

A Value Chain For Cotton Fibre, Seed And Stalks: An Innovation For Higher Economic Returns To Farmers And Allied Stake Holders

Environmental and Social Safeguards Management

A. Basic Information

1. Project statistics:

Component code	:	2
Name of Consortium Leader	:	Dr. S. Sreenivasan
Name of CPI	:	Dr R.P.Nachane
Name of CoPI	:	Dr R.H. Balasubramanya
Institution	:	Central Institute for Research on Cotton Technology (CIRCOT)
Mailing address	:	Principal Scientist and Head, Quality Evaluation & Improvement Division, CIRCOT, Adenwala Road, Matunga, Mumbai PIN code: 400 019 Telephone Number: 022 24127273 Fax No. : 022 24157239 Email drprnachane@hotmail.com, circot@vsnl.com,
Consortium partners	:	1. Central Institute for Cotton Research, Nagpur 2. Super Spinning Mills Ltd., Coimbatore
2. Date of Start	:	December 2007
3. Planned duration	:	4.5 years
4. Project cost	:	Rs. 903.12 lakhs

5. Project objectives:

1. To grow established cotton genotypes in the adopted villages with integrated production technology practises.
2. To reduce the level of contaminants in cotton by adopting appropriate on-farm and off-farm management practices and to label cotton bales with fibre attributes after appropriate ginning.
3. To prepare yarn, fabric, garments in the modern mill & to market them and to manufacture eco-friendly textiles in handloom sector by employing CIRCOT technology for bio-scouring followed by dyeing with natural dyes.

4. To enable farmers to earn additional income and to make alternate raw material available to industry by establishing cotton stalk supply scheme to board industries/briquetting.
5. To demonstrate innovative scientific processing of cotton seed for oil extraction and value addition to its by-products.

6. Brief project description:

The Indian Textile Industry uses about 62% cotton as its raw material, unlike the global textile industry that has a 40:60 mix of cotton and man made fibres. There has been a phenomenal increase in cotton production in India in recent years. The cotton production in 2007-08 and 2006-07 was 310 and 280 lakh bales respectively as against 240 lakh bales during 2005-06. This has become possible due to favourable combination of several factors namely, better quality inputs and improved production technologies like IPM, IRM etc. and large scale adoption of Bt cotton. The area of cotton cultivation unlikely to exceed substantially beyond the current level of 90 lakh hectares, the projected demand by the Ministry of Textiles for 2012 is about 375 lakh bales. Cotton consumption has also been steadily increasing and the growth rate in utilization is expected to continue at about 10-15%. If the high growth rate in cotton consumption is to be sustained then the strengthening of value chain of cotton and efforts to enhance the competitiveness of each player in the value chain have to be ensured.

Cotton being a commercial crop, there exists a value chain in the sense that seed cotton is converted into lint and through the yarn and fabric route into garments and made ups for both internal consumption and export. However, in the conventional value chain there exist a few missing as well as weak links. Ginning is still considered to be one of the weakest links characterized by excessive use of energy, presence of contaminants & trash and lack of facilities for quality assessment of individual bales. Although spinning sector is performing better with modern facilities, weaving/knitting sector still need to improve in quality and product up gradation to meet the international standards. Further, in the downstream processing such as preparatory chemical treatments like scouring and bleaching of yarns and fabrics, again eco-friendliness, energy use efficiency, effluent generation and its treatment are factors that need immediate attention. In the handloom sector, the picture is totally different. The workers are exposed to harmful chemicals and environment is also vitiated with chemical effluents in rural areas. Finally cotton stalks are not put to proper use and seeds are as such crushed for oil.

The present project aims to strengthen the above mentioned weak/missing links to increase the efficiency and economic competitiveness of cotton cultivation, processing and value addition. Best management practices encompassing INM and IPM modules will be adopted to raise long and extra long cottons in two locations namely, Nagpur and Coimbatore in which CICR would oversee the production activities. This part forms **first objective** of the project

For the **second and third objectives**, CIRCOT would demonstrate production of contaminant free cotton by utilizing appropriate picking methods for seed cotton, on farm storage and transportation. The seed cotton will be ginned under CIRCOT's supervision and individual bales will be tagged for fibre attributes and spun in Super Spinning Mills, Coimbatore and a suitable Mill at Nagpur. Long staple cotton yarns and fabrics from ELS cotton will be subjected to CIRCOT's bio-scouring treatment followed by dyeing with natural dyes and converted to handloom fabrics and marketing by Phoenix Products, at Bailhongal, near Belgaum. Also Super Spinning Mills would convert the yarn into knitted/woven fabrics, further make it into value added garments and complete the chain up to marketing of the product. A part of the woven fabrics will be supplied to Phoenix for bio-scouring and conversion to garments and marketing.

Under the **fourth objective**, cotton plant stalks from Coimbatore will be collected, chipped and transported to board industry for making binderless boards. The chips from Nagpur Centre will be supplied to particle board demonstration plant at Ginning Training Centre of CIRCOT, Nagpur for making particle boards. Edible Oyster mushroom crop will be raised on anaerobically pre-treated cotton stalks at CICR's Regional Centre, Coimbatore. This activity will be carried out under CIRCOT's supervision.

For the **fifth objective**, cottonseeds will be pre-treated with enzymes to see its effect on the easy removal of linters and kernel will be treated with enzymes to see the effect on the recovery of oil at S.S.D. Oil Mills Co.Ltd., Chennai. The hulls will be bio-enriched employing CIRCOT's technique for enhanced protein and increased digestibility at National Dairy Development Board (NDDB), Anand and feeding trials on cross-bred cows will be undertaken. Attempts will also be made to standardize the process to extract oil and edible protein from cotton seed kernel.

The project once implemented is expected to yield higher (10%) seed cotton output with better lint quality attributes, yarn and fabrics. The intervention of bio-scouring technique brings down the requirement of energy, chemicals and reduces the

load on effluents. Utilisation of cotton stalks will provide additional income to farmers, raw material to board industry, promote rural employment and indirectly save forest timber.

7. Environmental category issues in the subproject

- Social:
- Environmental

8. Safeguard policies triggered (World Bank policies)

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)	[]	[]
Projects on International Waterways (OP/BP 7.50)	[]	[]

B. Risk analysis and related issues

1. Production of Seed Cotton

Cotton is seasonal crop and is mainly grown under rainfed conditions in India. It is likely that failure of rainfall or unseasonal rain with unprecedented pest incidence will affect the yield.

- By following recommended package of practices and Best Crop Management Practices (BCMP) which include protective irrigation by proper harvesting of water, will not totally deplete the yield. There could be some reduction in yield in worst cases.

2. Contamination in Cotton

Non-implementation of appropriate on-farm and off-farm practices may lead to trashy and contaminated cotton.

- Appropriate picking, storage, transportation and proper ginning practices will bring down the percentage of trash to less than 2% with very low level of contaminants.

3. Bio-scouring of Cotton

Technology has been standardized at laboratory scale. Performance at field level may not be the same as that of bench scale. Since this is done using microbial system, their performance in different seasons may not be same.

4. Availability of Natural Dyes

Provided there is going to be great demand for the Natural Dyed cotton fabrics, availability of natural dyes could be a problem for large scale usage.

5. Availability of Cotton Plant Stalks

Cotton is a seasonal crop and is mainly grown under rain fed conditions in India. It is likely that failure of monsoon and climatic variation can result in failure of crop which can affect the availability of cotton plant stalks to the industry.

India is a large country and cotton is grown in almost all parts of the country. At a given time there can be heavy rainfall and flood in one area of the country and drought in other part. It is very unlikely that there will be drought throughout the country and a total failure of cotton crop. Due to vagaries of weather the yield of cotton crop may get affected, but yield of biomass may not be affected. Further about 35% of cotton in India is grown under irrigation. So the fear of non-availability of cotton stalks because of climatic variation is not too serious, though genuine.

6. Utilization of Cottonseed

Improper storage of cottonseed leads to spoilage by microorganisms resulting in aflatoxin production. The seed cake obtained after oil extraction will become unsuitable for cattle feed.

Cottonseeds appropriately stored will be able to prevent microbial damage.

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/ complimentary with the current as well as those proposed for the next five years in the areas of activities of the sub-project):

- Cotton Production
 - Good Quality Seed cotton

- ✿ Ensuring certified seeds for sowing with integration of Best Crop Management practices is expected to result in at least 15% more yield with expected Quality attributes. Farmers can get additional income to their produce and about 5-10 % premium for the quality.
- Post Harvest Management
 - Reduced level of contaminants in cotton
 - ✿ The adoption of recommended on-farm and off-farm management Practices will result in low levels of contaminants (from presents 4-5% to Around 1%-2%) resulting in better quality yarn.
 - ✿ Ensuring quality attributes to individual bales, spinning mills can adopt blending practices with desired end product quality and hence lot of time will be saved. This result in yarn with expected quality.
 - Eco-friendly pre-processing
- Bio-scouring
 - ✿ Bio-scouring in place of conventional chemical method will ensure energy efficient pre-processing in handloom sector. Pollution load will be minimal.
- Natural Dyes
 - Eco-friendly dyed yarns and fabrics will be made available by using natural dyes.
- Cotton Stalks
 - Additional income to farmers
 - ✿ Farmers can get an additional income of Rs. 500/- per tonne of stalk And on cleaning, chipping and transportation to board industry within a Distance of 50 km can fetch Rs. 2000/- per tonne.
- Additional raw material for board industry
- Energy efficient process for growing oyster mushroom
 - ✿ The initial pasteurization (80 C) of substrate is totally dispensed with due to the adoption of biological treatment at room temperature, thus saving energy.
- Seed
 - Enhanced oil recovery
 - Even 1% increase in oil recovery, one mill crushing cottonseed at 100 tonnes per day can earn Rs. 9-10 lakhs per month additionally.
 - Energy efficient process for mechanical delinting
 - It is expected to reduce the energy consumption by 20%
 - Bio-enriched cattle feed from hull
 - Enrichment of cottonseed hull with microbial protein with increased digestibility by solid state fermentation is an eco-friendly and energy efficient technique with no discharge of pollutants.
 - Edible protein from cottonseed kernel
 - Gossypol free protein from cottonseed kernels could go, in food grade formulations for human consumption.

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

Public institutes:

1. ICAR, New Delhi
2. NAIP, New Delhi
3. CICR Regional Station , Coimbatore
4. UICT, Mumbai
5. CMFRI , Mumbai

Private participation:

6. Eco board Industries Ltd., Pune
7. Cotap Res. Foundation, Mumbai
8. J.K. Agri. Seeds, Hyderabad
9. MAHYCO, Mumbai
10. SSM, Coimbatore
11. Century Textiles & Ind. Ltd., Mumbai
12. CITI, Mumbai
13. Bajaj Steel Industries Ltd.,
14. NCDEX, Mumbai

NGOs:

15. Phoenix, Belgum
16. Natural Dye Resources
17. Punjab Durrie Weaver, Mumbai

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

S. No	Date & Location	Programme	Participants	Remarks
1	7 th November 2006	Discussion about activities that can be carried out at Nagpur	CIRCOT, Mumbai- Lead Institute CICR, Nagpur (HQs) & Regional Station, Coimbatore M/s. Mohota Mills, Nagpur	Work that can be carried out at Nagpur
2	15 th November 2006	Discussion on proposed project on, "value Addition to Cotton"	CIRCOT, Mumbai- Lead Institute CICR, Nagpur (HQs) & Regional Station, Coimbatore M/s. Super Spinning Mills Ltd., Coimbatore M/s. Mohota Mills, Nagpur M/s. Natural Dye Resources Sawantwadi M/s. Western India Plywood Industries Ltd., Cannanore	Various activities related to the project were discussed.

S. No	Date & Location	Programme	Participants	Remarks
			Indian Institute of Science, Bangalore NDDB, Anand SPRERI, Vallabh Vidya Nagar	
3	20 th June, 2007	Discussions on proposed project on, "Value Addition to Cotton " after the acceptance of concept note	CIRCOT, Mumbai – Lead Institute CICR, Nagpur (HQs) & Regional Station, Coimbatore M/s. Super Spinning Mills Ltd., Coimbatore	Details related to the actual work worked out
4	23 rd June 2007	Discussion on use of natural dyes for dyeing of textiles	CIRCOT, Mumba-Lead Institute Natural Dye Resources(NDR), Mumbai	Use of natural dyes for preparation of eco-friendly textiles
5	20 th July, 2007	NAIP Stake Holders Workshop	ICAR, New Delhi NAIP, New Delhi CICR Regional Station, Coimbatore UICT, Mumbai CMFRI, Mumbai Eco board Industries Ltd., Pune Cotap Res. Foundation, Mumbai JK Agri Seeds, Hyderabad MHYCO, Mumbai SSM, Coimbatore Century Textiles & Ind Ltd., Mumbai CITI, Mumbai Century Textiles & Ind . Ltd., Mumbai Bajaj Steel Industries Ltd., Nagpur NCDEX, Mumbai	

12. Measures to Address the Issues:

A document on Safeguard Matrix has been prepared. Farmers will be educated about Best Crop Management practices. It includes INM, IPM. In case of pest or insect attack by unknown pests or insects, scientists will work out the appropriate methodology to tackle the problems. This will then immediately be passed on to the farmers so as to reduce the damage to the minimum.

During chipping operation of cotton stalk a lot of dust is generated. Inhaling this dust can be harmful to the workers. Appropriate protective devices will be provided the workers.

Use of pure enzymes for delinting and oil extraction can be very costly. We will be using a consortium of enzymes prepared by microbes. This will bring down the cost of enzymatic treatment considerably.

13. Consultation/ disclosures to be done in future:

- ✍ Tackling seed cotton contamination at the farm level and subsequent transportation to the mill.
- ✍ Reducing the trash content further down i.e. below 1% for extra long cottons.
- ✍ Improvement in bale packaging practices and generating some data so that this could Be used to update the specification for cotton bales which would meet the current Industry needs.
- ✍ Importance of manual picking of cotton and further post harvest management.
- ✍ Demonstration of appropriate picking models to the farmers to reduce the contamination and picking of the yellow bolls.
- ✍ The project should quantify value addition at each stage and show explicitly. How much each stake holder would be benefited by each activity; also the project Should provide enough buffer time so that if there is any delay in one activity /stage It should be possible to compensate it at the next stage.
- ✍ The seminar needs to be arranged for the participating farmers so that they will Understand the importance of the project before starting the work.
- ✍ Mechanical harvesting may be tried in a few farms for refinement of mechanical Picking technology.
- ✍ Educated farmers from Vidarbha may be approached for contract farming since in Yeotmal contract farming has been successfully carried out during a project on Bt Cotton by CICR.
- ✍ CIRCOT should also impress upon the government for excise relief for particle board Industry damages the eco-system through the felling of fully grown trees while Farmers can generate extra income through the use of agro waste.
- ✍ Chemical processing which is the weak link in a value chain needs to be addressed properly. Since UV finishing involves synthetic chemicals, use of natural dyes for imparting this value addition is a better alternative as envisaged the project.
- ✍ A portions of the cotton seed oil cake from delinted seed could be considered as feed for shrimp/fish etc. And trials could be carried out to evolve its efficacy.
 - a. Adoption of on-farm and off-farm management practices Dissemination of holistic crop management and extension services to participating farmers specifically IPM & IPNS through training & education programmes.
 - b. Tagging of individual bales with fibre attributes Demonstration of new products preparations to stakeholders
 - c. Microbiological(Bio-scouring) Scouring of yarns and fabric Transfer of technology of value-added health foods to stakeholders

- d. Removal of linters from enzymes kernels due to enzymes pre-treated seeds
Dissemination of information and sensitization of line departments of state and central governments to policy makers, planners and project partners for enhancement of millets consumption
- e. Enhanced oil recovery from kernels due to enzyme Pre-treatment
- f. Enrichment of cottonseed hulls with microbial proteins with enhanced digestible
- g. Biological pre-treatment of cotton stalk for seeding mushrooms
- h. Establishment of cotton stalk supply chain to board industry
- i. Gossypol free protein from cottonseed kernel

Consortium PI

National Coordinator

National Director

Annexure I: Environmental safeguard: Activities, issues, impact and mitigation measures

Activities ¹	Issues	Anticipated level of Impacts ³		Mitigation measures (Negative Impact) ⁴
		Positive	Negative	
Production of cotton	Reduced use of pesticides, fertilizers etc.	3		
	Use of bio-fertilizers and bio pesticide	2		
	Unknown pest/insect attack		2	Use of appropriate pesticide/ insecticide
Harvesting and storage	Reduced level of contamination and trash	4		
Ginning and pressing	Reduced dust level in ginnery	3		
Labelling of bales with fibre quality	-----			
Preparation of yarn and conversion of yarn to fabric and garments	Modern facility already exist	4		
Bio-scouring of yarns and fabric	Reduced level of pollution	3		
Dyeing of bioscoured yarn and fabric with with natural dyes	Reduced level of pollution	3		
Conversion of dyed yarn into fabric and garment	Reduction of health hazard to workers	3		
Marketing of garments	----			
Evaluation of yarns, fabric and garments properties	----			
Evaluation of UV protection properties of fabric dyed with natural dyes.	UV protection	4		
Chipping of cotton stalks Supply of chipped stalk to board making industry	Dust generation		2	Workers will be provided with protective mask
Composite board making and marketing	Additional raw material to industry	5		
Briquetting of chipping waste	Additional raw material for energy generation	4		
Bio Treatment of stalk and mushroom growing	Energy saving	3		
Enzymatic treatment and Delinting	Reduction in energy utilization and dust level	4		
Enzymatic pre-treatment of kernels for enhanced oil extraction	Reduced energy consumption and enhanced oil recovery	3		
Bio enrichment of hull for cattle feed	Enhanced protein content in cattle feed with improved digestibility and no effluent discharge	3		
Extraction of gossypol free edible protein from kernel	Availability of healthy food	4		

Annexure II: Social safeguard: Activities, issues, impact and mitigation measures

Activities ¹	Issues	Anticipated level of Impacts ³		Mitigation measures (Negative Impact)
		Positive	Negative	
Production of farmers	Higher income to farmers	4		
Harvesting ,storage & Transportation	Reduction in input cost	3		
	Additional Rural Employment	4		
Ginning and pressing	Reduction in health hazard of workers	2		
Labeling of bales with fibre quality	Employment generation for quality testing	4		
Preparation of yarn and conversion of yarns to fabric and garments	-----	3		
Bio-scouring of yarn and fabric & dyeing of bio-scoured yarn and fabric with natural dyes	Creation of jobs in bio-scouring technique and reduction in health hazard	3		
	Creation of jobs in collection of raw material and extraction of dye from natural resources	4		
Conversion dyed yarn into fabric and garment (Handloom sector)	Creation of jobs in handloom sector	4		
Marketing of garments	-----	3		
Evaluation of yarns, fabric and garments properties	-----	3		
Evaluation of UV protection properties of natural dyes	UV protection from direct sunlight	4		
Chipping of cotton stalk & transportation to board making factory	Extra income to farmers , rural employment & entrepreneurship development	5		
Particle board making and marketing	Employment generation	4		
Briquetting of chipping waste	Extra income to farmers	4		
Bio Treatment of stalk and mushroom growing	Creation of jobs and extra income to farmers	3		
Collection of seeds and transportation to oil mill	-----			
Enzymatic treatment and Delinting	Enzyme cost		2	Consortium of enzymes will bring down the cost
Enzymatic pretreatment of kernels and oil extraction	Enzyme cost		2	Consortium of enzymes will bring down the cost
Bio enrichment of hull & Cattle feed trails	Nutritional food for cattle	3		
Extraction of gossypol free edible protein from kernel	Availability of healthy food	3		