

Fabrication in Banana: A New Avenue for Additional Income

Nisarga G.,¹ Nagesh Naik,² Harshitha S. B.³ and Nethravathi B. C.⁴

¹Ph.D Scholar, Department of Fruit Science, K.R.C. College of Horticulture, Arabhavi, Karnataka

²Professor and Head, Department of Fruit Science, COH, Sirsi, Karnataka

³Ph.D Scholar, Department of Postharvest Technology, K.R.C. College of Horticulture, Arabhavi, Karnataka

⁴Department of Fruit Science, K.R.C. College of Horticulture, Arabhavi, Karnataka, India

SUMMARY

Banana is an herbaceous plant of genus *Musa*, belongs to family of Musaceae. It was originated from the regions of South East Asia including India, Malaysia and Pacific islands. It is referred as tree of paradise, Adams fig and Kalpataru on account of its various utilization pattern. Apart from providing fruits, banana also provides raw material for several processed products like paper and garments. Banana is harvested throughout the year and the stems are usually cut and thrown away as waste, by utilizing these banana stems we can produce good quality fibre and processed fabrics like garments. It also provides employment opportunities to thousands of poor people in India and helps in increasing farmers income.

INTRODUCTION

India is the world's largest producer of banana and its output accounts about 30 million tons followed by China, Philippines, Ecuador and Brazil. India alone accounts for 22 percent of global banana production with the area of 0.83 million hectares. It is estimated that annually 30 million tons of pseudostem biomass is produced through banana cultivation, from these there is scope to produce 1.5 million tons of banana fibre as by-product. (NRCB, 2018). Philippines and Japan are the global leaders in banana fibre extraction. It is already used in Philippines since from decades and hence it also known popularly as 'Manila Hemp' or 'Abaca's Hemp'.

History of banana fibre

The usage of banana fibre for textile purposes predates in history. The evidence of this can be found in epics like Ramayana where Sita and Rama wore "Naravastra" means beautiful things for beautiful people or clothes made from banana fibres. Not only in India, but also references of history reveal that, banana fibre cloth was made around 13th century in Japan. They used to produce fibres of different softness and fineness that yield yarn and textile with different qualities for specific use in olden days. Extracted fibre was used for making rugs, ropes and for tying flowers. Japans currency, the yen is made out of banana fibre. Philippines and Japan are the countries using banana fibre on large scale for commercial purpose. Demand for textile and readymade garments is increasing in India with increase in population (Avunori, 2017).

Origin of banana fibre

References of the history reveal that the banana fibre cloth was made around 13th century in Japan in the islands of Okinawan province.

Banana fibre

It is a natural fibre or a lignocellulosic fibre obtained from the pseudostem of banana plant (Bast fibre) relatively good in stiffness, mechanical properties, having high disposability and renewability. Moreover, they are recyclable and biodegradable (Mukhopadhyay *et al.* 2008, India).

Table 1: Composition of banana fibre

Composition	Quantity
Tenacity	29.98 g/denier
Fitness	17.15 denier
Moisture regain	13 %
Elongation	6.54 %
Alco-ben extractives	1.70 %
Total cellulose	81.80 %

Alpha cellulose	61.50 %
Residual gum	41.90 %
Lignin	15 %

Characteristics of banana fibre

- **Natural sorbent:** Fabric from these fibres lets us breath well and will keeps cool on hot days.
- **Soft, supple and shimmer:** Banana fabric is soft and supple, though not quite as soft as cotton or rayon. Nearly all plant stem-based fibres are a little stiffer and coarser than cotton or rayon. Its natural shimmer makes it look like silk.
- **Comfort:** Banana fibre clothing is comfortable and not likely to trigger allergies.
- **Biodegradable:** Since the fibres are plant-based products they get easily degraded by various group of microbes like bacteria and fungus.
- **Resistance:** grease proof, water proof, fire and heat resistant.
- **Durability:** Even if the banana fabric is made from the tough outer sheath, it is not as strong and durable as any fabric like hemp, bamboo or other natural fibre.
- **Insulation:** It is not particularly insulating.
- **Spin ability and tensile strength:** It is better than other organic fibres in terms of spin ability and tensile strength.

Species and varieties of banana suitable for fibre extraction

All species and varieties of banana are suitable for fibre extraction but the best quality fibres were extracted from three species viz., *Musa textilis*, *Musa sapientum* and *Musa basjoo*

Table 2 : Varieties suitable for fibre extraction (Avunori, 2017).

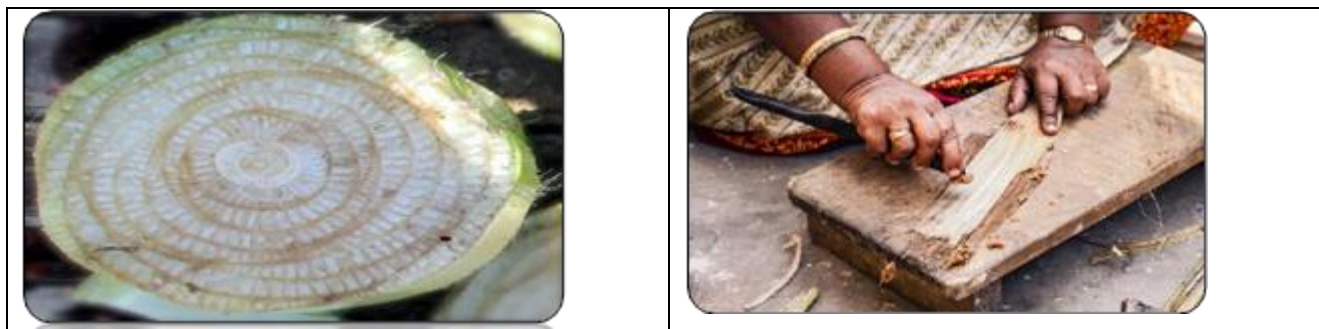
Sl. No.	Name	Ploidy level	Genomic constitution	States
1	Nendran	3x	AAB	Tamil Nadu and Kerala
2	Ney poovan	2x	AB	Tamil Nadu and Karnataka
3	Rasthali	3x	AAB	Tamil Nadu and Karnataka
4	Red banana	3x	AAA	Kerala, Karnataka and Maharashtra
5	Karpuravalli	3x	AAB	West Bengal, Tamil Nadu and Orissa

Fibre extraction methods: There are two methods of banana fibre extraction they are:

- Japanese method/Manual extraction method
- Nepalese method/Mechanical extraction method

Japanese method

Japanese method of making banana fibre involves taking care from the stage of plant cultivation. The leaves and shoots of the banana plant are pruned periodically to ensure their softness. The harvested shoots are first boiled in lye solution to prepare the fibres for making yarn. These banana shoots give away fibres having varying degrees of fineness and softness. This further results in yarns and textiles with differing qualities that can be used for specific purposes. The outermost layers of the shoot fibre are coarsest ones and hence they are more suitable for making home furnishing tablecloths, window curtains and processed fabrics.



Nepalese method

Nepalese method of making banana fibres involves harvesting the trunk of plants instead of the shoots. Small pieces of these trunks are put through a softening process by soaked in water to quicken the natural process. When all the chlorophyll is dissolved, only the cellulose fibres is remained they are extruded into pulp for mechanical extraction of the fibres, and then they are bleached, dried and dyed so that they become suitable for spinning into yarn.

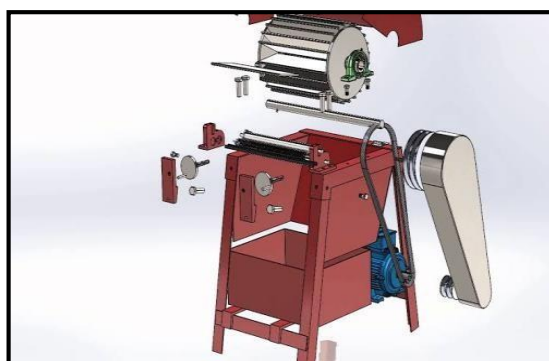
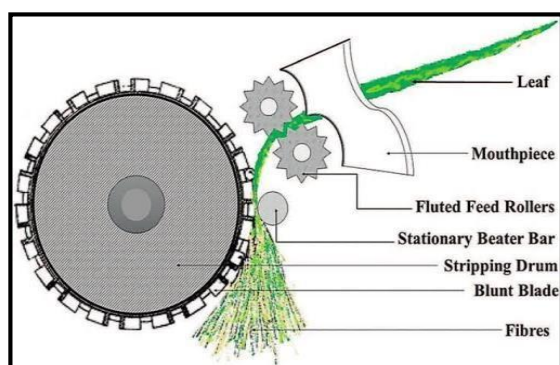
Fibre extracting machine

A special machine was designed and developed for the extraction of banana fibres in a mechanically automated manner. It consists mainly of two horizontal beams where by a carriage with an attached and specially designed cob, could move back and forth. The fibre extraction using this technique could be performed simply by placing a cleaned part of the banana stem on the fixed platform of the machine and clamped at the end by jaws. This eliminated relative movement of the stem and avoided premature breakage of the fibre. Later cleaning and drying of the fibres is done in a chamber at 200 °C and then these fibres are used for yarn spinning.

Banana fibre Extractor

Yarn spinning: Yarn spinning is the process of manufacturing continuous length of fibres from short fibres by running spinners. Different methods of spinning are there like ring spinning, rotor spinning and air jet spinning.

Bleaching: Bleaching operation is carried out to improve the whiteness of the fabric.



During bleaching the natural colouring matters present in banana are decomposed to colourless substances. The removal of these colouring matters helps to improve the whiteness of banana fabric.

Sizing and Starching: Sizing is a protective process. The process of applying a protective adhesive coating upon yarns surface is called sizing. This is the most important operation to attain maximum weaving efficiency especially for blended yarns.

Dyeing of banana fibres: Natural dyes are obtained from hibiscus, pomegranate, henna, harifra plants are used for dyeing the extracted fibre. The required dye in the required quantity is added to boiling water. Then the fibre is added and boiled for 15 minutes to 1 hour according to the requirement. It is later transferred, washed and dried.

Fabrication of banana output :

Fibre extracted from banana stem can be used for manufacturing of fibre ropes, eco-friendly bags, chappals, tea bags, reinforcement plasters, disposable plastics, table and door mats, furniture, textiles, embroidery, apparel designing and also in paper industries. (Mwaikambo, 2006)

**Baskets****Sarees****Paper files****Door mat****Dyed fabrics****Yarn****Government support to enhance minor fibres production**

- The year 2009 has been assigned by the UN as International year of natural fibres.
- Make in India Campaign formulated 5F theory, which states Farm-Fibre-Fabric-Fashion- Foreign.
- Strategic plan by ministry of textiles 2012-2017.
- Five fibre policy includes Banana, pineapple, sisal, Flax and hemp.

CONCLUSION

Abundant available raw material of banana can be utilized for the production of various products which are eco-friendly in nature and also helps to overcome the problem of plastic usage. Since fibre extraction and fabrication generates additional income to the farmers by transforming waste into wealth which increases banana fibre-based products in Indian and international markets along with the promotion of small-scale industries in rural areas.

REFERENCES

- Avanori., M. 2017, A study on banana fibre clothing. *M.Sc. Design space thesis*. National institute of fashion technology, Mumbai.
- Mukhopadhyay, S., Fanguero, R., Yusuf, A. and Senturk, U., 2008, Banana fibres variability and fracture behavior. *J. Engg. Fibres and Fabrics*, 3(2): 3945-3947.
- Mwaikambo., L. Y., 2006, Review of the History Properties and Application of Plant Fibres. *African J. Sci. and Tehcnol. Sci. and Engg.*, 7(2): 120-133.