Design And Fabrication of Harvester And Chopper For Onsite Fodder Collection

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Abstract- *This project speaks about the design and development of a combined Reaper and Chopper ,is a new integration of harvesting and chopping machines in a single unit with a unique extra feature of individual reaping and chopping .This machine helps farmers whose main income source is dairy farming . This machine reduces the time of fodder collection for cattle by simultaneously performing both reaping and chopping. This machine might be the best solution for the problems faced by small scale farmers relating with availability of labors and cost of harvesting.*

Keywords- Agricultural mechanization, design and development, grain, harvesting machinery, reaper, chopper

I. INTRODUCTION

Agriculture is the backbone of India. In India agriculture is facing serious challenges like scarcity of labor, water, pesticides, in peak working seasons and also in normal time. This is mainly for increased nonfarm job opportunities having higher wage, migration of labor force to cities and low status of agricultural labor's in the society. In India two type of crop cutting is employed manual method (conventional method) and mechanized method of crop cutter. The crop cutting is an important stage in agriculture field. Currently India farmer is using conventional method for crop cutting i.e. cutting crop manually using labor but this method is very lengthy and time consuming. To design and analysis the crop cutter machine which is help to the Indian farmer which is in rural side and small farm. It will reduce the cost of crop cutting in field. It will help to increase economical standard of Indian farmer. As a medium grade technology, many developing countries are using reaper for harvesting and chopper for chopping fodder to minimize production cost, and are there by, making agricultural process economical.

The harvesting of grain crops in our country is traditionally done by manual methods. Harvesting of major cereals, pulse and oilseed crops are done by using sickle. All these traditional methods involve drudgery and consume long time. Rice is one of the most important crop and staple food of millions of people in India which is grown in many countries of the world. The total area planted under rice crop in India is 42.20 million hectares. Improved weeder reduces weeding cost by 79-90%. Walking type vertical conveyer reaper, power tiller and tractor front mounted reaper save 50-60% labor and harvesting cost by 60-70% as compared to manual harvesting. Combine harvesting save 40-50% cost as compared to manual harvesting and threshing by power thresher. Reapers are used for harvesting of crops mostly at ground level. Reapers are classified on the basis of conveying of crops. It avoids fuel consumption, labor requirement.

Harvesting is the first and major post-harvest operation for separation, processing and storage of grains. Harvesting of grains by machines is an important part of mechanized agriculture. At present, developed countries all over the world are using automatic combine harvester for harvesting grains. Some developing countries are also using combine harvesters for harvesting as a high-grade technology. As a medium grade technology, many developing countries are using reaper for harvesting to minimize production cost, and are thereby, making agricultural production economical. [1] The harvesting of grain crops in Ethiopia is traditionally done by manual methods. Harvesting of major cereals, pulse and oilseed crops are done by using sickle. All these traditional methods involve drudgery and consume long time [1].

A Chopper is mechanical device used to cut the straw or hay into small pieces so as to mix it together and fed to Cattle. This improves animal digestion and prevents animal from rejecting any part of their food. As per today's scenario the population of cattle's is drastically increased. So to increase the productivity and reduce the physical effort required for running the machine the motorized machineries came into existence it is best for dairy farmers. Presently fodder cutting machines are electric driven as well as hand operated or engine driven.

II. LITERATURE SURVEY

Until the 19th century, most grain was harvested by cutting with a sickle, scythe, cradle or manual mowers then manually flailed or beaten to break the bond of the grain with the stalk, then winnowed to separate the grain from material

other than grain. In the developing world, these practices or the use of small stationary threshers are still in use for grain harvesting. A sickle is a curved, hand-held agricultural tool typically used for harvesting grain crops before the advent of modern harvesting machinery. The inside of the curve is sharp, so that the user can swing the blade against the base of the crop, catching it in the curve and slicing it at the same time. Scythe is a similar tool with the sickle used to harvest grain crops. The most noticeable difference between a sickle and the scythe is the shape of the blade (is shown in fig 2.1 B) of which the Scythe blade is more linear whereas a sickle blade is more in the shape of a C with a point at the top as shown in fig 2.1 A

Fig.2.1 a

Fig.2.1 b

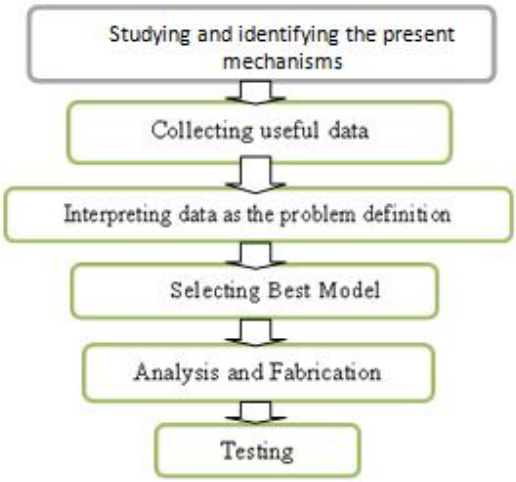
Cradle is a more developed tool for reaping and harvesting. It consists of an arrangement of fingers attached by a light frame work to the snatch of a scythe. Its purpose is to gather the straw as it is cut and deposit it in a swath. At the end of the cutting stroke, the cradle is tilted to drop the straw in a pile. Also, substantially more grain can be cut in a day with the cradle. However, loss due to shattering (grain dislodged from heads due to shock) is greater with the cradle (shown in fig.2.1) which makes to continue using the sickle to harvest grain. Reapers are harvesting-machines used for cutting grain-crops. They either deliver the grain to one side in gavels ready to bind into sheaves, or elevate the gavels upon a platform where two operators bind them into sheaves by hand. During the 19th century, mechanical reapers and binders were developed to cut and windrow grain for field drying. The sheaves were then hauled to stationary threshers. Around the start of the twentieth century animal drawn machines, “combines,” were developed that integrated cutting, threshing, and separating wheat and small grains. A reaper has been designed and fabricated at the University at the Agriculture.

Fig.2.1

III.OBJECTIVES

- Design, develop, fabricate and test agricultural equipment capable of reaping the fodder and chopping the same onsite and collecting it.
- The task is mainly focused towards helping small scale farmers for the fodder collection/reaping the crops.
- The developed product is intended to reduce the time and increase their income by minimizing harvesting cost, and number of workers.

IV. METHODOLOGY



V. OUTCOME OF PROJECT

- Development of Durable product to the farmer community.
- A complete manually operated/Engine assisted system increases the handling and Ease of use.
- Less complicated with fewer components leads to ease of maintenance and Low complexity of components.

- Ultimate objective is to benefit small scale farmers with Low cost multi utility equipment.
- Equipment is compact in nature which makes it Portable in nature.

VI. DESIGN CALCULATIONS

DESIGN OF GUIDE VANES

By performing shear strength experiment
Load = 19.62 N
Height = 340mm
Linear velocity v = $\sqrt{2gh}$ = 2.58 m/s .
Time of fall = h/v = 0.34/2.58 = 0.131 m/s
Acceleration a = v/t = 2.58/0.131 = 19.69 m/s²
Impact force = m×a
= 2×19.69
= 40 N
To find angular velocity
Displacement x = rθ
θ = v/r = 2.58/0.15 = 17.2 rad/sec
r = radius of cutting blade = 15cm
Angular velocity w = 2πN/60
17.2 = 2πN/60
N = 164.247 rpm

Torque required to cut the crop

T = F×r
T = 40×0.15
T = 6 N-m

Power required to cut the crop

P = 2πnT/60
P = 2π×164.27×6/60 = 103.19 w

The force required to cut 14mm dry maize stem = 40N
Since the length of guide vane = 100mm
One guide vane can accommodate = 8 maize stem i.e.100/14

Total force required to cut and guide vane is considered to be a cantilever fixed at one end with UDL.

- No of maize stem it can accommodate = 8
- Width of each maize stem = 14mm
- Force required to cut 14mm maize stem = 40 N
- Force on UDL is
  =22.85714 N/MM

Considering two criteria of maximum deflection of less than 1mm and maximum stress less than allowable stress.

- Length of cantilever = 100 mm
- Load on cantilever = 22.85714 N/MM
- Young's modulus of mild steel = 200000 Mpa

Considering maximum deflection of 1mm

By using max deflection equation of Ymax = Wlˆ4/8EI
Moment of inertia I = 1428.571 mmˆ4

VII. CAD MODELS

1. MODEL

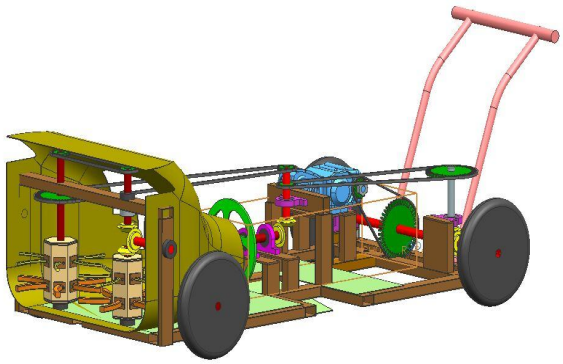


Fig.1 Model

2. Front view

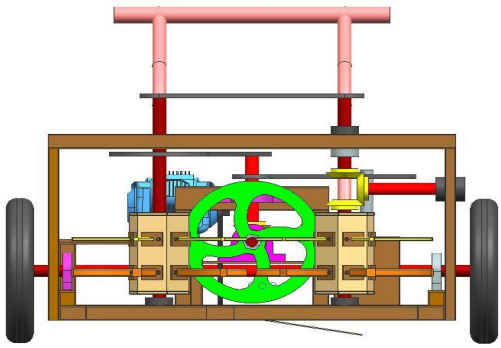


Fig.2 Front view

3. Top view

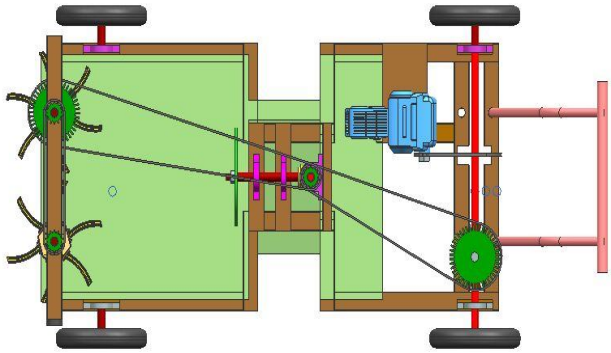


Fig.3 Top view

VIII. RESULTS

- This is machine used for harvesting and chopping onsite fodder collection.
- This machine will be helpful for small scale farmers &large scale farmers.
- The machine is simple in construction as there is not so much complication in design.
- The machine is designed in such a way that it will require minimum space to install.
- The cutting blades can be easily detached by operator for sharpening purpose.

IX.. CONCLUSION

By studying all the possibilities it is clear that, the harvester reaper and fodder cutter (chopper) machine is very easy to construct and it's working is also very simple and economical for farmers. This machine can run effortlessly, thus farmers work will be reduced. The cost of this machine is considerably less. The success of this machine depends on how the farmers use this machine and adopt in there farm land.

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