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

# Fiber Yield and Its Properties of Lady's Finger

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**Abstract**

*A research work was conducted on minor fiber crop of lady's finger at the workshop of Farm Power and Machinery Department, Bangladesh Agricultural University, Mymensingh, Bangladesh. The main objective of the study was to find out the fiber yield and its properties on lady's finger plant. Fermentation, mechanical extraction method (Scraping for leaf fiber) was conducted to extracted fiber from plant.The fiber properties of lady's finger like tensile strength, % elongation at break and diameter of fiber decreased with the increase of period of different fermentation methods. Lady's finger plant contained, average 3.94% fibre (green wet basis) and 14.01% (dry stick basis); average 24.84% stick; fibre-wood ratio was 0.16; and fibre yield/plant 1.57 gm. The estimated fiber production of lady's finger was 220 kg/ha.*

**Keywords:** Lady's finger, extraction, fermentation, fiber, yield

## INTRODUCTION

Okra [*Abelmoschusesculentus* (L.)Moench], also known as *Hibiscus esculentus* L. is a member of the mallow (Malvaceae) family and can be found as an annual (primarily the U.S.) or as a perennial in India and Africa (Lamont, 1999).Even within India, different names have been given in different regional languages (Chauhan, 1972).It is a popular green fruit vegetable in

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Bangladesh. It is commonly known as bhendi or lady's finger in Bangladesh (Rashid, 1999).

Lady's finger is cultivated for its fibrous fruits or pods containing round, white seeds. The fruits are harvested when immature and eaten as a vegetable. The young fruits produced by this species are used as a vegetable. They are picked when still immature (3-6 cm long), before the differentiation of fibers and before the seeds are fully developed.The leaves are also eaten as spinach byAfricans. The fibers extracted from the stems are sometimes used, as on the banks of theNiger in Mali, to make strings and nets (Chevalier, 1940).The roots and stems of okra are used for cleaning the cane juice from which gur orbrown sugar is prepared (Chauhan, 1972).It is presently used as vegetable crop only. But many of us do not still know the other important usages. Very good quality fibre having bright golden colour could be obtained from lady's finger plant. By planting lady's finger plant one could use lady's finger as vegetable, its bark as good fibre and its stick as cooking fuel. Okra (Lady's finger) fibres are extracted from the bark of the okra bahmia plant, a plant of the Malvaceae family, known botanically as *Abelmoschusesculentus*, well diffused for example in North-East India. These were demonstrated by FTIR investigations as being of cellulose origin,and not dissimilar from plants whose fibres found some use as a reinforcement in composites, such as pineapple (D. Saikia and M. N. Bora.*, 2003*). However, the main use of okra fibres in materials has been confined to employing the mucillage as a moisture absorber (F. Gogus and M. Maskand, 1999). Okra mucillage can be a source of polysaccharides, which can be used, with suitable chemical grafting e.g., using poly acrylonytrile, for the synthesis of biodegradable polymers (A. Mishra and P. Sunita, 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 study on fiber yield and its properties of lady's finger.

## MATERIALS AND METHODS

The study was conducted at the workshop of Farm Power and Machinery Department, Bangladesh Agricultural University, Mymensingh, Bangladesh.The raw materials,Lady's finger plants were collected from different places (Char Niloikkhia (Fig. 1), BAU campus (Fig. 2),Modhupur (Fig. 3)) at different times of research. After harvest the lady's finger plants were exposed to the yard of engineering workshop for 2-3 days.

**Fig.1:** Lady's finger plant at Char Niloikkhia

**Fig. 2:** Lady's finger plant at BAU campus

**Fig.3:** Hybrid and Local variety of Lady's finger plant at Modhupur Forest area

The unnecessary portion was separated by cutting then the weight of the stemwas taken before 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 fermenter was filled up by water.The amount of water is depends on the amount of samples which need to ferment.The samples were taken for fermentation with four treatments: i) Aerobic fermentation ii) Anaerobic fermentation iii) Fermentation with urea and iv) Fermentationwith CaO. Extracted fibers were washed in clean water. 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:

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

**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.

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

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

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.

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

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

**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.

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

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

**Determination of various physical properties of extracted fiber**

Hounsfield UTM 10KN (H10KS) was used for test of tensile and flexural strength, compression shear and other mechanical and physical properties of materials.

### Percent Elongation at breaking Test

Elongation recorded at the moment of rupture of the specimen, often expressed as a percentage of the original length. It corresponds to the breaking or maximum load.

1. Laid the fiber sample across the table of machine
2. Measure the length of fiber samples to be tested
3. Using two pair of needle-nosed pliers, grasp the sample at each end. Hold one end of the sample at "0" on the yard stick. *Slowly* stretch the other end of the sample as far as it will stretch, until the sample breaks.
4. Using the formula below, calculated percent elongation at the point of breaking

$$\frac{\text{Elongation at break}}{\text{Original length}}\ x100 = percent \text{ elongation at break} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (viii)$$

### Fiber dimension Test

Micro hardness tester machine (HMV-2 series) was used to measure the diameter of the fiber. The measuring range of this machine was .01 µm -500 µm.

## RESULT AND DISCUSSION

Lady's finger plants were collected from different field for measuring the various parameters which are shown in Table 1. The result of Table 1 shows that Lady's finger plant contained, average 3.94% fibre (green wet basis) and 14.01% (dry stick basis); average 24.84% stick; fibre-wood ratio was 0.16; and fibre yield/plant 1.57 gm.

**Table 1: Various parameters for Lady's finger:**

| Sample No. | Length of plant, (cm) | Surface Area of plant, ($cm^2$) | Green wt. before retting, (gm) | Stick wt. (gm) | % stick | extracted fibre/plant (gm) | %fibre (wet basis) | %fibre (dry stick basis | Wt. Loss, (gm) | % Loss | fibre-Wood ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 121.92 | 183.09 | 50.00 | 12.45 | 24.90 | 2.23 | 4.46 | 15.19 | 35.32 | 70.64 | 0.18 |
| 2 | 116.84 | 190.18 | 25.00 | 4.75 | 19.00 | 0.93 | 3.73 | 16.39 | 19.32 | 77.27 | 0.20 |
| 3 | 111.76 | 224.18 | 50.00 | 14.30 | 28.60 | 1.95 | 3.90 | 12.00 | 33.75 | 67.50 | 0.14 |
| 4 | 96.52 | 193.78 | 25.00 | 6.80 | 27.20 | 0.93 | 3.73 | 12.05 | 17.27 | 69.07 | 0.14 |
| 5 | 116.84 | 293.29 | 75.00 | 18.30 | 24.40 | 2.85 | 3.80 | 13.48 | 53.85 | 71.80 | 0.16 |
| 6 | 78.74 | 118.50 | 25.07 | 6.30 | 25.13 | 0.95 | 3.79 | 13.10 | 17.82 | 71.08 | 0.15 |
| 7 | 60.96 | 84.19 | 17.81 | 4.50 | 25.27 | 0.69 | 3.87 | 13.29 | 12.62 | 70.86 | 0.15 |
| 8 | 99.06 | 223.88 | 47.36 | 9.00 | 19.00 | 1.79 | 3.78 | 16.58 | 36.57 | 77.22 | 0.20 |
| 9 | 104.14 | 195.85 | 41.43 | 10.70 | 25.83 | 1.54 | 3.73 | 12.61 | 29.18 | 70.45 | 0.14 |
| 10 | 91.44 | 195.21 | 41.29 | 7.85 | 19.00 | 1.84 | 4.46 | 19.00 | 31.61 | 76.54 | 0.23 |
| 11 | 81.28 | 183.99 | 38.92 | 13.60 | 34.95 | 1.58 | 4.06 | 10.41 | 23.74 | 60.99 | 0.12 |
| **Mean** | **98.14** | **189.65** | **39.72** | **9.87** | **24.84** | **1.57** | **3.94** | **14.01** | **28.28** | **71.22** | **0.16** |
| **Standard Deviation** | **18.91** | **54.27** | **16.27** | **4.40** | **4.75** | **0.66** | **0.28** | **2.51** | **11.79** | **4.75** | **0.03** |

The obtained fiber of Lady's finger is shown in Fig. 4.

**Fig. 4: Obtained fiber of Lady's finger**

## EFFECT OF FERMENTATION ON VARIOUS FIBRE PARAMETERS:

The samples were taken for fermentation with four treatments. The treatments were taken for finding the effect on the period of fermentation, percentages of fibre, fibre strength and so on. These results are given below:

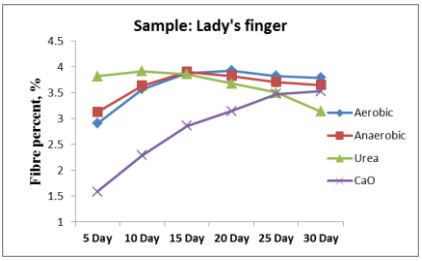


**Fig. 5: Effect on percent fibre of Lady's finger plant for different treatment**

Above Fig.4.7 showed that, for Lady's finger plant, maximum 3.93% fibre was found after 20 days of aerobic fermentation; 3.91%fibre after 15 days of anaerobic fermentation; 3.92%fibre after 10 days of fermentation with urea and 3.54%fibre after 30 days of fermentation with CaO.

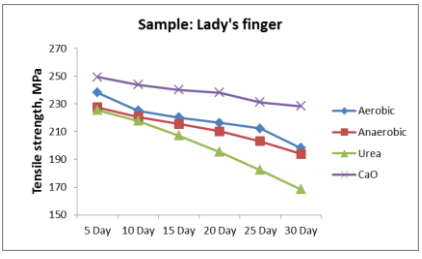


**Fig. 6: Effect on fibre strength of Lady's finger fibre for different treatments**

Above Fig. 6 showed that, for Lady's finger plant, 216.26 MPa strength was found after 20 days of aerobic fermentation; 215.6 MPa strength after 15 days of anaerobic fermentation; 217.85 MPa strength after 10 days of fermentation with urea and 228.3 MPa strength after 30 days of fermentation with CaO.

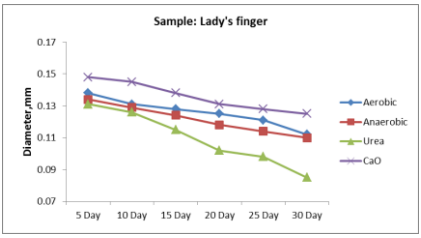


**Fig. 7: Effect on fibre thickness of Lady's finger fibre for different treatments**

Above Fig. 7 showed that, for Lady's finger plant, 0.125mm diameter was found after 20 days of aerobic fermentation; 0.124 mm diameter after 15 days of anaerobic fermentation; 0.126 mm diameter after 10 days of fermentation with urea and 0.125 mm diameter after 30 days of fermentation with CaO.

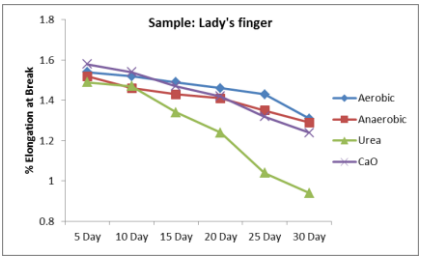


**Fig.4.22 Effect on elongation breaks of Lady's finger fibre for different treatments**

Above Fig.4.22 showed that, for Lady's finger plant, 1.46% elongation break was found after 20 days of aerobic fermentation; 1.46 % elongation break after 15 days of anaerobic fermentation; 1.47 % elongation break after 10 days of fermentation with urea and 1.34 % elongation break after 30 days of fermentation with CaO.

## CONCLUSION

It can be made from this study that the fiber properties of lady's finger like tensile strength, % elongation at break and diameter of fiber decreased with the increase of period of different fermentation methods. Lady's finger plant contained, average 3.94% fibre (green wet basis) and 14.01% (dry stick basis);

average 24.84% stick; fibre-wood ratio was 0.16; and fibre yield/plant 1.57 gm. The estimated fiber production of lady's finger was 220 kg/ha.

## RECOMMENDATIONS

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

## REFERENCES

1. A.Mishra and P. Sunita, *Carbohyd. Polym.*68, 95 **(2007)**.
2. Chauhan, D.V.S. 1972. *Vegetable Production in India*, 3rd ed., Ram Prasad & Sons (Agra).
3. Chevalier, A. 1940.L'origine, la culture et les usages de cinq *Hibiscus de la* section *Abelmoschus. Revue BotaniqueAppliquée*20: 319–328.
4. D. Saikia and M. N. Bora, *Indian J. Pure Appl. Phys.* 41, 484 **(2003)**.
5. F. Gogus and M. Maskand, *Dry. Technol.* 17, 883 **(1999)**.
6. Lamont, W. 1999.Okra a versatile vegetable crop. Hort. Technol. 9, 179-184. Siemonsmo,
7. J.S. 1982a. *La culture du gombo* (Abelmoschus spp.), legume-fruit tropical (avec reference special a la Cote d'lvoire). *Thesis Wageningen Agricultural University*, The Netherlands.
8. Rashid, M. M. 1999. Shabjibijjayan (In Bengali).Rashid Publishing House, 94, Old DOHS, Dhaka-1206.P. 476.