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SMALL SCALE SUGARCANE HARVESTER

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Abstract: Sugarcane is the major component for the production of sugar and ethanol. Ethanol is the predominant fuel in certain countries like Brazil. Hence production of sugarcane stands the most important and competing. Sugarcane grows between the regions 22^0N and 22^0S. The moderate temperature with adequate rainfall improves the cultivation of sugarcane. As far as India is concerned, India is the second leading producer of sugarcane. The tropic temperature in India well suits the sugarcane cultivation

In populous country as India, there could not be alone mass production and small scale farming plays a vital role. The technology has leaped far ahead in a century. Meanwhile it imposes a major threat of high cost for implementation. This hinders the small scale intensive farmers from implementing and hiring the agricultural machineries.

Sugarcane harvesting is a bit difficult and complicated task. It is mostly performed manually or at least in India where small scale cropping lies dominant. Manual harvesting of canes is less efficient and more time consuming on taking into account the fatigue factors of the manual workers. The existing sugarcane harvester comes in the robust structures of tractor and trucks, which prove efficient, though is not affordable by most farmers.

The main motive of the project is to reduce the structure to the most compact structure as possible and to minimize the cost of the existing machine to the great extent as possible. In the first attempt, complete automation at the minimal cost is cumbersome. But the manual efforts could be reduced to the possible extent.

INTRODUCTION

AGRI MACHINERIES

Agricultural technology refers to technology for the production of machines used on a farm to help with farming. Agricultural machines have been designed for practically every stage of the agricultural process. They include machines for tilling the soil, planting seeds, irrigating the land, cultivating crops, protecting them from pests and weeds, harvesting, threshing grain, livestock feeding, and sorting and packaging the products.

TYPES OF MACHINERY

Tillage implements prepare the soil for planting by loosening the soil and killing weeds or competing plants. The best-known is the plow, the ancient implement that was upgraded in 1838 by a man named John Deere. Plows are actually used less frequently in the United States today, with offset disks used instead to turn over the soil and chisels used to gain the depth needed to retain moisture.

The most common type of seeder, called a **planter**, spaces seeds out equally in long rows that are usually two to three feet apart. Some crops are planted by drills, which put out much more seed in rows less than a foot apart, blanketing the field with crops. Transplanters fully or partially automate the task of transplanting seedlings to the field.

There are machineries for the purpose of **irrigation** like pumps, motors etc.

For healthy crops cultivation, the weeds need to be either killed or rooted off. The machineries for spraying pesticides and insecticides to demolish weeds and unwanted microorganisms fall under the category **sprayers**.

The technology has advanced multi folds. Far later, machines for harvesting the crops were developed. They are called the **harvesters**.

LIST OF AGRI-MACHINERIES

SOIL CULTIVATION

- Cultivator
- Culti-packer
- Chisel plow
- Harrow
- Plow or plough

FERTILIZING AND PEST CONTROL

- Dry manure spreader
- Liquid manure spreader
- Spreader

IRRIGATION

- Drip Irrigation
- Centre pivot irrigation
- Sprinkler system
- Hydroponics

HARVESTER

- Rice harvester
- Carrot harvester
- Bean harvester
- Sugarcane harvester
- Corn harvester

SUGARCANE HARVESTER: AN INTRODUCTION

Harvesting machines are developed for different crops as different crops are not alike. Sugarcane harvesting is always a difficult and complicated task as the dense crops stands up to the height of an average man.

The machine designed specifically for the purpose of harvesting the matured canes is called the sugarcane harvester.

Fig1. Sugarcane harvester

The existing sugarcane harvester comes in gigantic tractor structure. It is obvious; it is inaccessible and unaffordable by small and medium farmers due to the high cost and less profit. Hence as engineers, it is our prime duty to reduce the complicated mechanisms and minimize the set up to the possible extent so that all kind of people could enjoy the benefits of technology.

BODY OF ARTICLE

AGRI MACHINERIES AND SMALL SCALE FARMING

As already mentioned in this article, agri-machineries are unaffordable by the small scale farmers. Due to the following reasons, small scale farmers could not afford agri-machineries:

- Economically infeasible.
- Higher 'rate of return' period.
- Lesser Awareness of the advancement of technology.

ECONOMICAL FEASIBILITY: Cost plays a dominant role as far as farming is concerned in populous country as India. In such countries, the nature of economy is such that, the income is not uniformly distributed

all over the nation. In such cases, people would definitely consider cost as a major factor to buy the equipments. Large yield producers have no much concern about the cost and the machineries are easily accessible but this is not the case with smaller yield producers.

RATE OF RETURN: It is the defined as the time period in which, the investor is expected to take back the invested amount. If the yield of the cultivation is higher, then certainly the rate of return of the tractor sugarcane harvester could be two to three years. When the input is considerably lesser, the rate of return could be ten years or more. Hence, small scale cultivators do not go for agri-machineries.

AWARENESS OF TECHNOLOGICAL ADVANCEMENT: In most cases, small scale farmers are less aware of the developments in technology and hence mostly machineries are left unnoticed or unknown.

SMALL SCALE SUGARCANE HARVESTER:

We have developed a sugarcane harvester, concerning about the small scale farmers. The machine has reduced set up and has been made compact with weight reduced to greater extent.

Fig2. Small scale sugarcane harvester

The figure shows the small scale sugarcane harvester, that we have developed.
The machine has the following components:

- Hand gripper
- Mud-wheel
- Frame
- Rubber tyre
- Rotary cutter
- Electric battery(12V, 10A)
- DC Invento motor(12V, 7A)
- DC motor (12V, 5A) – 3 no.

FRAME

The frame lays the foundation upon which the whole set up rests. It is made of hollow rod of square cross section of cs 4 sq.in. The dimensions of the frame are the following:
Length: 43 inches
Width: 18 inches
Length of side frame rod: 40 inches.

HAND GRIPPERS:

Hand grippers are the rods of length 36 inches that have been made into a curvature. The gripper serves for two purposes:

- To hold canes firmly so that they can be packed into a bundle.
- To hold the canes so that the leaves can be trimmed off manually.

The machine is semi-automatic and the primary motive is to reduce the manual efforts by 70%.

MUD-WHEEL:

The wheel designed in the manner to run and move in the loosened soils is known as mud-wheel. The wheel is made with six 10 inches circular rods with diameter 0.75 inches, welded together with nut and bolt adjustment assembly. The reduced weight of the wheel and sharp pointed edges makes it capable to move in the loosened soil and requirement of torque for the movement of wheel is lesser though high torque is required to pull heavy loads.

ROATARY CUTTER:

The rotary cutter is the major part of the machine. The rated speed of the rotating cutter is 4000 rpm. But for efficient cutting of the canes, 400-500 rpm stands sufficient. The cutter is made of stainless steel material and the diameter of the cutter is 200mm. When the canes come in contact with the sharp edges of the cutter, they are cut. The ground clearance can be adjusted accordingly using the lead screw mechanism.

BATTERY:

The battery used is of 12V and 10A capacity. The main motive for the usage of electric drive is to reduce the weight and increase the efficiency. Fuel-run drives render high weight and are noisy. Also, solar panel can be installed when the electric drive is used. Hence, it proves eco-friendly and man-friendly set up.

DC INVENTO MOTOR

DC invento motor is specialized 12V, 7A motor that is specifically used for high speed purposes. The rated speed of the motor is 1000rpm.

DC MOTOR

12V, 5A motor is used for the movement of grippers and actuating steering. The advantage of DC motor is that the speed of the motor is easily controllable. The rated speed of the motor is 500rpm.

CALCULATIONS:

Let us assume that the force required to cut the sugarcane is 10kgf=100N
Speed of the cutter N=400 rpm.
Cutting velocity = 41.9 m/s
Thickness of the cutter = 2.8mm
Power of the motor=120W
Thus calculating the torque required, T=2.86Nm.
Rack and pinion calculation for steering:
Pitch diameter = 60mm
No of teeth= 17
Module = 3.53mm
Speed = 100 rpm
Velocity = 10.5m/

CONCLUSION

It is the first attempt in view to make the agricultural technology to the small scale farmers. There is a view that Industrialization is harmful to farmers, but the same Industrialization could be moulded to promote farming. The farming scale has reduced exponentially and one of the reasons is that it requires great human skill and effort and even then the cost yield is less. In extended vision, the reduction of the human efforts and the natural investment proves significance in the mere future.

The attempt of making small scale sugarcane harvester might have few drawbacks but few modifications could be made. Following modifications could be made in the machine:

- Solar panel could be installed so that the machine is environment friendly.
- Complete automation could be brought.
- Installation of multi blades improves the efficiency.
- Installation of pallets or trolleys so that the cut canes be carried to the tractors or even to the mills.
- Packing mechanism for the cut canes could be designed and developed effectively.

