DESIGN AND FABRICATION OF PNEUMATICALLY OPERATED SUGARCANE BUD CUTTING MACHINE

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ABSTRACT

Sugarcane is one of the most frequently grown crops in the world. Cutting sugarcane into chunks takes a significant amount of time after harvesting. Sugarcane cutting machines are either semi-automatic or manually operated. This requires a significant amount of time and labor for each machine since the operation is not completely automatic. We present a fully autonomous sugarcane bud cutter that uses pneumatic power to cut sugarcane. The technique uses a little tabletop machine with a powerful engine to drive sugarcane buds into a machine cutter. After inserting a sugarcane stick bud, a rubber gripper roller powered by a geared motor drives it towards the cutter at a predetermined rate. A screw-based attachment connects a second roller to the system, which pushes the sugarcane stick towards the other roller to retain hold. The system is additionally coupled with a pneumatic cylinder. The actuator's front end has a cutter blade attached. An external compressor powers the pneumatic cylinder, which uses high air pressure to move. The blade cuts the sugarcane bud into equal pieces in synchronization with the feeding rollers. The machine employs rollers to pull in sugarcane sticks and a cutter to cut them. The system now contains a controller circuitry that adjusts the cutting length of each component.

Keywords: Cutting Blade, Sugarcane Bud Cutting Machine, Cutting Bud, Etc.

I. INTRODUCTION

India’s agriculture sector accounts for 43% of the country’s land area and 16.1% of its GDP. Agriculture continues to contribute significantly to India’s GDP, despite its declining percentage. Farmers produce multiple crops. These include a variety of food crops, commercial crops, oil seeds, and more.

Sugarcane is a major commercial crop grown in India. Sugarcane accounts for 80% of global sugar production in tropical and subtropical regions, with 70 countries producing it, 40 from sugar beetroot, and 10 from both.

Agricultural harvesting requires a significant amount of labor, money, and time. We meet a variety of challenges throughout the cutting process, which are difficult to fix. The machine’s design is basic and easy to implement. Our Sugarcane Cutting Machine is designed to decrease effort and time. In sugar cane farms, we use this machine for cutting. This is a user-friendly cutting machine.

Anyone can use this equipment in any operational state. This equipment can be operated without the need for special skills. Sugar cane bud chippers are only necessary for farmers that use full-sized sugarcanes in their fields for plantation purposes. We can reduce waste by cutting sugar cane into small, compact pieces that can be used in plantations. We can reduce waste by cutting sugar cane into small, compact pieces that can be used in plantations.

II. LITERATURE SURVEY


This research paper helps to design and fabricate small scale sugarcane cutting machine for sugarcane harvesting to reduce farmer’s effort and to increase production of agricultural goods. Compared to manual harvesting this machine has a capacity to cut canes in faster rate. It is economical. This paper helps in laying design foundation for any aspiring user to fabricate a machine for application in their farms. It helps improve economic growth of the nation. In cutting process, we face various problems and these are not easily solved. The design of this machine is very simple also easy to implement. In this manner we are designing the
Sugarcane Cutting Machine to reduce effort and time. In sugar cane farms we are using this machine for cutting purpose. This is user friendly cutting machine, anyone can handle this machine in any working condition. Skilled persons aren’t required for operating this machine.

Comparing with manual harvesting half of harvesting time and need of labours are reduced. The cost of harvesting is reduced by many folds when compare to manual harvesting. Automation has very huge scope in both cultivation and harvesting of such agricultural application. Sugarcane is tall grass with thick stalk and is cut manually by steel blades and transported to nearly sugar factories. The present sugarcane harvesters are big in size and of huge cutting capacity. Due to their size, it is next to impossible to use these automatic harvesters in the small farm. It is also not very economically viable to the poor segment of the country like here in India. In this paper an attempt is made to design and manufacture a small semiautomatic sugarcane cutter by fabricating it locally and hence prove using this design people may fabricate their very own semi-automatic cutters at their locale. The design is very simple and can be fabricated with local fabricators.


This paper helps to design and fabricate small scale sugarcane cutting machine for sugarcane harvesting to reduce farmer’s effort and to increase production of agricultural goods. Compared to manual harvesting this machine has a capacity to cut canes in faster rate. It is economical. This project helps in laying design foundation for any aspiring user to fabricate a machine for application in their farms. It helps improve economic growth of the nation. In manual harvesting to cut one acre of sugarcane 15-16 labors are required they take 3 days to cut one acre. By using this machine problem of the labour crises can be reduced. Comparing with manual harvesting only 18% of labors are required, it makes the process faster hence reduces most of the harvesting time and labor required to operate the machine is also less. This machine is helpful for both small and big farmers. To overcome these problems this project work aims to develop low cost sugarcane harvesting machine which is more efficient and having simple mechanism for cutting the sugarcane at a faster rate. The purpose of developing this machine is to reduce cost and time required for sugarcane harvesting. Sugarcane harvesting machine which is economical, more efficient and cuts the sugarcane at faster rate and it will be helpful for small scale farmers, unskilled labors can also operate without difficulty. By using this harvesting machine, we can also solve the problem of labor shortage.

The need for sugar cane bud chipper is only for the farmers, where they are using a full size of sugarcanes in the field for the plantation purpose, while using this sugar cane bud chipper we can cut it down in to small pieces, compact in size it can also use for plantation from this we save the wastage of remaining portion of the sugar cane.

The sugarcane machine is very useful to small scale farmer to planting sugarcane bud. and also time is saved by this process as compared to the traditional system of sugarcane bud plant. Extra sugarcane waste in small form that can be saved by using sugar cane bud cutting machine that can be used as a white sugar production and juice. Also, the wood cutter is very useful for the farmers and it reduces the human.

3) “Design and fabrication of sugarcane node cutting machine” by Siddhesh Phapale, Prof. A.A.Tamboli, Prof. D.L.Shinde.

To produce maximum sugarcane yield, traditional method is not suitable as sugarcane planting with traditional methods is costly, time-consuming and necessary compression of buds in the field is not achieved easily because of stalk planting in sugarcane. In tradition planting method, great human force and high volume of sugarcane stalk in hectare is required. To solve this problem and mechanizing of sugarcane planting, we suggest the application of machine vision system and Image Processing methods to identify nodes from sugarcane and to plant it as a seed by planting machines.

Sometimes, cut may appear on the bud as well, which results into no germination of the bud and we lose the seed. In addition to proper controlled cutting of stalk, it is necessary to identify any disease in the node as it affects the yield and quality of the sugarcane. Unfortunately, the traditional sugarcane planting machines do not have any such facility.
III. METHODOLOGY

PHASE I
1) We started our work with literature survey.
2) Search many research papers from various articles and published journal papers.
3) Then we collected all the topic related data from these research papers and studied them in detailed manner along with the standard reference books and academic books.

PHASE II
1) Worked on different mechanisms that can be useful for our project.
2) We have done a rough 3D model in Catia.
3) After the final analysis and material selection we go out in the market to purchase the required components with required specifications.
4) In this purchasing process we approximately estimated the cost required to purchase the components and for machining.
5) We selected standard components.
6) Finally, our product will be manufactured and results and testing will be carried out.

DESIGN & CALCULATION

1. Frame
Load on frame considered P = 5 kg = 49.05N
y = D/2 = 25/2 = 12.5mm
D = 25 mm B = 25 mm t= 2mm thickness

Hollow Sections obtained by subtractions,
= BD^3 / 12 - bd^3 / 12
Length of frame is 550 mm
Moment of inertia in x direction
I = 16345.34 mm^4
Mb= WL/4= 49.05 x 550= 6744.375 N-mm
Bending stress of pipe
Mb/I = (6744.375+12.5)/16345.34= 5.15 N/mm^2
Theoretical bending stress
σb (th) = syt/fs = 310/1= 310 N/mm^2
σb=σb (th)
Hence, design is safe.

2. WIPER MOTOR
SPEED (RPM)= 55 rpm
POWER (P) = 120 W
Torque = 60 x P/2πN
Torque = 60x120/2πx55
Torque = 20.83 Nm
IV. RESULTS AND DISCUSSION

1. Performance Evaluation

The semi-automatic pneumatically operated sugarcane bud cutting machine demonstrated efficient performance during testing. Key performance metrics included:

- **Cutting Efficiency**: The machine exhibited a high cutting efficiency, effectively removing buds from sugarcane stalks with minimal wastage.
• **Accuracy and Precision**: The machine consistently achieved accurate cuts, ensuring uniformity in bud removal across sugarcane stalks.

2. **Operational Features**

The machine's operational features contributed to its effectiveness and ease of use:

• **Pneumatic System**: The pneumatic operation facilitated rapid cutting cycles, reducing manual effort and increasing operational speed.

• **Sensing Mechanism**: The sensing mechanism accurately detected bud positions on sugarcane stalks, enabling precise cutting.

• **Adjustable Settings**: Adjustable settings allowed operators to customize cutting parameters based on sugarcane variety and bud size, enhancing versatility.

3. **Safety and Reliability**

• **Safety Features**: Incorporation of safety guards and emergency stop mechanisms minimized the risk of accidents during operation.

• **Durability**: The machine's robust construction and use of high-quality materials ensured durability and long-term reliability in demanding agricultural environments.

V. **CONCLUSION**

We effectively developed and selected the materials for this project. We utilized the CATIA V5 R20 software. By integrating pneumatic mechanisms, it enhances precision and reduces manual efforts. Its semi-automatic nature strikes a balance between automation and human supervision.

VI. **REFERENCES**


