DESIGN AND FABRICATION OF SUGARCANE HARVESTING MACHINE

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Abstract: This project is focused on the development of sugarcane harvesting machines. Now a days there is a need of fast production of agriculture products. 75% of Indian economy is based on agriculture. So, development of the agriculture field is considered as development of India. But now a days because of the industrialization, shortage of labour found in agriculture field. Day by day labour demands and their salary also increased. This project is a small work towards analysing sugarcane harvester machine aspects for economical harvesting which will help to minimize the working fatigue and to reduce labour cost. Today's world there is a heavy demand for sugar and its by-products. The major states growing sugarcane are Maharashtra, Uttar Pradesh and Karnataka. Now India is the leading producer of sugarcane in the world.

This paper aims to reduce labour as well as formers effort and to increase the output of agriculture products. If compare to other harvesting machines, this machine can cut the two-side from the lower and upper portion of the sugarcane with reasonable cost. Middle class formers are not able to buy a high cost machines. Hence, we are reducing the cost and size of the machine and reduce the effort on formers.

Index Terms – Design and fabrication of sugarcane harvesting machine**,** Low cost sugarcane cutting machine, fabrication of sugarcane harvesting machine.

I. INTRODUCTION

Sugarcane is harvested by mechanical harvester which moves along the rows of cane removing the leafy tops of the cane and cutting the stalk into short pieces or "billets". Billets are loaded into bins which are towed alongside the harvester. When full, the bins are taken by road or tramway to the sugar mill. The field capacity of mechanical cane harvesters varies with the size 2.5 to 4 ha per day of 8 hours. Harvesting is done based on maturity group. Farmers who grow a particular variety are usually conversant with the harvesting time. Even most sugar factories give cutting orders to formers based on crop age. This is not a scientific method since, planting time, crop management practice, weather conditions etc influences the maturity.

Sugarcane is an oldest crop known to man, it requires maximum number of labours, more time consuming and it also requires more money. In sugarcane harvesting process we face a lot of problems and those problems are difficult to solve manually. So, that this machine helps to reduce the effort on former, reduce the consuming of time, and also reduce the cost of labour. The design of this sugarcane harvesting machine is very simple and no skilled workers are needed to operate this machine.

II. LITERATURE REVIEW

Dr. Sharad S. Chaudhari [1] There project aimed at designing and fabricating small scale sugarcane harvester for sugarcane harvesting to reduce farmer's effort and to increase production of agricultural products. Machine consists of petrol engine and different mechanisms. When compare to manual harvesting by using this machine has capacity to cut canes in faster rate and it is economical. The machine is helpful for bot.

Prof. N.M. Pachkhand [2] in today's world there is a need for faster rate of production of agricultural products. Agriculture is the backbone of India. In India almost all farmers facing problems of labour shortage. Day by day labour wages are increasing and in the same way demand of agriculture products are also increasing and today's world need faster rate of production of agriculture products. This project aims to design and fabricate small scale sugarcane harvesting machine to reduce farmer's effort and to increase production of agricultural products. This machine consists of petrol engine with different mechanisms. When compared to manual harvesting this machine has a capacity to cut canes in faster rate and it is economical

Samaila [3] Sugarcane harvesting is a labour concentrated operation and its mechanization is a modern development in Nigeria. The difficulties in providing the needed spare parts for the imported harvesting machines and labour shortages during harvesting periods hamper the country's drive towards self-reliance in sugar production. To develop an effective and efficient machine for harvesting of sugarcane, a preliminary data on the energy requirement for the cutting and topping of sugarcane must be available for that a simple apparatus was developed to calculate the energy requirement for cutting and topping of sugarcane.

III. DESIGN OF MACHINE

Design of shaft:

For designing cutter shaft we are considering the 0.5 H.P electric motor A.C supply and speed is 2800 rpm so , calculating the design of shaft as follows.

$$P = 2 \times 3.14 \times N \times T / 60$$

$$= 2 \times 3.14 \times 2800 \times T / 60$$

$$T = 60 \times P / 2 \times 3.14 \times 2800$$

$$= 60 \times 0.373 / 2 \times 3.14 \times 2800$$

(P = 0.5 H.P = 0.373 KW)

$$T = 1.27 \text{ N- m}$$

Where,

P = Power of motor in KW

T = Torque in N-m

N = Speed of motor in rpm

So, considering the material of bar is bright rod, Therefore

Syt = 300 N/mm^2 and F.O.S = 2.5

$$fs = 0.5 \times syt / F.O.S$$

$$fs = 0.5 \times 300 / 2.5$$

$$= 60 \text{ N/mm}^2$$

Where,

fs = Shear stress in N/mm^2

Syt = Yield strength in N/mm^2

F.O.S = Factor of safety

So, to find the diameter of cutter shaft as follows

$$T = pi /16 \times fs \times (d^3)$$

$$= 3.14 /16 \times 60 \times (d^3)$$

$$d^3 = 16 \times T / 3.14 \times 60$$

$$= 16 \times 1.27 \times 10 ^3 / 3.14 \times 60$$

$$= 107.8 \text{ mm}$$

$$d^3 = 10.78 \text{ cm}$$

$$d = 2.20 \text{ cm}$$

The diameter of cutter shaft is 2.20 cm

$$T = pi /16 \times fs \times (d^3) \times (1- K^4)$$

$$(1-K^4) = T \times 16 / 3.14 \times fs \times (d^3)$$

$$= 1.27 \times 10^3 \times 16 / 3.14 \times 60 \times (2.20^3)$$

$$K = 0.30$$

$$K = (Di/Do)$$

$$= (22/Do)$$

Do = 70mm = 7cm

Where,

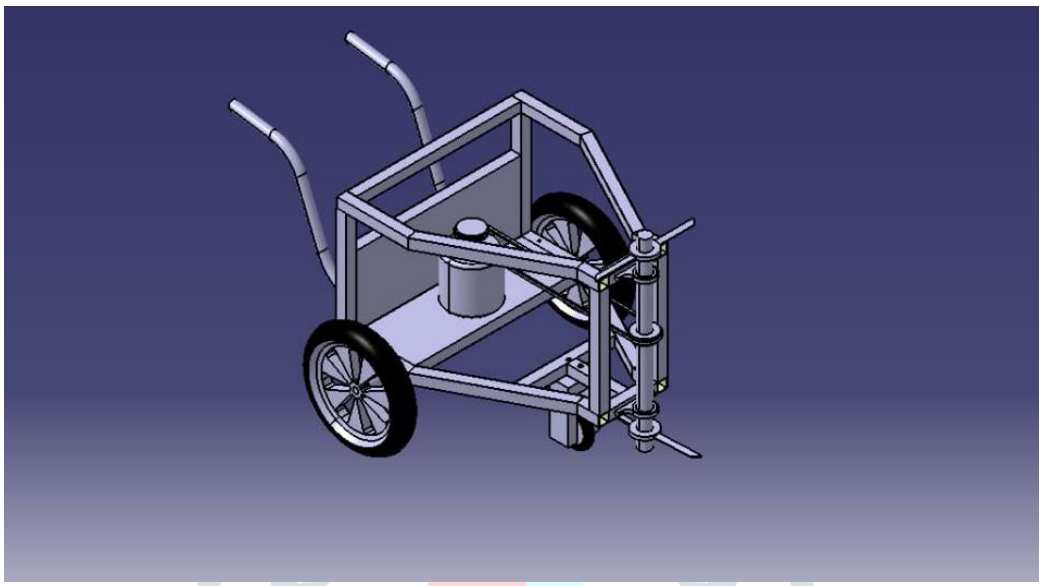
Di = inner diameter of pulley in mm

Do = outer diameter of pulley in mm

IV. CONCEPTUAL CAD MODEL

Development in agriculture is the need for huge agricultural based economies like India. So, it is important to develop the automation in agriculture field.

Fig .1 Basic cad model of sugarcane harvesting machine



This sugarcane harvesting machine is mainly used for cutting the leafs and as well as sugarcane stalks. It consists of a frame, motor, shafts, blades, wheels, the frame is used to mount the motor, batteries and other accessories and it is driven by wheels. Motor is connected to the shaft through the belt drive, when the motor rotates the shaft rotated in given directions with the help of belt. Shaft consists of two blades one is mounted on top of the shaft to cut the leafs and another one is mounted on the bottom of the shaft to cut the sugarcane stalks. These two blades are rotated in the given direction. The blades which are mounted on shafts is adjustable so, we can adjust the blades in a required positions to cut leafs and stalks. When we given the power supply to the motor the motor rotates and due to the connection between the motor and shaft the shaft will rotate. When this shaft rotates the two blades which are mounted on the shafts will also rotated in same direction. When these blades are rotated large force will exert on the sugarcane stalks. This force helps to cut the sugarcane stalks efficiently. By using this machine cutting of sugarcane stalks easily with reduced cost, reduced time, decrease the labour cost, and decrease the effort on former. It gives the production rate of nearly half acre per hour.

V. CONCLUSION

This design permits to have a capacity to cut sugarcane stalks approximately half acre/ hr .Comparing with manual sugarcane harvesting half of the harvesting time and labour cost is reduced. Compared to manual harvesting process it gives best results with a short harvest time.

Table 1. List of the components with costs

NAME	DIMENSIONS	QUANTITY	COST
Wheels	10cm and 20cm	4	1600/-
Rod	155cm,2.25cm	1	300/-
Frame	70.2cm × 90.7cm × 20cm	1	4000/-
Blade		2	800/-
Motor	0.5 H.P, 2800 rpm	1	2700/-
Nut and bolts	M12	10	150/-
Pulley	2.2cm and 7cm	2	350/-
Belt		1	150/-

Total cost INR = 10,050 /-, this range of cost is very best suitable for middle class formers. When comparing with the large scale, though the harvesting time and energy consumption is less in large scale, but the cost of machine is very high around 20 million rupees middle class formers are not able to invest that much amount on harvesting so that we reduced the cost of the small scale machine is Rs.10,050 /- So it will be helpful to our farmer. By comparing with manual harvesting, rs.10,050 /- for an acre can be saved by small scale harvesting machine. So very less time is needed to return one's investment

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