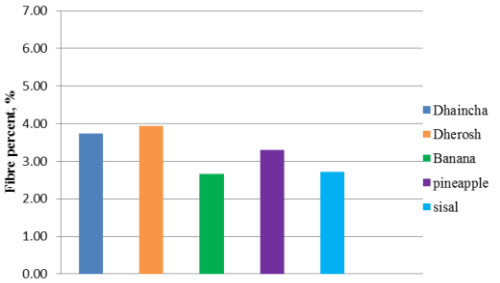

Fig. 7: Comparison of percent fiber yield among different plant sample

Above Fig.7 showed that fiber percent of Dhaincha was 3.74%,Lady's finger was 3.94%, banana pseudo stem was 2.66%, Pineapple leaf was 3.31%, Sisal was 2.71%, and jute was 6.38%. Among five sample, lady's finger plant contained greater percent of fiber which was 3.94%.

Comparison of fiber yield/ha among selected plant

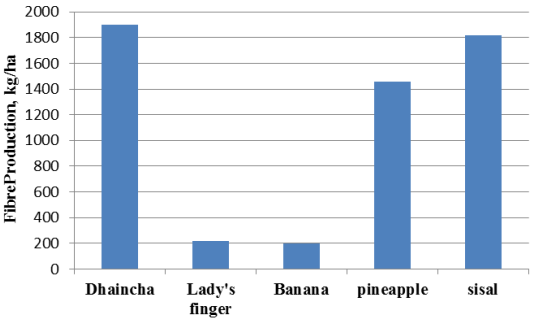

Fig. 8: Comparison of fiber yield/ha among selected plant

Above Fig. 8 shows that the estimated fiber production of dhainchawas the highest 1900 kg/ha and then sisal leaf, pineapple leaf, lady's finger and banana pseudo stem, was 1817 kg/ha, 1459 kg/ha, 220 kg/ha and 197 kg/ha, respectively. Among the selected sample the production of fiber/ha was higher for dhainchaplant.

CONCLUSION

It can be made from this study that Percent of fiber was the highest (3.94%) in Lady's finger among the five studied samples; while percent of stick was higher (63.81%) in dhainchathan in lady's finger (24.84%). The estimated fiber production of dhaincha was the highest 1900 kg/ha and then sisal leaf, pineapple leaf, lady's finger and banana pseudo stem, was 1817 kg/ha, 1459 kg/ha, 220 kg/ha and 197 kg/ha, respectively. Among the selected sample the production of fiber/ha was higher for dhaincha plant. On the other hand banana, pineapple leaf and lady's finger's offer a food source besides fiber production**.**

RECOMMENDATIONS

Further study on economic feasibility should be under taken to implement at the field level.

REFERENCES

1. Banglapedia (National encyclopedia of Bangladesh), (2008).Fiber crops.
2. D. D. Straney, D. E. Moctezuma, (2008), Plant Fiber Materials:Cloth, Paper; Spices And Herbs, University of Maryland.
3. Goyal, Hari., (2007). "Multiple references to non-wood fibers for paper".PaperOnWeb, Pulp & Paper Resources & Information Site.
4. M. Sarwar Jahan, Bernhard G. Gunter, and A. F. M. Ataur Rahman, (2008).Organisation for Economic Co-operation and Development (OECD) p. 401.
5. Md. ShamsulAlam, G. M Arifuzzaman Khan, (2007). chemical analysis of okra bastfibre (Abelmoschusesculentus) and its physico-chemical properties; journal of textile and apparel, technology and management; vol-5,issue-4,p-31.