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Design and Modification of Sugarcane Plantation Machine

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ABSTRACT

In ordinary days the plantation of sugarcane is done through manpower that is very complicated and time taking. This problem is short out by using of Sugarcane Planter. The principle of Sugarcane Planter machine is to convert rotary motion of the power wheel into the reciprocating motion of cutter. Cutter is used to cut the sugarcane into predecided size and there is ridger plough mounted over the machine for creating furrow in field. The sugarcanes fill in that furrows. There is also soil covering plate is provided which is used cover the sugarcane in the furrows through the soil. It is a multifunctional machine we can spray fertilizer, fungicide and insecticide with help of sprayer tank. There is tank with the spraying nozzles to perform these operations.

Keywords: Cutter, Furrow, Ridger, Sprayer tank, Sugarcane planter

I. INTRODUCTION

India has agriculture based economy and more than 50% of population depends on agriculture works. India is the second top most country of the world. The production rate is 361037000(Metric Ton) [1]. The plantation of sugarcane is varies with the environment condition and soil quality.

The fig.1 shows the sugarcane production rate in India at different states. In this map, dark brown colour states are highest sugar producing states which are Uttar Pradesh, Maharashtra, Odisha (500-1500 Lakh metric ton according to survey of FARMAR'S PORTAL of government of India. Medium brown colour states are medium sugar producing states which are Bihar, Gujarat, Andhra Pradesh, Karnataka, and Tamil Nadu (100-500 lakh metric tons). Light brown colour represents the lower sugar producing states which are Punjab, Haryana, and Madhya Pradesh (below 100 lakh metric tons) [2].

These data shows that the high rate of sugar cane production in India. So we have design the Sugarcane Planter machine. We use some levers, shafts, wheel, bearing, covering plate, plough and fertilizer tank.

Lever is a mechanical link which is used to connect two parts of machine and transfer the force from one part to another part of machine. Shaft is a rotating part of the machine and also supports the whole machine. Wheels are used to move the whole machine and transmit the power to the cutting blade. Bearings are used to hold the shaft and provide smooth rotation [3].

These are some machines are used to sugarcane plantation such as Tractor Operated Pit Digger for Sugar Cane Planting, Sugarcane Sett Cutter, Sugarcane Detrasher. These are run through power take-off of tractor that increase load on engine and consume much amount of fuel and pollute the environment.

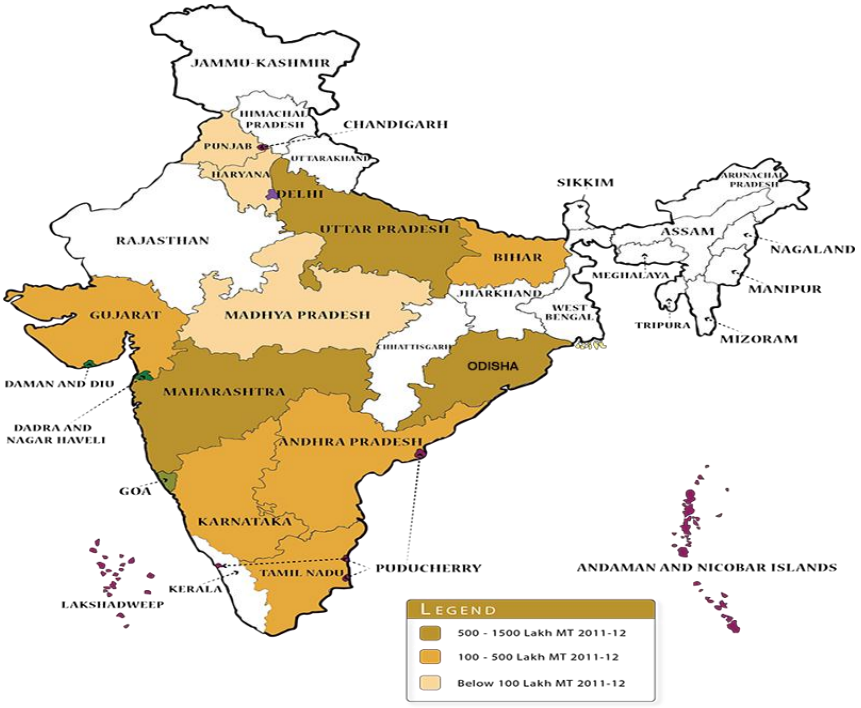

Figure 1.Sugarcane production in India.

Our machine is a mechanical sugarcane planter machine which facilitates the five operations at a time without using power take-off. The power obtained from the rotation of the wheel to cut the sugarcane.

The traditional method of sugarcane planting is very time consuming process. The sugarcane sets are placed manually and then covered by animal operated plough or manually. Conventional methods require more men power. Some tractor operated planters are available in market but they need the power take-off.

Our machine is a mechanical sugarcane planter machine which facilitates the five operations at a time without using power take-off. It makes two furrows at a time, cut the cane into sets and placed in furrows, apply fertilizer, insecticide and fungicide and cover the furrows. It is less costly, less time consuming and provide uniformity.

Sugarcanes which are planted through this machine will used in production of sugar, brown sugar and sugarcane juice. These products plays very important role in daily life of human beings. All sweets generally use sugar for its sweetness. So the requirements of sugar are high. The planted sugarcanes send to the sugar mills through the wagons and trucks. After then juice of sugarcane suck from it. This juice further move for the production process.

II.LITERATURE REVIEW

Umesh S. Patkar et al., (2007), the planter feeds nearly the same length of the cane as the distance traveled by the tractor and is independent of the speed of power take-off. The planting interval of the canes is uniform all along the cane planting length [4].

S. Mandal and P. Maji (2008), the sugarcane planted with the 2-row Tractor mounted Sugarcane Cutter Planter were free of any damage of buds. Sugarcane growers of India will found this unit acceptable. This kind of equipment reduces the cost of operation, impart consistency, better utilization of resources, quality work performance resulting in better production and productivity [5].

Vahid Jamadar et al., (2017), this design permits to have a capacity to cut approximately half acres of sugarcane cultivated land/hr. 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 [6].

III.METHODOLOGY

3.1. *Driving mode*

In sugarcane planter machine the wheel is provided to move that machine and also driving the cutting blade which cut the sugarcane and these move with the movement of the tractor also we can move the machine manually by manpower and buffalos.

3.2. *Crank slider mechanism*

Slider crank mechanism is used to convert the rotary motion into the reciprocating motion. The machine driving wheel is connected to the crank through the rotating shaft and a connecting rod is connected to the crank and cutting blades. The small end of connecting rod to the cutting blade and big end is connected to the crank [7].

3.3. Ridger furrow

Ridger furrow is a simple arrangement of two plates which is separated through some angle. This part is in some depth at field and create furrow. The upper side of soil that looks like triangular dome which is called ridge and depth which created through ridger furrow is called furrow. Sugarcane placed in that furrows and soil covering plate covers the furrows [8].

3.4. Covering plate

Covering plate is a simple arrangement of two plates which is separated through some angle. The angle is opposite to the ridger furrow. When the sugarcane placed in furrow which is created by ridger furrow will cover through the soil of ridge by the covering plate.

3.5. Sprayer tank

This sprayer tank mounted over the machine. Sprayer tank used to spray the fertilizer, fungicide and insecticide in the furrows. It connected with the nozzles through the pipes. The tank is filled with fertilizer or fungicide, insecticide and spray through the nozzle and fertilizer comes through the tank with the help of pipe.

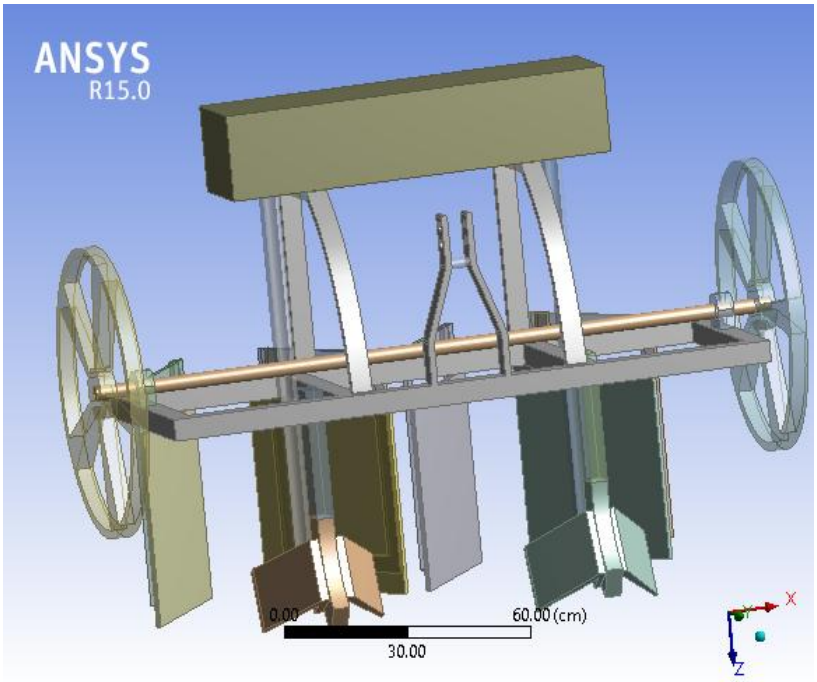

Figure 2. ANSYS design of sugarcane planter

This project design done on the ANSYS R15.0 in design modular and structural steel used as a material and the colours of the part taken through itself ANSYS R15.0 design modular.

3.6. Working

Sugarcane planter is connected through the tractor. The wheel of sugarcane planter move with the movement of the tractor wheels. That movement of sugarcane planter wheel is further transfer to the crank with the help of shaft. By this rotation of wheel crank is also move this rotation of crank will converted into reciprocating motion of cutting blades by means of connecting rod. Ridger ploughs of the machine in some depth of field

and create ridge and furrow with movement of machine. Covering plate is mounted just behind the ridger plough that covers the furrow by the soil of ridge. The furrow is filled by the sugarcane which is cut through the cutting blades. There is sprayer tank also provided that is filled by either fertilizer or fungicide, insecticide that spray through the nozzle by gravitation.

Figure 3. Project during manufacturing

The sugarcane planter during manufacturing shown in the above fig.3. In this figure, ridger plough and soil covering plates are assembled. Remaining works are connecting the wheels with the cutter and manufacture the spraying system of fertilizer and fungicide.

IV.CALCULATIONS

4.1: *Specifications*-

S.No.	Name	Symbol	Data (cm)
1	Pitch of furrow	P_f	65
2	Depth of furrow	D_f	30
3	Length of sugarcane	L_s	30
4	Spacing of sugarcane	S_s	10

5	Dia of wheel	D_w	60
6	Length of frame	L_f	60
7	Width of frame	W_f	150

Let us consider some terms related to the sugarcane planter machine they are:

Pitch of furrow = $P_{f,}$

Depth of furrow = D_f

Length of sugarcane = L_s,

Spacing of sugarcane = S_s,

Dia. of wheel = D_W

Pressure on ridger furrow = P_r

Pressure of covering plate = P_c,

Force of soil on ridger furrow = F_s,

Force of ridge soil on covering plate = F_r,

Area of ridger furrow plate = A_r,

Area of covering plate = A_c,

Torque on wheel = T_w

Mass of sugarcane = M_s,

Acceleration of cutting blade = A_b,

Cutting force of blade = $F_{b,}$

4.2 pressure on ridger furrow

$$P_r = \frac{Force\ of\ soil\ on\ ridger\ furrow\ (F_s)}{Area\ of\ ridger\ furrow\ (A_r)}$$

4.3 Pressure on covering plate

$$P_c = \frac{Force\ of\ ridge\ soil\ on\ covering\ plate\ (F_r)}{Area\ of\ covering\ plate\ (A_c)}$$

4.4 Torque on wheel

$$T_s = \frac{2\times\pi\times N}{60}$$

Where N= number of rotation of wheel

4.5 Cutting force

$$F_b = mass\ of\ sugarcane\ (M_s) \times Acceleration\ of\ cutting\ blade\ (A_b)$$

V.RESULT AND DISCUSSION

As a result of this paper on comparing this sugarcane planter to other sugarcane plantation machine it does not increase the load on tractor's engine and fuel consumption is not too much increasing as compare to others. It is clear that this machine is much efficient and multifunctional machine. It can use for sugarcane plantation as well as fertilizer spraying in now days. This machine is suitable for ridge and furrow method of planting which is very popular in India.

VI. CONCLUSIONS

We conclude that by this paper these are most machines are used to sugarcane plantation which are Tractor Operated Pit Digger for Sugar Cane Planting, Sugarcane Sett Cutter, and Sugarcane Detrasher. They take power from PTO of tractor this will increase load on engine and consumption of fuel. That will cause of environment pollution. This machine is a mechanical sugarcane planter machine which provides the five operations. These are creating furrow, cutting of sugarcanes, filling in furrow, spraying fertilizer, fungicide and covering the furrow. The power obtained from the rotation of the wheel to cut the sugarcane. The traditional method of sugarcane planting is very time consuming process. The sugarcane setts are placed manually and then covered by animal operated plough or manually. Conventional methods require more men power. Our machine is a mechanical sugarcane planter machine which facilitates the five operations at a time without using PTO power. It makes two furrows at a time, cut the cane into sets and placed in furrows, apply fertilizer, insecticide and fungicide and cover the furrows. It is less costly, less time consuming and provide uniformity. Sugarcanes which are planted through this machine will used in production of sugar, brown sugar and sugarcane juice. These products plays very important role in daily life of human beings. All sweets generally use sugar for its sweetness. So the requirements of sugar are high.

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