

Design Development and Fabrication of Sugarcane Bud Cutting Machine

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ABSTRACT

In today's world, the entire requirements are being fulfilled through automatic system. The demand for reducing the wastage of sugarcane .So the search of automatic system is completed by this project. One alternative to reduce the mass and improve the quality of seed for sugarcane would be to plant excised axillaries buds of cane stalk, popularly known as bud chips. These bud chips are less bulky, easily portable and more economical material. The bud chip technology holds great promise in rapid multiplication of new sugarcane varieties. The problem of establishment and initial growth could be addressed by application of appropriate plant growth regulators and essential nutrients.

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I. INTRODUCTION

Agriculture is one of the most significant sectors of the Indian Economy. Agriculture is the only means of living for almost two thirds of the workers in India. The agriculture sector of India has occupied 43% of India's geographical area, and is contributing 16.1% of India's GDP(Gross Domestic Product). There are number of crops grown by farmers. These include different food crops, commercial crops, oil seeds etc. sugarcane is one of the important commercial crops grown in India.Sugarcane is grown primarily in the tropical and sub-tropical zones of the southern hemisphere. Sugarcane is the raw material for the production of white sugar. It is also used for chewing and extraction of juice for beverage purpose. About 7.5% of the rural population, covering about 45 million sugarcane farmers, their dependents and a large number of agricultural labors are involved in sugarcane cultivation, harvesting and ancillary activities.



Figure no 1 sugarcane bud\

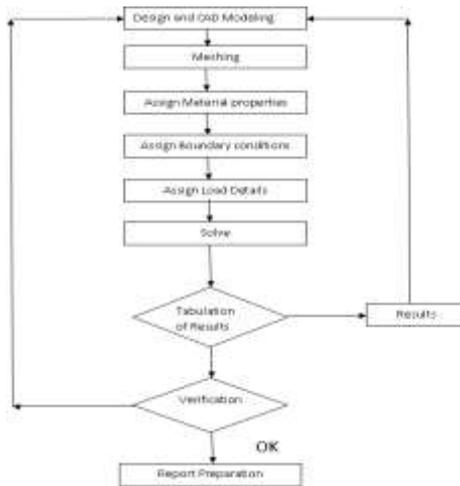
II. LITERATURE REVIEW

Abel Royetal[1]. Discussed about the development to design and fabricate semi automated sugarcane bud cutting machine for agriculture, to reduce farmer's efforts and to increase production of agriculture products. In this machine two operations are carried out at a time.

Ningappa H Kurietal[2]. Discussed that that the Sugarcane is a vegetative propagated crop. In India, for conventional system of sugarcane cultivation, about 6 – 8 tones seed is used as planting material, whichcomprises of about 32,000 stalk pieces having 2-3 buds. Cane cuttings with one, two or three buds known as sets are used as seed. This large mass of planting material poses a great problem in transport.

Sanjay Patiletal[3]. Discussed that the demand for reducing the wastage of sugarcane .So the search of automatic system is completed by our project. One alternative to reduce the mass and improve the quality of seed cane would be to plant excised auxiliary buds of cane stalk, popularly known as bud chips. These bud chips are less bulky, easily transportable and more economical seed material. The bud chip technology holds great promise in rapid multiplication of new cane varieties.

III. METHODOLOGY



Methods

1) **Change Manual Method in to Automatic** – By using appropriate capacity of single phase motor, gearbox which will reduce wastage and increase productivity as it will reduce strain on hands of worker and more emphasis on safety of operator.

2) **New cutting technology** – The research work in this domain was studied and new methods were developed to achieve desired goal.

3) **Single phase operation** – The power supplied to machine is single phase so to make it easy to operate at any location.

❖ Construction:

A. Power Source – Electric Motor(Single Phase)



Fig –2: Electric Motor

Electric motor is an electrical machine that is used to convert electrical energy into mechanical energy. For smaller loads as in household application. Although traditionally used in fixed-speed service, induction motors are increasingly being used with variable-frequency drives in variable-speed service. VFDs offer especially important energy savings opportunities for existing and prospective induction motors in variable-torque centrifugal fan, pump and compressor applications.

B. Gear Box:

Gearbox is used to reduce speed of shaft and to control the rotation motion. Most modern gearboxes are used to

increase torque while reducing the speed of a prime mover output shaft. This means that the output shaft of a gearbox rotates at a slower rate than the input shaft, and this reduction in speed produces a mechanical advantage, increasing torque. Some of the simplest gearboxes merely change the physical rotational direction of power transmission. Worm and worm gear box is used to transmit the output power. A gear box designed using a worm and worm-wheel is considerably smaller than one made from plain spur gear, and has its drive axes at 90° to each other. With a *single start* worm, for each 360° turn of the worm, the worm-gear advances only one tooth of the gear.

C. Shaft:

A Shaft is a rotating element, usually circular in cross section; line shaft is used to transmit power from one shaft to another, or from the machine which produces power, to the machine which absorbs power. Shaft is used to transmit power from motor to gearbox and from gearbox to mechanism. A shaft is an element used to transmit power and torque, and it can support reverse bending. Most shafts have circular cross sections, either solid or tubular. Shafts have different means to transmit power and torque. Shafts are able to avoid vibration of the elements, and assure an efficient transmission of power and torque, some changes in the cross-section of the shaft can be made.

D. Cutter:

This is the main section of the scooping machine. The scoop cutter is used to cut the sugarcane bud and to get the same size of sugarcane bud. Because of scooping cutter the wastage of sugarcane reduces and safety of farmer increases.

E. Spring:

A spring is an elastic object used to store mechanical energy. When a coil spring is compressed or stretched slightly from rest, the force it exerts is approximately proportional to its change in length. Spring is used to give the upward and downward direction to the cutter. Because of spring the cutter move upward and downward direction. Spring is assembled with the cutter.

F. Supporting frame:

The whole assembly is mounted on this frame. The complete frame is made up of mild steel. To give sufficient height to machine.

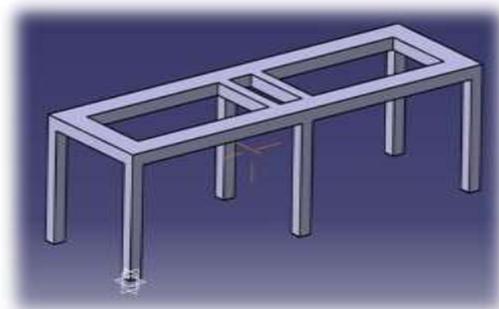
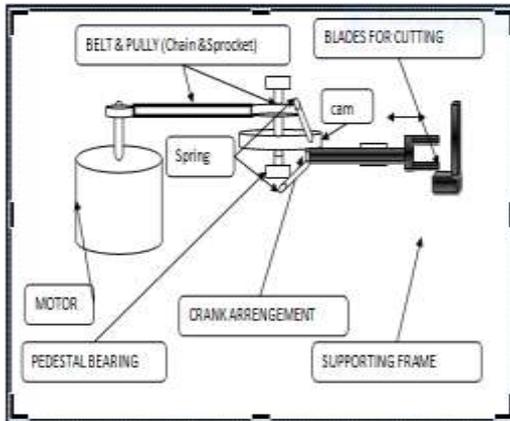


Fig – 3: Supporting Frame

Block Diagram



◆ Construction & working of Sugar cane bud cutter:

Construction of the sugar cane eye cutter is simple. Electric motor is used in this sugar cane bud cutter. On the motor shaft pulley is attached & cam mechanism is attached other side and cutter is attached to the crank and then by using motor is generated reciprocating motion due to process the sugar cane bud is cut.

IV. DESIGN AND CALCULATION

Design is the creation of plan or convention for the construction of a system. Designing often necessitates the aesthetics, functional and economical dimensions of both the design object and design process. It may involve considerable research, modeling, interactive adjustments and redesign.

Speed and Power Calculations:

◆ Speed calculation:

The main objective of this project is to produce upto 3400-3600 buds from both the cutters. By considering one second for cutting stroke and one second for return stroke, both side cutters will get 1800 seconds of cutting stroke in an hour. Since the cutter and slider arm arrangements are connected to the crank, the rotation of the crank place a vital role. By considering that the crank will complete its one rotation in two seconds and for half rotation of the crank one bud can be produced. This can be achieved only if the crank speed is 30 rpm.

Speed of the motor (N_1) = 1440

rpm Speed of the crank (N_2) = 30

rpm

Gear ratio = $N_1/N_2 = 1440/30$

Gear ratio = 1:48

So in order to convert 1440 rpm of the motor into 30 rpm of crank, a gear reduction box of gear ratio 48:1 has to be used.

◆ Power calculation:

From the literature survey it is found that shear force required to cut the sugarcane is 529.74N for one blade, so the force required shearing the sugarcane by two blades is 1059.48N. For this force shaft diameter has to calculate. The stroke length of sliding arm is assumed to be 150mm. (All formulae and values are taken from design data hand

Stroke length of sliding arm By considering the force (F) = 1059.48N

$$F \times D = T \times \Theta$$

Where, F = Force to cut sugarcane in N.

D = Distance travelled by the sliding arm in mm.

T = torque in N-mm.

Θ = Angle between rotating crank and sliding arm in radians

FABRICATION OF DIFFERENT PARTS OF MACHINE:

Fabrication of frame

This consists of a upper frame and columns to connect to the frame.

Upper Frame

Part : Upper frame

Material : Mild steel ("L" Shape Angles)

the frame with the help of resting plate. Shaft is coupled with the gear reduction box and then is welded to the crank which provides required speed for the crank rotation.

Assembly of mechanism

The scotch and yoke mechanism consists of crank, sliding arm, yoke, pin and supporting plate. The pin is welded to the crank according to the dimensions and then yoke is fitted into the pin. After this sliders are welded to the yoke with the help of supporting plate.

◆ Assembly of sliding arm

Scooper is made up of medium carbon steel and is used to scoop out sugarcane buds when it is fed against it. The scooper is welded to the free end of the slider. When the slider reciprocates, the scooper removes the buds from the sugarcane. The diameter of scooper is 35mm, thickness is 2mm and length is 95mm. The main purpose of using a scooper is to avoid wastage of sugarcane during seed sowing. The scooper used is detachable and can be replaced when required.

V. CONCLUSION

The earlier described in the paper we given an option to bud cutting machine in the available market now, which is very cheap. Hence the cutting mechanism of buds of sugar cane made in simple in construction.

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