

TITLE OF THE STUDY

**FEASIBILITY STUDY FOR SETTING UP OF
BANANA & PINEAPPLE FIBRE BASED UNIT
IN TRIPURA**



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Submitted by

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EXECUTIVE SUMMARY

Natural fiber is seen as the most imminent alternative for chemically treated synthetic fiber. Natural Fiber based products are now getting more and more preferred across the globe over synthetic fiber products which has less bio degradable characters and the manufacture of which add more to the carbon credit. India has a big role to play in such a situation by utilizing its large reservoir of fibers in the most diverse terrine of our country. Banana and Pineapple, one of the two most important horticulture crops are source of extractable fiber also. This study is an attempt to explore the possibilities in Tripura.

North East region of India is the land of immense untapped opportunities. The region is endowed with rich natural resources in the form of soil, water, plants and animal diversity. These resources provide the basic ingredients for development in agriculture as well as Industrial sectors. But bottlenecks in infrastructure, Geographic isolation and political unrests is restricting the region from advancing in pace with the rest of India. Tripura in particular is a state where there is a vast potential of extraction and value addition of natural fiber, especially from banana and pineapple.

Natural fibres of Tripura

Tripura state is having abundant natural resources, through this Project we are covering two major natural fibres of Tripura are Pineapple & Banana.

Pineapple Leaf Fiber

Pineapple Leaf Fibre (PALF) serving as reinforcement fibre in most of the plastic matrix has shown its significant role as it is cheap, exhibiting superior properties when compared to other natural fibre as well as encouraging agriculture based economy. PALF is multi-cellular and lignocelluloses materials extracted from the leave of plant *Ananas cosomus* belonging to the *Bromeliaceae* family by retting (separation of fabric bundles from the cortex). PALF has a ribbon-like structure and is cemented together by lignin, pentosan-like materials, which contribute to the strength of the fibre. The following table shows that the PALF is a multicellular fibre like other vegetable fibres. Their study also found that the cells in this fibre have average diameter of about 10 μm and mean length of 4.5 mm with aspect ration of 450. The thickness of the cell wall (8.3 μm) lies between sisal (12.8 μm) and banana leaf fibre (1.2 μm). The excellent mechanical properties of PALF are associated with this high cellulose and low micro-fibrillar angel. Table given below indicates the physical and mechanical properties of PALF obtained from South India Textile Research Association (SITRA), Coimbatore, India.

Pineapple Fiber extraction by Hard Working Hands :

In spite of all the advancements in mechanization introduced, hand extraction is the most prevalent method for extracting fiber pineapple out of pineapple leaves. In this method, pineapple leaves are scraped using a coarse stone or knife. The outer layers of the leaf are removed and what remains is the fine fiber. Hand scraping of the leaves must be done in the first three days after harvesting. If left any longer, the leaves will become dry and the fibers will be difficult to extract. The gathered leaves must be sorted to remove any damaged, diseases or broken leaves.

Steps in hand scraping:

Step 1 : Take one leaf, and remove the marginal prickles if not yet removed. At the base of each leaf, insert your thumb nail into the leaf to separate a thin strip of leaf with the marginal prickles on from the rest of the leaf.

Step 2 : Do step 1 on both sides of the leaf. Then holding the two narrow strips of leaf in one hand, pull firmly along the length of the leaf to remove all the marginal prickles.

Step 3 : Lay a leaf on the wooden board with the tip pointing away from you and the upper side of the leaf facing upwards. Place your knee or foot on the base of the leaf to secure it in position

Step 4 : Take the broken ceramic plate and with the sharpened edge, firmly scrape off the first layer of fleshy green leaf to expose the top fibers. This is done by applying heavy pressure and a firm forward push with the plate. Start about four inches from the base of the leaf.

Step 5 : Turn the leaf around so that the base of the leaf is pointing away from you and your knee or foot is placed on the tip of the leaf anchoring it in place.

Step 6 : Hold the leaf and with the fingers and peel out the first layer of fibers, set these aside. These are the coarser .bastos. fibres.

Step 7 : Take the sharpened coconut shell, lay the leaf back on the board with the freshly scraped side facing upwards, and with the tip pointing away from you, scrape firmly yet gently to remove the second layer of fleshy green leaf. This will expose the second layer of fibres. These are the finest fibers. Once again start about 4 inches from the base of the leaf. Turn the leaf around so the base faces away from you and continue to scrape away the last 4 inches of this second fleshy layer until the full length of fibers are exposed.

Step 8 : Hold the leaf in one hand and with the other hand loosen the fibers with the thumb and then peel the fibers away from the back of the leaf. This may be done by folding the leaf just below the base to break the outer leaf layer, then peel upwards to the base of the leaf, then downwards to the tip of the leaf.

Step 9 : Keep the coarse fiber separate from the fine fibers, after ten leaves have been processed; loosely tie all the coarse fibres together at one end into one bundle and the fine fibers together into another bundle.

Step 10 : Soak the fibers in water and then beat with a wooden block to remove the green chlorophyll still attached to fibers.

Step 11 : Wash the fibers, hold the bundle of fibers in one hand and wash in running water, such as in the river, to avoid the fibers from tangling. With care, they may also be washed in a bowl of water. Then place in a clean water and using a clamshell continue to scrape the chlorophyll away.

Step 12 : After washing, hang the fibers out of air for a few minutes and then repeat the washing and scraping process again until clean. After cleaning, air dry.

Step 13 : The dried fibers are knotted together to form longer threads suitable for waving.

Since pineapple fabric is hand loomed by only a few weavers, it is very precious and scarce, which also makes it expensive. One meter of Pine fabric costs as high as US\$16 per meter. It is used for table linens, mats, bags and other clothing items. Because it is lightweight but stiff, this sheer fabric can be used in any creative design. These hand woven fabrics can be colored with vegetable dyes originating from leaves, and bark of different trees. Pineapple fiber is often blended with cotton, abaca, and silk to create wonderful light, breezy fabrics.

Pineapple Fabric Benefits

- Regal and timeless are the two words that come to mind. In fact, piña is often traditionally used for wedding attire.
- beautifully elegant appearance
- lightweight

- blends well with other fibers
- similar in appearance to linen
- softer than hemp
- more texture than silk
- washable and easy care
- no dry cleaning

Banana

Banana belongs to the *Musa* family. This plant is usually referred to as a tree but is actually a giant herb, whose trunk or stem is composed of overlapping leaf bases, which sheath it. Each stem fruits only once, being replaced by new suckers, which in turn flower, fruit and die. It is a tropical plant, which grows in sheltered position. They are identified by large paddle shaped leaves with a thick midrib. Banana is mainly cultivated for its seedless fruit, which can be eaten raw as well as ripe. The flowers of the plant are also edible. The young plant along with the leaves have an auspicious value in the Indian culture. Banana leaf has a special utility in the southern part of India, where it is used as a plate for eating. Due to its length and the character to eventually droop, the edges of the leaves tend to fray.

Currently two types of materials in banana plant is used for further production:

- Banana bark
- Banana fibre

Banana bark :

- No need of extraction
- Low-cost machinery for spinning
- Easy to develop products, marketing will be easier due to lower cost

Procedure for Banana bark drying & storage

Collect and store the banana bark during the harvesting season for the rope production. No need to collect during cultivation time.

- Collect the stems of banana plants
- Remove the layers of banana bark
- Dry the banana bark in sunlight, keep it for dry and please note that don.t keep in grass floor. Either it can be on kept on cement flooring or rock flooring or on dry sand.
- After Sunset, please keep it back in a room, which the floor is dry, also please note that the banana bark should not absorb any moisture.
- After noticing the banana bark is dried, it should not have any wetness in the bark. Then the bark is completely dried
- It can be bundled the dried banana barks of 10 in each and store it in a dry place.

Skills practiced with Banana bark:

- Rope making (by hand spinning & by machine spinning)
- Crochet
- Braiding
- Frame weaving / twisting

Banana bark rope making

Rope making is one of the most basic skills for converting any linear material into a usable stage. Rope is the longer layer of bark, twisted or braided together to improve strength, for pulling and connecting. It has good tensile strength but is too flexible to provide compressive strength. Rope making is a simple process and hence practiced in most of the craft pockets. Ropes can be made by two methods viz, hand spinning and machine spinning.

Rope making by hand

The usual practice in hand spinning is to roll the bark into short length of 16 to 19 inches, giving a clock-wise twist by hands. When a sufficient quantity has been made, two of these short lengths are taken in hand together and made into yarn of two plies by giving a counter twist, using both palms. When the counter twist reaches near the end of the striking, further pieces of short lengths kept ready are added one after other, while the counter twist by hand is continued till the required length of yarn for a knot is reached. This is reeled in the form of a hank and a knot is made at the end. Handspun yarn always has a soft twist and good quality.

Rope making by machine / spinning (Ratt machine / charkha)

Banana barks are soaked in water for sometime (around be 2 mins) and then spliced. Two or more strands of the spliced material are taken and rolled between the palms. The material is twisted in only one direction thus obtaining a S-twist. or a Z-twist..A combination of material is also done for variations. Rope making ratt machines are required for the production, one machine (machine will cost around Rs. 5,000/-) available at Coir Board and its vendors. Using one machine, 5 people can work as shown below. This machine (spinning) helps to make faster production of ropes.

Advantages of banana bark ropes:

- No sophisticated extraction process is involved.
- Low-cost technology, machine will cost around Rs.5,000/- only and no maintenance costs for the machine
- No need of power.
- Output for an experienced artisan: 500 . 600 mts per day i.e. earning around Rs. 40-60 per day (8 hours) . this target can be achieved after practicing 3 months.

Banana fiber:

Banana is a multiple celled structure. The lumens are large in relation to the wall thickness. Cross markings are rare and fiber tips pointed and flat, ribbon like individual fiber diameter range from 14 to 50 microns and the length from 0.25 cm to 1.3 cm, showing the large oval to round lumen. It is estimated that 70 full-grown banana trunks yield a single kilo of dry banana fiber. Once extracted, banana is a lustrous, shimmering fiber. Banana fiber is a natural fiber with high strength, which can be blended easily with cotton fiber or other synthetic fibers to produce blended fabric & textiles. It is mainly used by cottage industry in Southern India at present. Banana Fiber also finds use in high quality security/ currency paper, packing cloth for agriculture produce, ships towing ropes, wet drilling cables etc.

- i. Extraction machine is required for extraction of fibre (costs around Rs.40,000/-)
- ii. Currently spinning technology is not available in India
- iii. Extracted fibre itself is expensive and products can be developed for high-end domestic & as well as export market.

The use of .Banana. fiber for textile and other purpose as natural material is a new concept for India. However, considerable research work has been done by textile research organizations including BITRA, SITRA (South Indian Textile Research Association, Coimbatore), KVIC (Khadi Village Industry Corporation) and NRCB (National Research Centre for Banana, Trichy) and it has been found that banana fiber can be a very promising source of natural fiber in the coming period. It may be noted that this fiber is already used successfully in Philippines since decades and hence it is also known popularly as .Manila Hemp.. The other name of this fiber is .Abaca., it belongs to *musa sapientum* species.

Product Application

The use of .Banana. fiber for textile and other purpose as natural material is a new concept for India. However, considerable research work has been done by textile research organizations including BITRA, CITRA, KVIC(Khadi Village Industry Corporation) and NRCB (National Research Centre for Banana-Trichy) and it has been found that banana fiber can be a very promising source of natural fiber in the coming period. It may be noted that this fiber is already used successfully in Philippines since decades and hence it is also known popularly as “**Manila Hemp**”. The other name of this fiber is .Abaca.; it belongs to *musa sapientum* species. The fiber tips of banana are pointed and flat, ribbon like individual fiber diameter range from 14 to 50 microns and the length from 0.25 cm to 1.3 cm, showing the large oval to round lumen Banana fiber is a natural fiber with high strength, which can be blended easily with cotton fiber or other synthetic fibers to produce blended fabric & textiles. It is mainly used by cottage industry in Southern India at present. Banana Fiber also finds use in high quality security/ currency paper, packing cloth for agriculture produce, ships towing ropes, wet drilling cables etc.

SWOT analysis for banana fiber and rope:

Strengths

- Tripura Produce 96 thousand tonnes of banana
- By-product of banana fruit cultivation and hence raw material is cheaply

Weaknesses

- High production cost for the final product
- Not much expertise as yet in India for banana fiber extraction
- No patent held by India on banana fiber
- Lack of dedicated branding and market expansion drive from entrepreneurs

Opportunities

- Increasing awareness on a global level on the benefits of using natural fiber made products
- Mainly use the fruit and ignore the trunk/ stem
- Existing domestic market

Threats

- High level of competition from synthetic fibers.
- Low level of research and development to invent cost effective means of production.

Case study on Banana bark production unit

Production unit: Mr. Murugeshan, Melakkal, Madurai, Tamil Nadu.

No. of artisans: 20, by next year he is planning to increase upto 50. This unit currently paying wages of Rs.60/- per day for each artisan.

Technology used:

- Rope making by Ratt machine

This unit does production of:

- Banana bark ropes
- Banana crochet Products (Bags,bottle holders, cushion covers,etc.)
- Supplying Banana bark
- Scrubbers
- Different gift articles like Christmas gifts, etc

Production capacity:

- This unit does 2,00,000 mts of banana bark every month, and supplies @ Rs.0.17 per metre (single ply ropes). Double ply ropes @ Rs.0.40 per metre.

Quality features

- This unit led by an entrepreneur, he takes most care of the products supplied by this unit and it is well supported by his artisans.

Existing buyers:

- Industree Crafts, Bangalore
- Rope International, Chennai

Suggested clusters for the implementation of the project

As per the data of Govt. of Tripura, Pineapple & Banana cultivated almost similar in all the regions, we are suggesting to do pilot projects in the following clusters for the implementation of the training programmes:

- Dhalai :
 - o Banana rope making : 20 artisans
 - o Banana crochet & frame weaving : 10 artisans
- Udaipur
 - o Banana rope making : 20 artisans
 - o Banana crochet & frame weaving : 10 artisans
- Joginder Nagar / Indira Nagar :
 - o Since it is a tradition bamboo weaving cluster, we have selected this cluster. Artisans already skilled, we need to train weavers with some different techniques to weave banana bark ropes.

Probable buyers

Kumarapp National Handmade paper institute Ramsinghpura, Sikrapura Road Sanganar, . 303 902 JAIPUR	Khazi Hand made paper industries, Gramodaya Road, Sanganer . 303 902 JAIPUR Ph: 2730024, 2730076 Fax: 91-141-2732065
Salim,s paper Private Ltd., E-142,143 Sitapura Industrial area, Tank Road, JAIPUR	Amir Hussain, Hath kagazudyog, Sanganer . 303 902 JAIPUR Ph: 2731292
National hand made paper Institute,Industrial Area Ramsinghpura Sikarapura Road, Sanganer . 303 902 JAIPUR	Kalbana Hand made paper Industries, Bawarika bas, Nashion ka Rasta Sanganer . 303 902 JAIPUR Ph: 2731084 Fax: 91-141-2732115

Stakeholders / organizations		
Sl. No.	Name of the organization	Roles / services offered
1	Dept. of Rural Development, Govt. of Tripura	<ul style="list-style-type: none"> Swarnjayanti Gram Swarozgar Yojana . cluster development programmes in Tripura
2	Office of Development Commissioner (Handicrafts), Ministry of Textiles, Govt. of India	<ul style="list-style-type: none"> Ambedkar Hastashilp Vikas Yojana . Rs. 20,000/- for each artisan in upgrading skills, designs & technical interventions Also it supports handicraft clusters with common facility centre Provides free stalls to the handicraft artisans across country with Gandhi Shilp Bazaar exhibitions and Dilli Haat Cluster development programmes in handicrafts, it also offers grants for natural fibre crafts also
3	National Bank for Agriculture & Rural Development	<ul style="list-style-type: none"> NABARD supports credit linkages to SHGs through local banks Women Development Projects ARWIND, MAHIMA, DEWTA Entrepreneurship & Skill Development Rural Entrepreneurship Development Programme (REDP) RUDSETI, Skill Development/Upgradation Initiatives
4	DRDA, Govt.of Tripura	<ul style="list-style-type: none"> Supports SHGs, rural development, handicrafts sector through several different projects
5	SWAVALAMBAN - Self-Employment Generation Programme	<ul style="list-style-type: none"> The basic objective of this programme is to ensure that a sizable number of unemployed youth can be developed as potential entrepreneurs so that they can take up gainful Self Employment in different activities/trades/areas for economic self-reliance.
6	Coir Board, Cochin	<ul style="list-style-type: none"> Offers subsidized Training Courses for artisans uration of the course: 6 months Total strength :10 candidates per batch. Qualifications: The candidates must be literate. Age :18-45 years Commencement of training : January and July every year. Syllabus (only practical class):- Spinning and rope making, Dyeing and shade matching Weaving matting and carpet Weaving mats
7	IL&FS Cluster Development Initiative Pvt. Ltd., Agartala	<ul style="list-style-type: none"> Implementing agency for Tripura Bamboo Mission Project . sponsored by Dept. of Industries & Commerce, Govt. of Tripura Having public-private partnerships in the crafts sector Having grass root level experience in Tripura in implementing Bamboo / seetal patti cluster development projects