

Turning Banana Waste into Wealth

¹A. Beaulah, ²K. R. Rajadurai and ^{1*}S. Maanchi

¹Professor and Head, Department of Postharvest Technology, Horticultural College and Research Institute, Periyakulam, TNAU, India

²Professor and Head, Department of Floriculture and Landscape Architecture, Horticultural College and Research Institute, Periyakulam, TNAU, India

^{1*}Senior Research Fellow, Department of Postharvest Technology, Horticultural College and Research Institute, Periyakulam, TNAU, India

Corresponding Author: preethiee1996@gmail.com

Abstract

Banana (*Musa* spp.) is a globally important fruit crop, widely cultivated in tropical and subtropical regions. India is the largest producer among the countries. Banana cultivation and processing generate significant amounts of waste, including peels, pseudostems, leaves and rejected fruits, which pose environmental challenges if not properly managed. Recent research and industrial developments have shown the potential for converting banana waste into value added products for food, energy, pharmaceutical, textiles and packaging industries. In this article summarizes the current status of banana waste generation, its chemical composition and advanced utilization strategies of banana pseudostem. This emphasizes sustainable waste valorization approaches and their role in promoting a circular economy.

Keywords: Banana, Pseudo stem utilization, Handicrafts and Eco-friendly fiber production.

1. Introduction

Banana refers to an evergreen monocot, perennial, large, subtropical herb belonging to the family Musaceae and the genus *Musa*. Banana is one of the most consumed fruits worldwide, ranking among the top five agricultural commodities in global trade. According to FAO (2023), global banana production exceeds 120 million tonnes annually, with India contributing approximately 32 million tonnes, accounting for nearly 30% of global output. However, banana production generates a substantial amount of waste at various stages cultivation, harvesting, postharvest handling, and processing. These residues primarily include pseudostems (60%), leaves (15%), peels (20–40% of fruit weight), bracts and rejected fruits. The disposal of banana waste is a growing environmental concern due to its high organic load and rapid microbial degradation, leading to foul odors, greenhouse gas emissions and soil contamination. On

the other hand, banana waste is rich in fiber, starch, bioactive compounds and minerals, making it a promising raw material for multiple value-added products. Among all banana residues, pseudostem waste is the most abundant and underutilized component. Therefore, this chapter focuses on pseudostem fiber extraction and its transformation into eco-friendly handicrafts. This approach not only minimizes environmental waste but also creates sustainable livelihood opportunities for rural women, promoting economic empowerment and a circular economy.

2. Global Scenario of Banana Production

Banana is cultivated in more than 130 countries, with major producers including India, China, Philippines, and Brazil. The fruit is consumed fresh and processed into chips, puree, baby food, and flour. The processing industry generates large quantities of peel waste, estimated at 18–20% of total fruit weight. Global estimates suggest 40–60 million tonnes of banana waste are generated annually (Singh *et al.*, 2022).

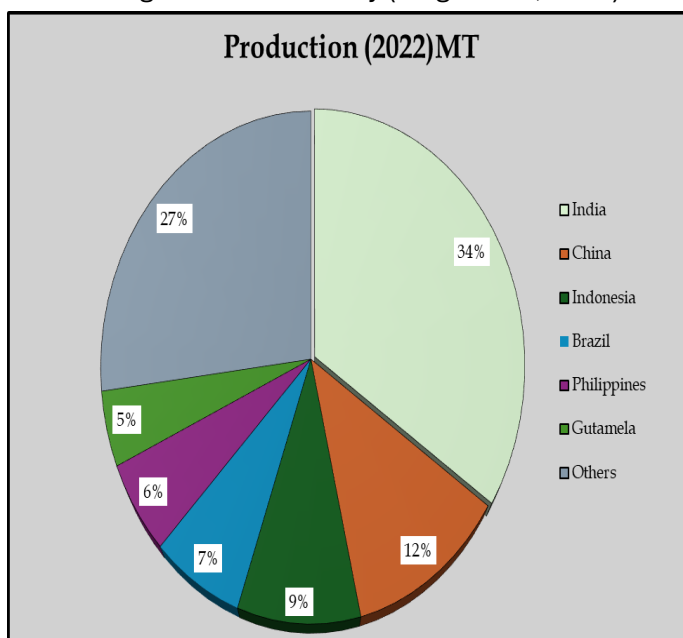


Table 1. Proximate composition of banana waste components

S.No	Component	Moisture (%)	Starch (%)	Fiber (%)	Lignin (%)	Ash (%)
1.	Banana Peel	70–80	18–22	7–12	6–8	8–10
2.	Pseudo stem	90	4–6	30–40	10–12	10–14
3.	Leaves	75–80	3–5	15–20	12–15	9–12

3. Utilization of Banana Pseudo stem for Fiber Extraction and Handicrafts

India is the world leader in banana production, with major growing states such as Tamil Nadu, Maharashtra, Gujarat, Andhra Pradesh and Karnataka. In India Banana pseudostem, which is usually discarded after fruit harvest, is a valuable source of natural fiber. Every hectare of banana generates nearly 220 tonnes of biomass residue, mainly pseudostems (Kumar *et al.*, 2023). Banana fiber is considered one of the strongest natural fibers, with applications in textiles, ropes, mats and handicrafts. Traditionally underutilized, modern processing methods have unlocked its commercial potential in eco-friendly products and sustainable industries.

3.1. Process of Banana Pseudo stem for Fiber Extraction

Banana after harvest → Pseudo stem Collection → Sheath Separation → Fiber Extraction (Manual / Mechanical) → Cleaning & Degumming → Drying → Softening → Bleaching & Dyeing → Weaving / Handicraft Production → Finished Products (Mats, Bags, Ropes, Textiles)

Extraction methods

The extraction of banana fiber involves separating the fiber from the pseudo-stem. Various methods can be employed to extract banana fiber, each with its own advantages and limitations.

(a) Manual Extraction

Manual extraction involves peeling the pseudo-stem and scraping the fibers manually. In rural areas, manual extraction is still practiced. This method is labor-intensive but results in low yield but high-quality fiber with minimal damage. It is cost effective and only applicable for small scale operations.

(b) Mechanical Extraction: Mechanical extraction uses machines to crush and strip the fibers from the pseudostem. It is decortications process, where the

pseudo stem sheath passes through rotating blades to scrape off the non-fibrous material. This method is more efficient and produces uniform, clean fibers than manual extraction and suitable for large scale operations. However, it may lead to some degradation in fiber quality due to mechanical stress.

Processing of Banana Fiber

After extraction, fibers undergo several processing steps to make them suitable for weaving and handicrafts.

(1) Cleaning and Degumming

Removal of lignin, gums, and pectin using water washing and chemical treatment (alkali treatment improves softness and strength).

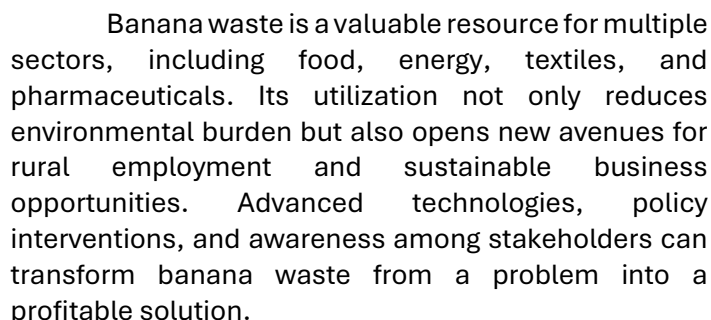
(2) Drying: Sun drying or hot-air drying to prevent microbial growth.

(3) Softening: Mechanical or chemical processes to improve flexibility.

(4) Bleaching and Dyeing: Fibers are bleached for light color and then dyed with natural or synthetic dyes to produce attractive shades.


Fig. 2: Process of Extraction of Fiber from Banana

(5). Weaving and Handicraft Production: Banana fiber is versatile and used to produce eco-friendly and biodegradable products. Common products include;



(b) Bags and Purses: Fashionable, sustainable alternatives to plastic bags.
