

Design and Development of Cotton Crop Cutting and Crushing Machine

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ABSTRACT

Cotton is very useful in our life. Today, the world uses more cotton than any other fiber. There are various methods to cultivate cotton crop. As India is an agro based country where various crops are cultivated. In states like Maharashtra and Gujarat, cotton crops are mostly cultivated, as the climatic condition is suitable. Major problem during cultivation of this crop is the left over stalks which are burned thereafter, which leads to increase in pollution and labour work and time duration as well. So we are designing and fabricating a machine which will help to overcome the factor like time of operation, labour cost etc. This machine consists of petrol engine, roller and cutter; hence it will work efficiently as compared to manual operational work. It is easy to understand hence it will no longer be contraption for farmers and they can operate it easily.

Keywords: Cotton Stalks, Fabricate, Cultivation, Roller and Cutter.

I. INTRODUCTION

In the country like India where the main source of income is agriculture. Agriculture is the backbone of our India. Needs to concentrate in some aspects like how to increase productivity and profit, how to reduce cost and how to solve and ease the problems of workers. To overcome this we will make a machine for cutting and crushing of cotton crops during harvesting and named as “Design and Development of Cotton Crops Cutting and Crushing Machine”. In India agriculture has facing serious challenges like scarcity of agricultural labour, in peak working seasons but also in normal time. This is mainly for increased nonfarm job opportunities having higher wage, migration of labour force to cities and low status of agricultural labours in the society. The crop cutting is important stage in agriculture field. Currently Indian farmer used conventional method for cotton crop cutting i.e. cutting crop manually using labour but this method is very lengthy and time consuming. So in order to reduce the labour cost, time consumption, and also the air pollution by burning the cotton crops, this machine will definitely helpful for the farmers. As the concept of cotton crop crushing machine is to crush the crops in pieces and let it decompose as it will be helpful for the farmers and also will reduce the time consumption in various ways. Crop crushing is the last stage, thus our aim is to provide a crop crushing machine which will reduce human efforts and time requirement as well. As India is also a leading manufacturer of paper and having large area covered by forest and trees from which wood is supplied to the paper manufacturing industries. The cotton plants are also used as raw material in paper manufacturing units because it gives more strength in paper or paper board, In India there is no concept of producing chips from cotton stalks before supplying to the industry. The concept behind the study is to do the research for designing the Cotton crop cutting and crushing machine that can cut the crops in chips form as we know the physical and mechanical properties such as tensile and compressive strength, shear strength, impact test, torsion test and bending moment of cotton stalks then it is easy to design various machine components. Nearly 70% of farmers in Maharashtra region are taking the production of cotton. After extracting the cotton from the cotton crops the farmer will only save 20% of total crops for supplying purpose and leftover is count to be as waste. Leftover dry crops of cotton plants are to be produced in the form of chips by cotton crop cutting machine and can be supplied to the paper manufacturing industry as it is rich in fiber. Cutting of cotton stalks as only in recent years has been permitted for industrial purposes in India and some Asian countries. The crop residual stalks and fiber have great potential for many products such as wood, paper, fuel resources, animal forage. These stalks are tall plants and its stem has large diameter. A stalk has high percentage of lignin and consist of a woody core and outer fibrous tissues. These characteristics may make cutting cotton more energy intensive than any other crop. So in order to reduce the labour cost, time consumption, and also the air pollution by burning the cotton crops, this machine will definitely result in helping the farmers and result in profit in their source of income.

II. LITERATURE REVIEW

In the research paper of “MULTI CROP CUTTER”, has given that it is easy to fabricate, low cost and light weight. Their aim was on focus easy of cutting operation to the small land holders for cutting varieties of crop in less time and at low cost by considering different factors as power requirement, cost of equipment, ease of operation, field condition, time of operation and climatologically conditions. The operating, adjusting and maintaining principle are made simple for easy and properly handling by unskilled operators.

The research paper of “DESIGN AND FABRICATE CEREAL CROPS CUTTING EQUIPMENT” presents the cereal crop cutting equipment for the cereal like Chick Pea. Their aim was to fabricate the equipment which is simple to operate and safe with low cost of maintenance. Also it requires less manpower.

Adarsh Jain , Vinay N. Thorat & Kiran This Fabrication model sugar harvesting machine consists of Petrol Engine & mechanisms are used in this machine to compare to manual harvesting by using this machine has capacity to cut sugarcane with faster rate and economically.

Dr. U.V. Kongre along with his team fabricated a “ MULTI CROP CUTTER”. The machine was manually operated. The uses of it was that it makes the harvesting process faster. Hence reduce most of the cutting time and labour required to operate the machine is also less.

Pamujula Hythika madhav and Bhaskar HD, Tumkur designed and fabricated “ MANUALLY OPERATED ROTARY LAWN MOWER “. The manually operated lawn mower works without fuel .the gear train mechanism and bevel gear system used to rotate the cutting blade.

Arvind C.'s et.al [4] paper made by student of BNM Institute of Technology, Bangalore. They provided design concept of Paddy harvester and calculation between conventional and modern harvester. This project is focused on developing a machine which addresses labour problems faced by small scale farmers. The power from the engine is provided to the cutter through slider crank mechanism and driven by a pulley arrangement a collecting mechanism is provided to the cutter to collect the harvested crop

III. FORMULATION OF PROBLEM

- Farmers use conventional method for cutting the cotton crops which is very complicated, and time consuming method. After cutting, crops are burned on land which creates air pollution and also reduces the soil fertility.
- There is a scarcity of labours in agriculture because of non agricultural job opportunities having Lower wages, migration of labour forcing towards cities and low status of agricultural labours in the society.
- So taking the entire problem into consideration. It will be essential to design and develop the machine for cutting and crushing the cotton crops to overcome these problems.
- Now a days cotton plants are also used as raw material in paper manufacturing units because it gives more strength in paper or paper board therefore it is also a great profit for the farmers.

IV. IMPORTANCE OF PROJECT

This project is very useful for the farmers, by designing a cotton crop cutting and crushing machine which cut the cotton crop more easily. Our aim is to focus on easy cutting of cotton crops, crush it and spread over the cultivated area or else collect the chips and supply the waste product to the industry and which results in production of paper and also to improve the fertility of soil by decomposing cotton crushed stalks on the land which works as a fertilizing agent instead of burning in the cultivated area. This machine is made very simple for easy and properly handling by unskilled operators.

V. LISTS OF MACHINE COMPONENTS

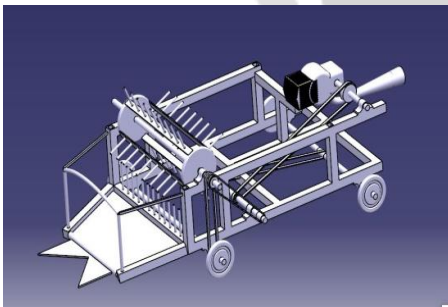
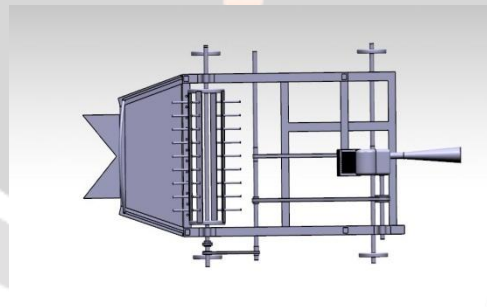
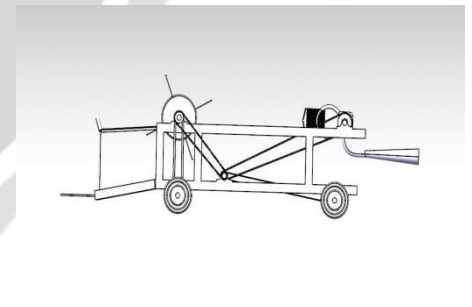
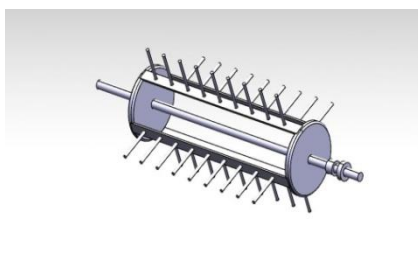
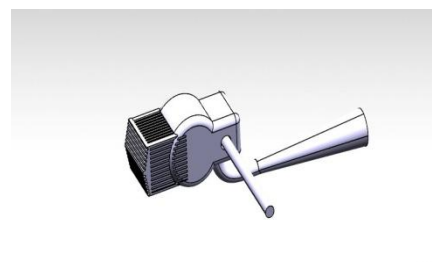
- 1) Engine
- 2) Bearing
- 3) Shaft
- 4) Frame
- 5) Chain & Sprocket
- 6) Crusher
- 7) Roller

VI. SPECIFICATION OF THESE COMPONENTS

Name of components	Specifications
Engine	6.14kw & 8000RPM
Bearing	Radial Bearing, 20 ϕ
Shaft	MS 20 ϕ
Frame	MS L section 25 \times 25 \times 3thk MS sheet 1.5 thick
Chain & Sprocket	High carbon steel
Crusher	Mild Steel Bright

VII. FINAL MODEL

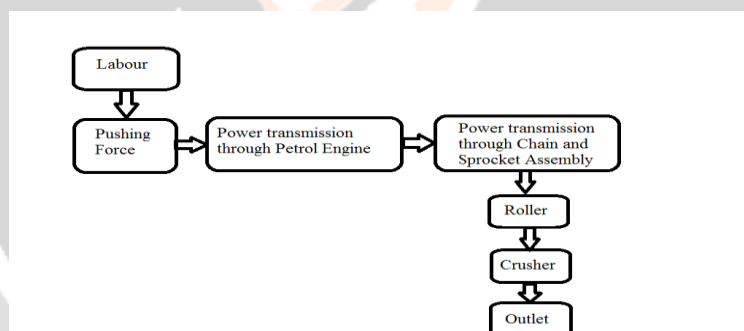
Fig. Actual Fabricated Model of Machine

VIII. CAD MODEL**FINAL MODEL****TOP VIEW****SIDE VIEW****IX . CAD COMPONENTS:****1. ROLLER****2. ENGINE**

X. Comparison of Cutting and Crushing of Cotton Stalks

• Cutting And Crushing done by Manual method	• Cutting And Crushing done by Machine
1. Amount Paid to the labour for 1 day = 400 Rs / Labour	1. Expected quantity of Petrol required for 1 Acre = 4 Litres
2. Total number of Labours required in General to Cut n crush the Stalks in a day = 4	2. Cost of 4 Litres of Petrol = 300 Rs.
3. Total amount paid to the labours = $4 \times 400 = 1600$ Rs. / Acre in one day	3. Amount paid to the labour = 300.00 Rs.
4. Total Expenditure in one day = 1600 Rs.	4. Total expenditure = Total Cost of Petrol + Amount Paid to the labour + Maintainance = $300 + 300 + 100 = 700.00$ Rs.
5. Total time taken to cut and crush the Stalks = 5-6 Hours	5. Total time taken by Machine = 1 – 2 Hours

XI. Block Diagram



A Block Diagram is a diagram of a system in which the principal parts or functions are represented by blocks connected by lines so, in this block diagram we have

1. Labour will give the direction by handling the machine.
2. It will acquire some pushing force
3. As the prime mover is a Petrol Engine, it will transmit the power to whole assembly by shaft.
4. From shaft the power will be transmitted by Chain and Sprocket Assembly to the whole machine.
5. Assembly is connected to Roller which will pull the plant inwards in the crusher.
6. Crusher is attached by engine shaft which will crush the crop.
7. Crushed plant will be thrown out on the field as the output.

XII. WORKING

- It is a compact cotton cutting machine having power unit of Hero Splendor 97.22 cc Petrol engine having power 6.14 kw and Torque 8.05 Nm.
- It consist of four wheels , engine and cutter, shaft, chain & sprocket.
- Chain and sprocket mechanism is used to transmit power to all the operating components.
- We are using the engine which works on principal converting chemical energy into electrical then into mechanical work.
- The engine transmit the power to shaft which with coupled with chain and sprocket which rotates the rear wheel.

- The rear wheel is rotated in clockwise direction which traps the crop in blade, forward moment thus bends crop towards the cutter.
- This chain drive will transmit the power to shaft on which cutter is mounted, as the cutter will rotate it will cut the crop continuously and this will cause wearing and tearing of cutter.
- This four wheel help to move the machine from one place to another and we will use metal wheel and metal frame chassis, simply it will increase the life of machine.

XIII. RESULTS

For Machine:

When machine is working in 1 acre area the fuel consumption is = 4 litre of petrol and

Number of labour required is = 4

Therefore, Fuel cost is Rs.300 + labour cost is Rs.400 = Rs.700

For Labour :

Total number of labour required to cut the crop from 1 acre of farm = 4

Labour working in 1 acre area the cost is =Rs. 400*4= Rs.1600

Cutting time and crushing time for 2 labour in 1 acre area of farm= 6 hr.

Hence in above comparison its clear that the cost of working by machine in the farm is less as compared to labour cost.

XIV. CONCLUSION

It is concluded that machine is easy to control on the field and the machine is operated by single labour/person. The machine will also eliminate the labour problem and struggles of labour in cutting the crop and the machine is designed to run on petrol engine it does not require any external agent to drive it like tractor or power tiller. On the basis of result, it is also concluded that this machine will serve a great deal for small scale cultivators.

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