Design & Fabrication of Sugarcane Bud Chipper Machine

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Abstract

Sugarcane is an oldest crop known to man, a major crop of tropical and sub-tropical regions worldwide. Sugarcane is a glycophyte, sucrose storing member of tall growing perennial monocotyledonous grass. Across the world 70% sugar is manufactured from sugarcane. India is the second largest country in sugarcane production in the world, Sugarcane is a major source of raw material for sugar industries and other allied group of by-product industries. The economic importance of the crop is much more that signified by its share in gross cropped area.

Keywords: *Chipper Machine, Sugarcane, Fabrication, Sugarcane bud*

Introduction:

The world economy is currently dominated by technologies which rely on fossil energy and this will remain the case for much of the 21st century. Recognition of sugarcane as an important energy crop was recently heightened by the advent of large-scale sugarcane-based ethanol production from molasses and directly from cellulose. Sugarcane is one the most efficient crops in the world in converting solar energy into chemical energy. Sugar cane is the most efficient biofuel feedstock in commercial use today and sugar cane ethanol will contribute to reduce greenhouse gas up to 90% compared to conventional fuels. It is also being used as a feedstock for the next generation of advanced bio-fuels, such as bio-butanol and diesel and many other valuable by-products through sugarcane biotechnology (Yadav and Solomon, 2006; Solomon, 2011a). Apart from production of sugar and alcohol (biofuel), sugar industry provides raw material to more than 25 other industries. The important by- products of this industry are acetic acid, butanol, paper, plywood and industrial enzymes (Arencibia, 1998).

PROBLEM STATEMENT: In India, for conventional system of sugarcane cultivation, about 6 – 8 tones seed cane/hector is used as planting material, which comprises 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, handling and storage of seed cane and undergoes rapid deterioration thus reducing the viability of buds and subsequently their sprouting. Stalk sections, called “billets,” “setts,” or “seed pieces”— containing one or more buds— are usually planted in late summer, rooting and developing into a stand over winter. And these pieces of sugarcane is cut by blade manually by farmers, and there is more chances of accidents during the cutting of Sugarcane buds.

Fig: Conventional Sugarcane Planting

OBJECTIVE :

Sugarcane plays a major role in the economy of sugarcane growing areas and, hence, improving sugarcane production will greatly help in economic prosperity of the farmers and other stakeholders associated with sugarcane cultivation. In India, many sugar units have transformed themselves into Sugar-Agro industrial Complexes, producing a variety of chemicals and utility products from sugarcane, Sucrose content is the highly desirable trait in sugarcane as the worldwide demand for cost-effective bio-fuels is increasing.Sugarcanes' high efficiency in fixing CO2 into carbohydrates for conversion into biofuel has awakened the world's interest in the crop. One alternative to reduce the mass and improve the quality of seed cane would be to plant excised axillary 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. The left- over cane can be well utilized for preparing juice or sugar or jiggery. However, only the bud alone is required enough for cultivating sugarcane. Our machine design facilitates the cutting of bud alone from the sugarcane and saves time compared to that of manual and other cutting processes. Our machine makes use of combined operation of a motor connected to a rotating circular disc which is further connected to a shaft which facilitates the reciprocating motion of a perpendicular cutter over the sugarcane, thus facilitating smooth cutting of bud from sugarcane. This design aims at simplifying the bud removal process by making use of the above-mentioned machine which requires minimum human labor, less capital investment and saves time thus proving to be a profitable investment for every farmer.

SCOPE OF OUR PROJECT:

Income for Farmers Through Our Machine: Based on the case study that we performed during the time of developing this machine's design, we collected certain data related to the conventional sugarcane cultivation method and our method of cultivating sugarcane. In conventional method about 36000 whole sugarcane pieces are required to be planted for cultivating sugarcane in one acre of land. However, in our method only 36000 sugarcane buds are required for the same purpose and not whole piece of sugarcane. Therefore, the saved parts of sugarcane can be sold to vendors in market which acts as an added source of income for the farmer. It is estimated that the profit that can be earned through this way is about Rs 11,433. Here is the detailed calculation, Conventional method: 36,000 pieces of sugarcane is required for cultivation (One acre). 1 Ton=6,750 pieces Hence, 5.2 ton of Sugarcane pieces used (One acre). Our method: 36,000 buds used for cultivation (One acre). 36,000 buds= 1.5 ton Left out sugarcane pieces weight = 3.7 Tons 1 Ton sugarcane=Rs 3.090 Hence, 3.7x3090=Rs 11,433 This is the Profit that can be earned by the farmer.

METHODOLOGY

Sugarcane is vegetatively propagated for commercial cultivation. Different kinds of planting materials viz. cane setts: settlings and bud chips are used for raising sugarcane crop. Sugarcane Bud: Little portion of stem with one bud is known as bud chip. Bud chips are used to raise settlings in nursery. They were found to produce a good crop when transplanted in main field. The principal advantage of bud chips is substantial saving in seed material. Seed requirement is reduced to less than one ton per acre.

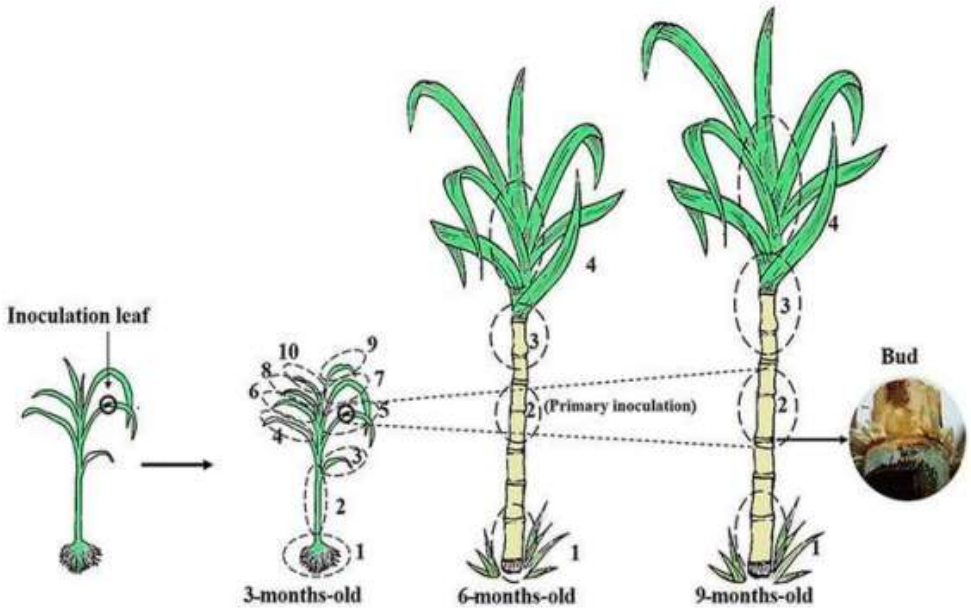


Fig:Stages of Sugarcane growth

Step 1 – Problem Definition A particular problem is taken into consideration and problem definition is prepared. Other parameters such as scope of work, objectives of work are also defined.

Step 2 –Selection of Mechanism The combination of force and movement defines power, and a mechanism manages power to achieve a desired set of forces and movement. A mechanism is usually a piece of a larger process, known as a mechanical system or machine.

Step 3 – Force Analysis An analysis yielding the respective forces acting at any point of any member, or part of a member, of a mechanism, obtained by using relationships for dynamic equilibrium in a plane rigid body subject to external forces within this plane and to internal forces due to its motion in this plane.

Step 4 – Material Selection Materials selection is an ordered process by which we can systematically and rapidly eliminate unsuitable materials and identify the one or a small number of materials which are the most suSelectio

Step 5 – Design of Machine Elements Design is essentially a decision-making process. If we have a problem, we need to design a solution. In other words, to design is to formulate a plan to satisfy a particular need and to create something with a physical reality.

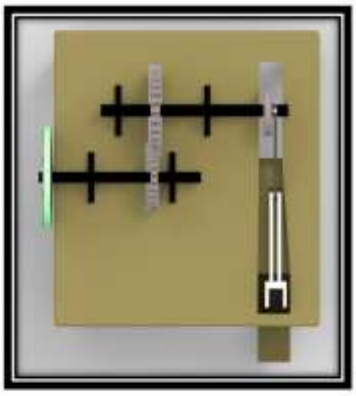
Step 6 – Parts Drawing Part drawings help define and illustrate specific mechanical requirements and processes. They are engineering drawings specifically for mechanical purposes. These technical drawings help communicate problems and solutions.

Step 7 – Manufacturing After finalizing the design and material, fabrication of model is done and various finishing operations are performed.

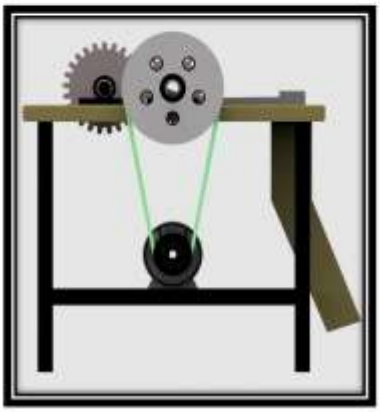
Step 8 – Testing Checking whether the machine is working properly and also test the functioning of all the components.

3D DRAWING & DRAFTING OF MODEL

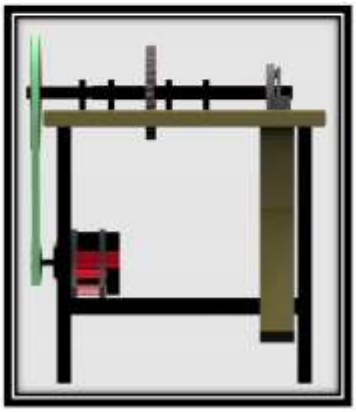
3D Model.



Top view



Side view



Front view

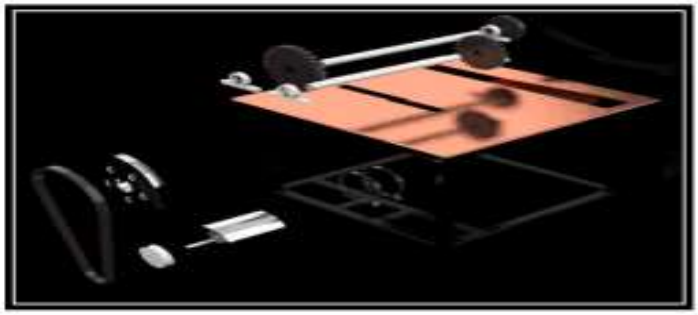


Fig.5 Exploded view of machine

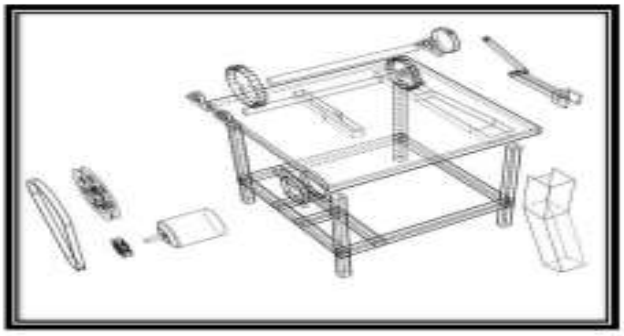


Fig.6 Isometric view

DESIGN OF SUGARCANE BUD CHIPPER MACHINE

Design consists of application of scientific principles, technical information and imagination for development of new or improvised machine or mechanism to perform a specific function with maximum economy & efficiency. Hence a careful design approach has to be adopted. The total design work has been split up into two parts:

1) System design

2) Mechanical Design

System design mainly concerns the various physical constraints and ergonomics, space requirements, arrangement of various components on main frame at system man + machine interactions, No. of controls, position of controls working environment of machine, chances of failure, safety measures to be provided, servicing aids, ease of maintenance, scope of improvement, weight of machine from ground level total weight of machine and a lot more. In mechanical design the components are listed down and stored on the basis of their procurement. Design in two categories namely, Designed Parts Parts to be purchased For designed parts detached design is done & distinctions thus obtained are compared to next highest dimensions which are readily available in market. This amplifies the assembly as well as postproduction servicing work. The various tolerances on the works are specified. The process charts are prepared and Passed on to the manufacturing stage. The parts which are to be purchased directly are selected from various catalogues & specified so that anybody can purchase the same from the retail shop with given specifications.

System Design: In system design we mainly concentrated on the following parameters: Selection Based on Physical Constraints: While selecting any machine it must be checked whether it is going to be used in a largescale industry or a small-scale industry. In our case it is to be used by a small-scale industry. So, space is a major constrain. The system is to be very compact so that it can be adjusted to corner of a room. The mechanical design has direct norms with the system design. Hence the foremost job is to control the physical parameters, so that the distinctions obtained after mechanical design can be well fitted into that. Arrangement of Various Components keeping into view the space restrictions the components should be laid such that their easy removal or servicing is possible. More over every component should be easily seen none should be hidden. Every possible space is utilized in component arrangements.

Components of System: As already stated, the system should be compact enough so that it can be accommodated at a corner of a room. All the moving parts should be well closed & compact. A compact system design gives a high weighted structure which is desired. Man-Machine Interaction: The friendliness of a machine with the operator that is operating is important criteria of design. It is the application of anatomical & psychological principles to solve problems arising from Man – Machine relationship. Following are some of the topics included in this section.

➢ Energy expenditure in foot & hand operation

➢ Lighting condition of machine

Approx Cost of product :

Table No. 1 Cost Estimation

Components	Material used	Unit price	Quantity	Total price
Motor	--	3200	1	3200
Gear pair	Stainless steel	1150	1	1150
Pulley	--	200	2	400
Belt	Leather	350	1	350
Shaft	Mild steel	450	--	450
Cutter	High carbon steel	750	1	750
Slider mechanism	Mild steel	250	1	250
Nut & Bolt	Mild steel	--	--	70
Pedestal bearing	Cast iron	80	4	320
Total price				7290

FUTURE SCOPE

1. In current situation we have to feed the sugarcane bud manually to the machine and it may lead to accident sometimes, hence to avoid such type of accident automatic feeding of sugarcane bud can be possible by using some automation.

2. We can also use the different types of mechanisms to operate the cutter of sugarcane bud chipper machine.

3. By certain modification the bud collection can be automated to collect and store the buds from machine.

CONCLUSION

In rural areas people faced issues like wastage of sugarcane human effort required, fatigue to operator. So, we introduce motor operated sugarcane bud chipper machine. All these problems are being eliminated and this machine can be successfully implemented for the increase in the production rate of the bud, time required for cutting each bud will be reduced. Also, sugarcane wastage is reduced because of proper installation of clamping to hold the Sugarcane. By providing high profits at low investment and also by simplifying bud removal process along with minimizing labor requirement, our machine proves to be highly profitable investment for farmers and breakthrough in farming technology.

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