Design and Development of Sugarcane Bud Chipping Machine

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ABSTRACT

In today's world, sugarcane accounts for 80% of sugar produced worldwide. The sugarcane industries just borrow the sugarcane stalks as a whole from the farmers who actually grows it and is further processed in a conventional sugar processing machine without actually separating the planting material it's known as Bud (which acts as a seed), thus wasting it by crushing it or maybe in some other ways. What we actually intend to do is to solve the above-mentioned problems by creating an Automated machine which will be employed to separate the bud and the furrow part of the sugarcane so that they can be used in future for sugar processing and obtaining the planting material. These bud chips are less bulky, easily transportable and more economical seed material. The left-over cane can be well utilized for preparing juice or sugar or jaggary. In sugarcane inter node cutting operation, sugarcane is cut at its nodal part in small pieces and bud is separated from the sugarcane for seedling purpose. The existing (traditional) tools used for bud cutting of sugar cane are unsafe, messy and need skill and training. The risk of injury is also too high this necessitates the development of a bud cutting machine for sugar cane. The specially designed blades are prototyped using stainless steel Material attached to the hub. Hub is mounted to the shaft which is driven by the worm gear through chain drive. The bud chip technology holds great promise in rapid multiplication of new cane varieties.

Keyword: - *Sugarcane , bud, bud cutting machine, and rapid multiplication.*

1. 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. There are number of crops grown by farmers, 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, jaggery. It is also used for chewing and extraction of juice for beverage purpose. In addition to being the third most important cash crop in India, sugarcane ranks third in the list of most-cultivated crops, coming after paddy and wheat. India is one of the largest sugarcane producers in the world, producing around 300 million tons of cane per annum. The production of sugar is the second largest agro-processing industry in the country, after cotton and textiles. India has more than 566 sugar mills. About 4 million sugarcane farmers and a large number of agricultural labourers are involved in sugarcane cultivation and auxiliary activities, constituting 7.5% of the rural labour force. In addition, the industry provides employment to 500,000 skilled and semi-skilled workers in rural areas. There are several methods for sugarcane bud chipping. It is by manually, and also by the use of machines. Manual bud chip cutting with hand knife is a common practice. These traditional tools used for bud chipping of sugar cane are unsafe, messy, minimum productive and need skill and training. The risk of injury is also too high. This necessitates the development of an

automated sugarcane bud chipping machine. The device, called sugarcane bud chipper, is consists of specially designed blade with a quadrant edge to surgically cut out the buds in a high impact operation, with clean finish and practically no damage to the cane.

The study of sugarcane cultivation shows that there is need of sugarcane seeds which is cultivated by sugarcane bud. Using sugarcane bud chipper the buds can be separated. The device includes a hemispheric knife actuated by a hand operated lever. One needs to place the cane on the platform and press the hand lever. After every stroke the cane needs to be rotated by 180 degrees by the other hand, the chipped buds can be shown directly in the field or may be grown in nurseries. A worker can extract an average of 150 to 200 seeds of buds per hour with a bud chipper machine, which will not meet the requirement of buds for nursery in short period of time. Also, problem arises when the worker need to work with the bud chipper continuously to extract buds, which leads to fatigue in his body. This may result in decrease in quantities of bud's extraction at the end of the day. Since this is seasonal work the availability of labor having skills is very difficult. Considering all the factors it is not possible to meet the requirement of buds for nursery later to forward them as seeds to grow in field. Hence this methodology is not providing proper facility for the development of nursery.

1.1 LITERATURE REVIEW

1. Prakash Killedar et al. [1] describes about sugarcane node and cutting machine. Sugarcane is one of the important crops in India and many other countries. The sugarcane industry remains the main pillar of Indian economy. The sugarcane mode cutting machine is developed for the cutting the node of sugarcane from sugarcane.

2. Krishna Prasad et al. [2] says that in today's world, sugarcane accounts for 80% of sugar produced worldwide. The sugarcane industries just borrow the sugarcane stalks as a whole from the farmers who actually grows it and is further processed in a conventional sugar processing machine without actually separating the planting material it's known as Bud (which acts as a seed), thus wasting it by crushing it or maybe in some other ways.

3. N. Dileepan et al. [3] project helps to design and fabricate small scale sugarcane cutting machine for sugarcane harvesting to reduce farmers effort and to increase production of agricultural goods. Compared to manual harvesting this machine has a capacity to cut canes in faster rate.

R. Abarna et al. [4] explains about sugarcane bud removal machine with advancements. While marketing and promoting the sugarcane farming, many drudgeries related issues have remained unaddressed.

1.2 PROBLEM STATEMENT

The old method of cutting node of sugarcane, i.e., by hand is more time consuming. There are many sugarcane cutting machines are available in market, but they are made by using pneumatic, hydraulic or electrical power. Costs of these machines are also more. This cost is not economical for small and medium range farmers. Remaining sugarcane is used for feeding for animals like cows.

1.3 OBJECTIVE

To avoid wastage of sugarcane. Cost efficient for farmer and small laboratory. Avoid use of external power like electric power. Avoid use of compressor and electricity used in pneumatic or electric sugarcane machine. To reduce the human effort to cut the buds from the sugar cane for sowing purpose.

1.4 SCOPE

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1.5 METHODOLOGY

Step 1:- We started the work of this project with literature survey. We gathered many research papers which are relevant to this topic. After going through these papers, we learnt about sugarcane bud chipping machine.

Step 2:- After that the components which are required for our project are decided.

Step 3:- After deciding the components, the 3 D model and drafting will be done with the help of CATIA software.
Step 4:- The components will be manufactured and then assembled together.

Step 5:- The experimental observations will be taken; calculations will be done and then the result will be concluded.

2. RESEARCH WORK

2.1 DESIGN WORK

For Spring-

Outer diameter of the spring D0= 48mm
As per design data book for cold drawn wire steel wire diameter d = 6 mm,
Inner diameter of spring,
Di = 48-12 = 36 mm
Calculating the load bearing capacity of spring for any service life,

Spring index C= Do/d = 48/6 =8

C = 8
Then Wahl factor of spring,
K= (4C-1)/(4C-4) +0.615/C
For C =8
K= 1.18
Now to Find load holding by spring P,
P = 618:47N
Thus, spring hold the load of 708.54 N remaining load is absorbed by magnet.
Deflection of spring (δ) can calculate by,
δ = (8PD3N) =(Gd4)
δ = 56:04mm
Spring rate = P= = 11N-mm
Spring stiffness = K = 11N-mm:
Number of turns = N = 17
As spring has square and ground ends number of Inactive turns = 2
Total number of turns, N = 17
Free length of spring,
Lf = solid length + deflection + axial gap
= 55 + 56 + 0.15(56)
= 55 + 56 + 0.15(56)
Lf = 120mm:
Pitch of spring = Lf=N
Pitch of spring = 13.33mm

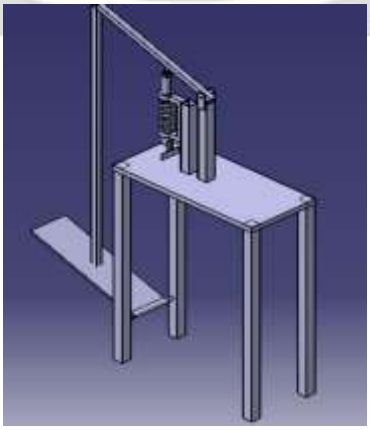

Fig-1: Catia Model

2.2 ANALYSIS

	A	B	C
1	Property	Value	Unit
2	Material Field Variables	Table	
3	Density	7850	kg m^-3
4	Isotropic Secant Coefficient of Thermal Expansion		
5	Coefficient of Thermal Expansion	1.2E-05	C^-1
6	Isotropic Elasticity		
7	Derive from	Young's Modulus an...	
8	Young's Modulus	2E+11	Pa
9	Poisson's Ratio	0.3	
10	Bulk Modulus	1.6667E+11	Pa
11	Shear Modulus	7.6923E+10	Pa

Fig-2: Geometry

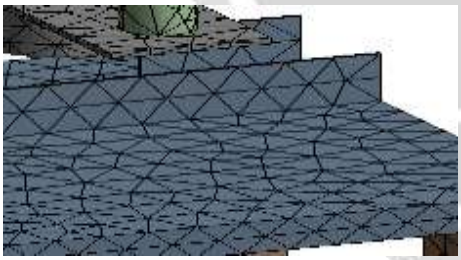

Fig-3: Meshing

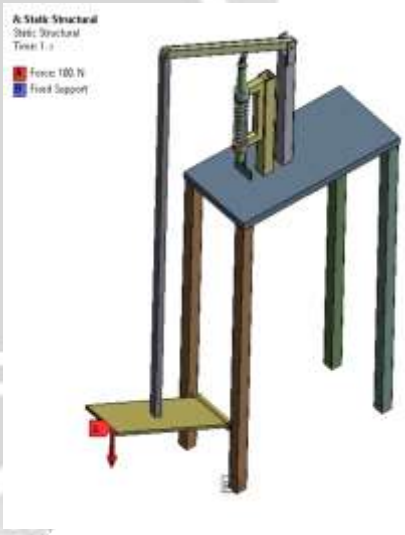

Fig -4: Boundary Condition

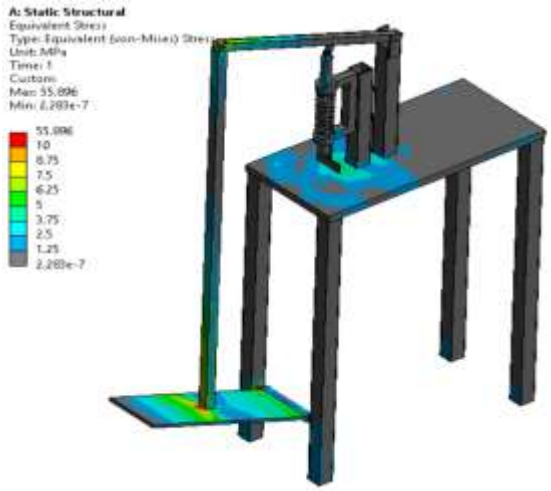

Fig-5- Result- Equivalent stress

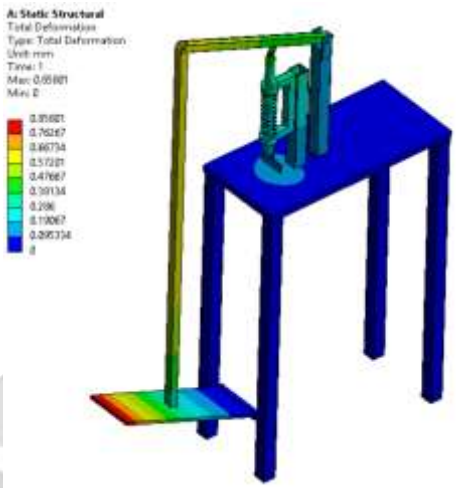

Fig-6: Result- Total deformation

3. FABRICATION OF SUGARCANE BUD CHIPPING MACHINE

1 CUTTING:

Cutting is done so that we get the required components for building our project of required sizes. Cutting operation is done to obtain the parts of our machine.

2 WELDING:

Welding operation is done to join the different parts of our machine. The time taken for this operation is 120mins. It helps in getting strong joints.

3 DRILLING:

Drilling is done to make holes at required spaces and of required sizes so that we can screw the parts which need to be dismantled constantly and we don't need a permanent joint between two parts.

4 FINISHING:

Finishing is done so that the rough edges and other rough parts of the machine can be smoothed for better efficiency of the machine.

5 POLISHING:

It is done to achieve smooth and shiny surface by rubbing it using a chemical action.

4. RESULTS

1. We have got maximum equivalent (Von- Mises) stress of 55.896 MPa.

2. We have max total deformation as 0.85801mm, so it is within acceptablr range.

5. CONCLUSION

- We have successfully reduced the wastage of sugarcane by separating the bud from the cane so that no separate batch is kept just for plantation purpose.
- No need for external power as the process can be done manually.
- Human effort is reduced as the body weight is used as opposed to using only hand strength.

6. REFERENCES

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