

MM 4.2 : Commercial Technology Development for Value Addition to Cotton Plant Stalks, Cottonseeds and Processing Dust

Principal Investigator : R. H. Balasubramanya, CIRCOT, Mumbai

Target & Achievement

Target/activity	Achievement during 2004-2005
<p>Designing and development of hand-cum-power operated and Hydraulic system cotton stalk compacting machine</p>	<p>Hand –cum power operated cotton plant stalk compacting machine</p> <ul style="list-style-type: none"> i) Sturdy platform 150 cm x 45 cm x 45 cm ii) Side doors iii) Sturdy pressing plate 144 cm x 42 cm x 1 cm held by two fixed screw system iv) Motor 5HP (1440 rpm) – power is transmitted by worm wheels with a teeth ratio of 1/10 v) The rpm is reduced to half by introducing reduction gear system vi) Limiting switches are provided (on top and bottom) to control the motion of the screw <p>Cotton Stalks Compacting Machine Using Hydraulic System</p> <ul style="list-style-type: none"> i) Sturdy platform 150 cm x 45 cm x 45 cm ii) Side doors iii) Sturdy pressing plate 144 cm x 42 cm x 1 cm held by four fixed guide rods with suitable bushes iv) 3 phase, 5HP Hydraulic pump is provided-force is transmitted to two vertical hydraulic cylinders (350 strokes/min) through flexible hose pipes v) Limiting switches are provided
<p>Conversion of paper prepared from cotton linters to folders, carry bags, file covers and greeting cards</p>	<p>File covers and carry bags (400 each) were prepared from the paper made from cotton linter pulp and distributed to dignitaries at the 75th Annual General Meeting of ICAR at New Delhi</p>
<p>Full scale mill trials on the preparation of particle boards at Ecoboard Industries Ltd.</p>	<p>Commercial Trials on Cotton Plant Stalks</p> <ol style="list-style-type: none"> 1. Preparation of particle boards from 8 tonnes of cotton stalks was undertaken at M/s Ecoboard Industries Ltd. 2. 24 mm, 18 mm & 12 mm boards of 13.5' x 6' were made with different surface finishes 3. The properties satisfy BIS specifications except water absorption

Progress of Work

Hand –cum power operated cotton plant stalk compacting machine

Constructional Features

The Hand-cum-Power Operated Cotton Stalk Compacting Machine has been fabricated from mild steel sheets. The machine has got a sturdy platform (150 cm x 45 cm x 45 cm) with side doors opening from top. There is a sturdy pressing plate (144 cm x 42 cm x 1 cm) held by two fixed screw system (pitch, 1.27 cm) connected by a common shaft. A 5 HP motor with 1440 rpm is provided, the power of which is transmitted to the screws by worm wheels with a teeth ratio of 1/10. The rpm of motor is reduced to half by introducing Reduction Gear System. Limiting switches are provided one on top and one at the bottom to control the motion of the screw after compaction to the set level and after reaching the top position of the side door. In the event of electricity failure the machine can also be operated manually by rotating a wheel which brings down and up the pressing plate. Vertical slits are provided on the doors on either side to introduce ropes before placing cotton stalks and for tying after compaction.

Operating Procedure

Cotton stalks are kept horizontally in the space after opening one side door to a height of 12” followed by closing the door. Once the unit is switched on, the top plate starts moving down and compresses to the desired level and stops at which stage the bales are manually tied and by switching on the unit again, the pressing plate is made to move up. The process is repeated. It takes about 30 seconds to come down and another 30 second to go up. In order to utilise the idle time of another 30 seconds, provision has been made to fill up trays with cotton stalks which can be pushed inside, pressed, tied and can be taken out from the side opening. It is possible to make about 200 bales of 10 kg each in a day of 6 hours employing 2 persons.

Cotton Stalks Compacting Machine Using Hydraulic System

Constructional Features

The present Cotton Stalk Compacting Machine (Fig.4.2.1) has been fabricated from mild steel. The machine has got a sturdy platform (150 cm x 45 cm x 45 cm) with side doors opening from top. There is a sturdy pressing plate (144 cm x 42 cm x 1

cm) held by four fixed guide rods with suitable bushes. A three phase, 2HP hydraulic pump is provided, the force of which is transmitted to the two vertical hydraulic cylinders (350 strokes/min) through flexible hose pipes (1.25 cm), one connected at the top and another at the bottom of the cylinders. The piston moves up and down due to hydraulic pressure. The rpm of motor is 1440.

Limiting switches are provided, one on top and another at the bottom to control the motion of the hydraulic cylinders after compaction to the set level and also when the pressing plate reaches the top position of the side door. Vertical slits are provided on the doors on either side to introduce ropes before placing cotton stalks and for tying after compaction.

Operating Procedure

Cotton stalks are kept horizontally in the space after opening one side door to a height of 18" followed by closing the door. When the unit is switched on, the pressing plate starts moving down due to the compression of hydraulic cylinders to the desired level which is controlled by the limiting switches at which stage the bales are manually tied and by switching on the unit again, the hydraulic cylinders are made to move up lifting the pressing plate the movement of which is again controlled by the limiting switch. The process is repeated. The entire operation takes about 14 seconds (7 seconds to come down and same time to go up). It is possible to make about 250 bales weighing 15 kg each in a day of 6 hours by two skilled persons. The stalks were mechanically cut into chips of about 1.5 cm to 2.0 cm size using an electric chaff cutter. The chipped stalks were packed in gunny bags and stored for undertaking trials. Data on transportation of stalk in stick form and in chip form has been collected. The bulk density of cotton stalks in stick form was found to be around 0.7 kg/m³ while in chip form it increases to about 1.4 kg/ m³. About 1.2 tonnes of cotton stalks in stick form could be transported in one truck having dimensions 16'x8'x6.5' while in chip form about 3 tonnes of stalk could be transported. Trials were also undertaken to increase the bulk density of stalk and chips after baling. After pressing and baling the bulk density of stalk was increased to about 2.4 kg/m³ while the bulk density of chips to 2.6 kg/m³. After baling about 4 tonnes of cotton stalks in stick form can be accommodated in a truck while in chipped bale form about 5 tonnes of material can be accommodated in a truck and the efficiency of cotton stalk compacting machine is given in Table 4.2.1.

Table 4.2.1 : Efficiency of Cotton Stalk Compacting Machine

Model	Name	Operation Time	No. of bundles made in 6 h by 2 persons	Weight (Kg)
I	Hand operated	5 min	35	5
II	Power operated (1HP single phase)	3 min	75	8
III	Hand-cum power operated (2HP three phase)	1 min	150	15
IV	Hydraulic (2 HP Hydraulic pump three phase)	14 sec	250	15

Particle Boards from Cotton Plant Stalks**Commercial Trials on Cotton Plant Stalks**

1. Preparation of particle boards from 8 tonnes of cotton stalks was undertaken at M/s Ecoboard Industries Ltd.
2. 24 mm, 18 mm & 12 mm boards of 13.5' x 6' were made with different surface finishes
3. The properties satisfy BIS specifications except water absorption. The properties of boards are given below (Table 4.2. 2).

Table.4.2.2 : Properties of Boards

Properties	BIS Standard	Cotton Stalk Board
Density (kg/m ³)	500-900	731
Modulus of Rupture (n/mm ²)	11	13
Tensile strength (n/mm ²)	0.3	0.5
Screw withdrawal strength	Face	1250
	Edge	700
Thickness swelling	12	16
Water Absorption	2 h	40
	24 h	80
Moisture (%)	5-15	4

4. File covers and carry bags (400 each) were prepared from the paper made from cotton linter pulp and distributed to dignitaries at the 75th Annual General Meeting of ICAR at New Delhi.
5. Greeting cards were also distributed to various officers in the Council

Patents filed during 2004-2005

1. Hand-cum-Power Operated Cotton Stalk Compacting Machine
2. Machine for Compacting Cotton Stalk Using Hydraulic System.
3. Biological Softening of Lignocellulosic Material for Preparing Binderless Boards
4. Process for Preparation of Multilayer Particle Board from Cotton Plant Stalks