

## A Value Chain on Utilization of Banana Pseudostem for Fibre and Other Value Added Products

### 1. Environmental and social safeguard management

#### A. Basic information

##### 1. Project statistics:

**Component Code:** Component 2 (PCS)

**Code of Proposal:** 4586

**Name of Consortium Leader/** **Dr. R. P. S. Ahlawat**

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**Consortium Partners:**

- 1) Central Institute for Research on Cotton Techn (CIRCOT), Adenwala Road, Matunga, Mumbai – 40
- 2) Man Made Textile Research Association (MAN) Surat- 395 002 Gujarat
- 3) J.K. Paper Ltd., Songadh, Dist Tapi, Gujarat

**Associate Partners**

- 1) National Research Centre for Banana, Tiruchirapalli
- 2) Gujarat Agro Industries Corporation Ltd., Ahmedaba

**2. Proposed Date of Start:** May, 2008

**3. Planned Duration:** 4 years and 1 months

**4. Project cost:** **Rs.581.56**

##### 5. Project objectives:

- ❖ Standardize processes for extracting textile grade fibres from pseudostem and prepare home furnishings
- ❖ Standardize processes of pulp and paper making from pseudostem, fibres and scutching waste both at hand made and industrial levels
- ❖ Develop value added edible products from central core
- ❖ Preparation and evaluation of enriched sap and scutching waste vermicompost
- ❖ Develop linkage for marketing of pseudostem based products

## 6. Brief project description:

In India, banana is cultivated on 5.65 lakh ha area and the leading states are Maharashtra (0.54 lakh ha), Gujarat (0.49 lakh ha), Tamil Nadu (0.82 lakh ha), Andhra Pradesh (0.56 lakh ha), Karnataka (0.42 lakh ha) and Kerala (0.59 lakh ha). In addition to fruit production, huge quantity of biomass (pseudostem, leaves, suckers *etc.*) is generated. Presently, this biomass is discarded as waste. In past, some researchers have successfully demonstrated use of banana pseudostem and leaves for extraction of fibres on a small scale. In India, the fibres are being used for preparing handicrafts, ropes *etc.*, which otherwise can be used for making fabrics, home furnishings and good quality papers. The major problem of non-adoption of fibre extraction technology is low recovery of fibres leading to high transport cost. The scutching waste and sap obtained as by-product during fibre extraction can be used for preparing enriched vermi-compost and as liquid fertilizer, respectively. Apart from this, the high value products *viz.*, mordant from sap, microcrystalline cellulose powder from fibres and edible products from central core can also be obtained. In view of possibility of multiple uses of pseudostem, there is need to develop a value chain involving farmers, entrepreneurs and co-operatives for realizing higher income from banana production system.

Present project envisages development of effective value chain for efficient utilization of each and every component of banana pseudostem. At Navsari Agricultural University, Navsari as well as on farmers' fields, extraction of fibres will be done on semi-commercial scale. Simultaneously, evaluation of quality of fibres of predominantly grown banana varieties will also be explored in association with National Research Centre for banana, Tiruchirapalli. The fibres obtained will be initially supplied to CIRCOT, Mumbai for preparation of yarn through necessary modifications in machine and subsequently, the modified version of yarn machine will be installed at Navsari or at farmers' co-operative for yarn making on large scale. Once the yarn is available, it will be supplied to MANTRA, Surat for preparing fabrics and furnishings initially on pilot scale and subsequently on a large scale. A portion of the fibres will also be tested for pulping and paper making characteristics on laboratory scale at CIRCOT, Mumbai and on industrial scale at JK Papers Ltd., Songadh for making quality papers. In addition to paper and fabrics, a process will also be standardized for preparing microcrystalline cellulose of pharmaceutical grade at CIRCOT, Mumbai.

Scutching waste generated during the process of fibres extraction from banana pseudostem will be converted into enriched vermi-compost and tested in different crops initially at Navsari Agricultural University and subsequently on farmers' fields. Simultaneously, scutching waste will also be used for paper and board making on hand made scale at NAU and

on industrial scale at JK Papers Ltd. Songadh. For this purpose, pulp sheet will be prepared at NAU and supplied to JK Papers Ltd., Songadh for quality testing and paper making on industrial scale.

During the process of extraction, along with fibres and scutching waste, sap will also be obtained. In first phase of the project, possibility of using enriched sap as liquid fertilizer through drip system will also be explored and demonstrated on farmers' fields on large scale. As the fibre extraction machine will be installed in selected cluster of villages, sap will be locally available to the farmers. Simultaneously, a part of sap will be supplied to CIRCOT, Mumbai for standardizing the use of sap as mordant in textile dyeing. These studies will be on a small scale during the project period. Apart from this, studies will also be conducted for enhancing the strength of fibres through use of nanotechnology.

Another important aspect incorporated in the project is to develop edible products from central core of pseudostem. The processes for preparation of edible products *viz.*, fried chips, pickles and ready to use as vegetable from central core will be standardized at NAU, Navsari.

During last phase of the project, an effective marketing network of banana pseudostem based products *i.e.*, fibres, fabrics, furnishings, recipes, papers, board *etc.*, will be established by involving NAU, CIRCOT, MANTRA, JK Papers, NRCB and Gujarat Agro-Industrial Corporation Limited, Gujarat. Similarly, attempts will be made to popularize the developed technologies among the entrepreneurs and other stakeholders through awareness, meetings, literatures, *etc.*

With the implementation of this project, it is expected to give 15-20 per cent additional net profit to the banana growers through selling of fibres. Not only this, but use of pseudostem based vermi-compost and sap will curtail the fertilizer expenses by about 20-25 per cent along with advantage of sustaining soil health. The pseudostem fibres will be an additional source of raw material for textile and paper industries. The value addition through these processes will be to the extent of 3-4 folds. As far as paper industry is concerned, use of fibres or scutching waste containing very less lignin than conventional raw material (forest timber) will minimize the cost of processing and ETP.

Similarly, development of processes for use of sap as mordant and micro crystalline cellulose from fibres will provide an alternate material for dyeing and pharmaceutical industries, respectively. The edible products developed during the project, will add new recipes in food industries. The project as a whole is capable of generating huge employment opportunities in rural as well as urban areas with minimal environmental hazards.

**7. Environmental category issues in the sub-project:**

- Social
- Environmental
- Eco-friendly

At present, the banana pseudostem are dumped on road side or burnt which causes environmental pollution. Implementation of this project will enable effective utilization of pseudostem through development of technologies / processes for fibre, paper which includes both industrial and hand made scale, fabrics, home furnishings, mordant, MCC, edible products and enriched manures. Production of these products from pseudostem will facilitate utilization of pseudostem in eco-friendly ways. Apart from safe utilization of pseudostem, it will also generate additional income and rural employment. However, the possible points where environmental problems are expected to arise along with mitigation measures are furnished below:

SN	Process where environmental pollution is expected	Mitigation measures
1.	Dyeing, printing and finishing of fibre, yarn and fabrics	The expected pollutants will be treated in standard effluent treatment plant by MANTRA, Surat, which has adequate infrastructure and technologies for dealing with such problems. The measures can be used by others also.
2.	Pulping and paper making (Industrial scale)	J. K. Paper Pvt. Ltd. is already having treatment plants for bringing the effluent generated during pulping and paper making to safe disposal levels. The measures can be used by others also.
3.	Scutching waste and sap	As these by-products will be utilized for preparation of vermi-compost and direct use of sap as liquid fertilizer, there is no possibility of environmental deterioration.

**8. Social and Environmental safeguard & mitigation strategies**

Safeguard Policies Triggered (World Bank Policies)	Yes	No
Environmental Assessment (OP/BP 4.01)	X	
Natural Habitats (OP/BP 4.04)		
Pest Management (OP 4.09)		
Cultural property (draft OP 4.11 – OPN 11.03-)		
Involuntary Resettlement (OP/BP 4.12)		
Indigenous Peoples (OD 4.20)		
Forests (OP/BP 4.36)		
Safety of Dams (OP/BP 4.37)		
Projects in Disputed Areas (OP/BP 7.60)		
Project on International Waterways (OP/BP 7.50)		

## ***Risk analysis***

### ***Availability of raw material***

As the present project is based on the banana pseudostem, the only risk involved is inadequate availability of pseudostem in the event of natural calamities leading to total / partial failure of crop in the area. Another manmade risk is fluctuation in selling prices of pseudostem based products.

### **9. Impact assessment:**

Given below and adequately addressed.

### **10. Potential indirect and/ or long term impacts due to anticipated future activities in the project areas (assessment of anticipated conflict / complimentarily with the current as well as those proposed for the next five years in the areas of activities of the sub-project):**

#### **Pseudostem fibers:**

- Good quality fibers will be available for fabrics, garments and paper making. This will give additional monetary income to the farmers and entrepreneurs
- Extraction of MCC (pharmaceutical grade) will provide an alternative coating material because of its high dispersability.
- Alternative material for paper industry which will ultimately need less forest timber.

#### **Scutching waste and sap:**

- Both the waste products will be converted to enriched manures which are capable of saving of fertilizer expenses to the extent of 20-25 per cent along with sustaining soil health.

#### **Edible products:**

- The edible products developed from central core will add novelty in food processing industries.

### **11. Identity the key stakeholders and describe mechanisms for consultation with and to them done / disclosure so far done including pre-project consultations with stakeholders workshop before formulating the full proposal, discussing the full proposal with some stakeholders before submission to PIU:**

#### **Public institute:**

- ICAR, New Delhi
- NAIP, New Delhi
- NRC on Banana, Thrissur
- CIRCOT, Mumbai

## Private participation

- MANTRA, Surat
- JK Papers, Songadh, Surat
- Gujarat Agro Industrial Corporation, Gandhinagar

## 12. Chronology of meetings/ activities held in connection with preparation of the concept note and full proposal

SN	Date	Location	Programme	Remarks
1.	12-10-07	-	On line submission of concept note	--
2.	20-11-07	NAU, Navsari	Brainstorming meeting with all the scientists of NAU	--
3.	23-11-07	NAU, Navsari	Meeting for selection of partners and finalization of proposal	--
4.	27-11-07	NARM, Hyderabad	Stakeholders workshop with NAIP	--
5.	01-12-07	NAU, Navsari	Brainstorming session/meeting for reviewing of the proposal	--
6.	11-12-07	New Delhi	Sensitization workshop	--
7.	07-12-07	NAU, Navsari	Submission of core component proposal	--
8.	12-01-08	NAU, Navsari	Meeting with JK Paper, Songadh	--
9.	13-01-08	NAU, Navsari	Meeting with MANTRA, Surat for explaining their role and getting their requirements	--
10.	17-01-08	MANTRA, Surat	Meeting with MANTRA, surat	--
11.	21/22-01-08	HQ, NAIP, New Delhi	For presenting the draft proposal before TAG-I	--
12.	27-01-08	CIRCOT, Mumbai	Meeting with CIRCOT, Mumbai for discussing their role and fund requirement	--
13.	18-02-08	NAU, Navsari	Presentation of revised proposal before the scientists	--
14.	11/12-03-08	HQ, NAIP, New Delhi	For presenting the draft proposal before TAG-II	--
15.	28-03-08	NAU, Navsari	Meeting with consortium partners for discussing the comments given by TAG-II	--

## 13. Measures to address the issues

The proposed activities of this project envisage utilization of banana pseudostem which is presently a waste material causing problem of safe disposal. However, after standardization and development of processes for value added products through this project, may have following environmental and social issues which have been adequately addressed in this project.

<b>Activity</b>	<b>Anticipated issues</b>	<b>Mitigation Measures</b>
Fibre	Use of fibre in textile and paper industries will generate effluent	Modern effluent treatment plants are available will be used. This technology will be popularized among stake holders through training, demonstration and literature distribution
	While preparing yarn from pseudostem fibre, dust will be generated	Necessary protection mask available in the market will be used.
Marketing	Banana pseudostem based products being new in this region there is need to develop marketing linkage	This will be achieved through well established network of fruits and vegetable co-operatives available in the region. Further, the awareness about the new products will be created through training of stake holders, farmer days, <i>krishimela</i> , exhibition <i>etc.</i>

**Consultation/disclosures to be done in future:**

- ❖ The modified machine of fibre extraction and yarn making will be demonstrated among the stake holders. For this purpose necessary training programme will be organized in consultation with consortium partners, related co-operatives, farmers, weavers *etc.*
- ❖ Processes for preparing vermicompost and use of sap as liquid fertilizer in different crops will be demonstrated through large scale demonstrations on farmers’ fields. Further, for wider publicity, farmers’ days will also be organized.
- ❖ Standardized processed for preparing edible products from central core will get dully certified by approved laboratory. Up-scaling of production with the help of co-operatives and Gujarat Agro Industrial Corporation.
- ❖ The processes and products finalized through this project will be popularized among the stake holders and consumers through sensitization and awareness programs like workshop, exhibition, *melas etc.*
- ❖ For all the processes and products developed during the course of this project will be published in English and Gujarati and circulated among the stake holders including line departments of government.

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**Consortium PI**

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**National Coordinator**

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**National Director**

**Annexure-A****Environmental Safeguard: Activities, issues, Impact and Mitigation Measures**

Sr. No.	Activities <sup>1</sup>	Issues <sup>2</sup>	Anticipated level of Impacts <sup>3</sup>		Mitigation measures (Negative Impact) <sup>4</sup>
			Positive	Negative	
1.	Extraction of fibres from banana pseudostem	Additional raw material for textile and paper industries	5	-	-
		Use of sap as liquid fertilizer and scutching waste for preparation of vermi-compost and paper	4	-	-
2.	Yarn making from fibres on large scale	Generation of dust	-	2	Workers will be provided with protective mask
3.	Weaving of yarn for fabrics	-	-	-	-
4.	Processing of yarn for fabrics and furnishings.	Effluent generation	-	2	Modern ETPs will be used
5.	Hand made paper and board making	Effluent generation	-	2	Modern ETP are available, which will be used.
6.	Paper making at industrial scale from fibres and scutching wastes	Effluent generation	-	2	Banana pseudostem fibres being low in lignin content, less quantity of chemicals would be required during its processing as compared to presently used high lignin woody raw materials
		Additional raw material for paper making industry			
7.	Edible product development from central core of pseudostem	-	5	-	-
9.	Use of pseudostem sap as mordant	Eco-friendly mordant for natural dyes	4	-	-
10.	Micro crystalline cellulose from fibres	Renewable raw material	-	2	The BOD & COD levels are very low and ETP will be used
11.	Marketing of pseudostem based value added products	-	-	-	-

**Annexure-B**

**Social Safeguards: Activities, Issues, Impact and Mitigation Measures**

Sr. No.	Activities <sup>1</sup>	Issues <sup>2</sup>	Anticipated level of Impacts <sup>3</sup>		Mitigation measures (Negative Impact) <sup>4</sup>
			Positive	Negative	
1.	Extraction of fibres from banana pseudostem	Employment generation and additional income source	4	-	-
2.	Sap and scutching waste generation during fibre extraction	Source of organic manure partial substitution of chemical fertilizers	4	-	-
2.	Yarn making from fibres on large scale	Employment generation	2	-	-
3.	Weaving of yarn for fabrics	Employment generation	2	-	-
4.	Processing of fabrics for furnishings etc	Employment generation	2	-	-
5.	Hand made paper and board making	Employment generation and additional source of income	5	-	-
6.	Paper making at industrial scale from fibres and scutching wastes	Additional income and employment generation	2	-	-
7.	Edible product development from central core of pseudostem	Employment generation and additional source of income	3	-	-
8.	Preparation of vermi-compost from scutching waste and use of sap as liquid fertilizer	Employment generation and reduction in the expenses towards fertilizers	5	-	-
9.	Use of pseudostem sap as mordant	Eco-friendly mordant for natural dyes	2	-	-
10.	Micro crystalline cellulose from fibres	Renewable raw material	2	-	-
11.	Marketing of pseudostem based value added products	Marketing linkages between banana cooperatives and industries	5	-	-