CIRCOT Leaflet No. 63

International Year of Natural Fibres

Cotton Stalk : An Additional Raw Material to Board Industry

CFC/ICAC/20

Central Institute for Research on Cotton Technology

International Cotton Advisory Committee

Common Fund for Commodities

Introduction

In India, the area under cultivation of cotton during 2008-09 was about 9.4 M ha with the lint yield of about 290 lakh bales. It has been estimated that on an average annually about 23 million tonnes of cotton stalks are generated, that are treated as agro waste and not utilised for any commercial purposes. The chemical composition of cotton stalk is akin to hard wood and is a good renewable source of raw material for the board industries.

CIRCOT started working on this raw material way back in 1975 and standardised many technologies for production of pulp and paper, particle board, hard board, as a substrate for growing edible oyster mushroom, etc. A number of industrial trials were also undertaken and proved beyond doubt that cotton stalk is also one among the most suitable raw materials for manufacturing pulp and paper, composite boards and as a good substrate for raising edible mushroom crop.

Why board industries are not inclined to use cotton stalk as a raw material?

- Presently bagasse, a byproduct from sugarcane crushing industries is available from an organised sector for use in board making.
- Assured supply of bagasse at an affordable price
- Available in a bale form,bagasic in large quantities can be transported and stored in a pyramidal structure
- About 25% of the cotton stalks are used as fuel by the rural masses
- Absence of an established cotton stalk supply chain makes procurement difficult for board industry
- Lack of awareness among farming community about utility of cotton stalk as an industrial raw material
- Non-availability of techno-economic feasibility for use of cotton stalk in particle board industries
- Lack of awareness among board industries about potential of cotton stalk as a raw material

In order to address these issues, CIRCOT submitted a proposal to CFC, Netherlands through ICAC, Washington, USA and a project was sanctioned in 2004 mainly to establish a cotton stalk supply chain and installation of a 1 TPD demonstration plant at CIRCOT's Regional Unit at Nagpur to finetune the technology.

Supply Chain for Cotton Stalks

The following models were tried for the purpose of establishing a supply chain :

1. Transportation of cotton stalks directly from the field to the factory
2. Transportation of chips from the field to the factory
3. Transportation of cotton stalks from the field to a centralised chipping centre and transportation of chips to the factory

Among all the three models tried, the third model was found to be technically more feasible and economically viable.

Model 3

Collection and transportation of cotton stalks by farmers from the field to the chipping centre. Chipping and subsequent transportation to the factory by an entrepreneur

Advantages :

- ★ It is easy for a farmer to collect and transport cotton stalk to the nearest chipping centre.
- ★ Entrepreneur can establish a chipping centre in rural area, as sufficient quantity of cotton stalks at one place is assured and feasible to produce chips by using a tractor operated chipper.
- ★ Timely and assured supply of cotton stalk chips to the Board Industry situated not farther than 50 km from the chipping centre

Model 3 has been found to be viable and accordingly an NGO was identified and the work was entrusted. The expenditure towards collection, chipping and transportation is given below.

Cost per tonne of Ready to Use Cotton Stalk Chips at Factory Site

Sl. No.	Particulars	In US $	In Rs.
1	Labour charges for uprooting, cleaning and chipping	24.2	1210.00
2	Transportation charges	7.1	355.00
3	Loading and unloading charges	1.1	55.00
4	Raw material cost	11.1	555.00
	Total	43.5	2175.00

It has been observed that when the entire operation was carried out by an NGO in a chipping centre and supplied to a board industry situated at a distance less than 3 km, the total cost per tonne of ready to use chips worked out to about Rs. 1200/-

Based on the experience over the years, the following conclusions have been drawn.

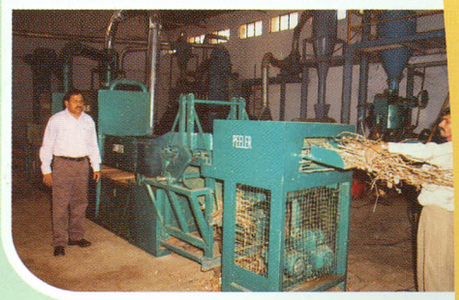
- Farmer can get additional income for the cotton stalks at the rate of Rs. 500/- per tonne
- Ready to use cotton stalk chips can be supplied economically to the existing board industries situated not far away than 50 km from production site.
- 10-20 TPD plants can be established by prospective entrepreneurs in cotton growing areas
- Existing board factories can use cotton stalks as one of the raw material for board making

Availability of Cotton Stalks in Nagpur District, Maharashtra, India

3 tonnes/ha 40% moisture	Cotton stalks uprooted immediately after the completion of last picking of seed cotton (contains green leaves, boll rinds and unopened bolls)
2.4 tonnes/ha 25% moisture	Devoid of leaves after 5 days of drying in open in the field (leaves contribute to about 5%)
1.7 tonnes/ha 20% moisture	Manual cleaning of cotton stalks (Removal of boll rinds, unopened bolls and small branches which contribute to about 25%)
1.5 tonnes/ha 15% moisture	Chipping of whole cotton stalks (loss during chipping, about 10%)
1.3 tonnes/ha 10% moisture	Transportation of chips to a maximum distance of 50 km (loss during loading, unloading and transportation, 5%)

Availability of Cotton Stalks in Sirsa District, Haryana, India

14 tonnes/ha 47% moisture	Cotton stalks uprooted immediately after last picking of seed cotton (contains green leaves, boll rinds and unopened bolls)
10.22 tonnes/ha 25% moisture	Left in the open sun drying for 5 days (Removal of leaves; weight reduction by 5%)
7.15 tonnes/ha 20% moisture	Manual cleaning of cotton stalks (leaves, boll rinds, unopened bolls and small branches) and drying (Matrerial loss 25%)
6.07 tonnes/ha 15% moisture	Chipping of whole cotton stalks (material loss is 10%)
5.46 tonnes/ha 10% moisture	Transportation of chips to a maximum distance of 50 km (material loss during loading, unloading and transportation 5%)



Cleaning of Cotton Stalks

- Presence of boll rinds and bark affects the quality of boards.
- Machine Cleaning is possible but expensive and farmers can not afford to use this in field.
- Manual cleaning by beating the dried stalks against a wooden mallet has been found to be economical.
- Manual removal of stalk after the picking of seed cotton is an alternative and effective method.

Demonstration Plant

- One tonne per day capacity installed with indigenous machinery - automatic plant except sanding and trimming.
- All crop residues can be processed in this plant.
- 4' x 3' boards with different thicknesses can be prepared.
- Different chemicals can be added to impart desired properties namely, water repellency, termite resistance, mildew resistance etc.
- An useful facility to demonstrate the technology to prospective entrepreneurs.

Ten tonnes per day plant : Ideal in small holding situation

- Cotton stalk is available seasonally.
- Even in Maharashtra and Gujarat where maximum cotton is grown, the size of the land holding ranges from 0.5 ha - 2 ha.
- Mixed cropping is common
- Availability of stalks is about 2 tonnes/ha under rainfed conditions and 5 tonnes/ha under irrigated conditions.
- Ideal to have 10 TPD plants in Vidarbha and Saurashtra areas
- Number could be more - say one plant in a radius of 10km.

Cost Estimation and Profitability for a Particle Board Plant (10 TPD capacity)

Production capacity : 10 TPD (384 boards of 8'x4'x12 mm),

Raw material : 15 TPD of cleaned chips/day

No. of shifts per day : 3

A	Capital Investment	Rs. in lakhs	In US $
1.	Land & Building Land : about 1 hectare Building : (Area about 10,000 sq.ft., raw material storage)	 25.00 45.00	 50,000.00 90,000.00
2.	Plant and Equipment	422.00	8,44,000.00
3.	Auxiliary and service equipment, margin money for working capital	90.00	1,80,000.00
	Total Project Cost	**582.00**	**11,64,000.00**
B	Cost of Production		
1.	Raw Material & Utility	205.00	4,10,000.00
2.	Labour & Supervision	35.10	70,200.00
3.	Repairs, maintenance & overheads	28.00	56,000.00
(I)	Total Manufacturing Cost	268.10	5,36,200.00
(II)	General Expenses	17.50	35,000.00
(III)	Depreciation & Interest	102.00	2,04,000.00
	Total cost of production B (I+II+III)	**387.60**	**7,75,200.00**
	Cost of production per kg board	12.92	0.26
	Cost of production per sq.ft. (12 mm thickness)	10.50	0.21
C	Profitability		
	Selling price per unit (8'x4'x12 mm) @ Rs.13.50 per sq. ft	Rs 432.00	8.64
1.	Gross Annual Income	497.66	9,95,320.00
2.	Annual Cost of Production	387.60	7,75,200.00
3.	Annual Return (1-2)	110.06	2,20,120.00
4.	**Return on Investment (ROI)**	**19%**	**19%**

Awareness Programmes

- A number of meets were arranged in Vidarbha, Sirsa, Ludhiana, Coimbatore, Guntur and Dharwad.
- Farmers are more responsive in Vidharbha and Gujarat and ready to spare stalks for board making.
- In Sirsa and Ludhiana, cotton stalks are chipped in wet condition and used to bake bricks in brick kilns.

Technology Transfer

- CIRCOT provided technology and logistic support to supply ready to use cotton stalk chips through an NGO to M/s Godavari Particle Board plant in Nanded.
- About 500 tonnes of chips were supplied in 2008-09 season.
- Has plans to make available 1500 tonnes in the ensuing season.

For further details contact

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