

Design & Modeling of Mobile Chaff Cutter a Review

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ABSTRACT

This machine targets new agriculture entrepreneurs and farmers working on factory farms , the fodder requirement is high in factory farms, as the feed is provided to cattle at one place unlike the traditional methods where they travelled miles and fed themselves .Our machine performs three operations at same time which is cutting , chaffing and collecting operation It is a compact machine which can cut up to two layers of grass at a time, firstly the grass is cut down using cutting blades with triangular teeth which cut the crops by scissoring action. Further the grass moves inside and chaffed by s shape chaff cutter blades , finally moves out by centrifugal force and collected outside in a gunny bag, It runs on diesel engine of 3HP, this power from engine, is provided through pulley and gear box arrangement to the cutter. . This machine can be a solution to the problems faced by farmers regarding cost and labour implementation.

Keywords: Chaff cutter, factory farms, scissoring action

1. INTRODUCTION :

In India, animal husbandry is an integral part of the rural economy. The forage (dry or wet) production requires high labour, coupled with a lack of sufficient land for forage. Production and forage scarcity during the dry season means that available forage must be efficiently used to minimize waste. Traditionally, the farmers chop forage into small pieces for easy consumption by the animals. This method is tedious, time consuming and quite dangerous to operator, as well as low output and lack of uniformity. The population of cattle in India in 1987 was 274 million. For such kind of population traditional human powered fodder cutting machines were used, but due to this the efforts for running the machine was physically demanding. And as per today's scenario the population of cattle is drastically increased. So to increase the productivity and reduce the physical effort required for running the machine the motor-ized machineries came into existence i.e. The power operated chaff cutters, but the machine is stationary , and the fodder need to be bought down from farms for chaffing which is again tedious and time consuming process , and also requires more no. of labours which increases the cost, to overcome all this problem we designed a machine which cuts the crops chaffs it and fill it in sac bags.

2. LITERATURE REVIEW:

Laukik P. Raut, Vishal Dhandare[1]This project was made by mechanical engineering students of GHRCE . They have made a compact harvester which can cut up to two rows of soya bean at a time , the machine works on a 3hp diesel engine . this machine was developed concerned to small scale growers.

Dinesh Mohan [2] This paper was submitted under the transportation research and injury prevention program conducted at iit delhi the topic raised concerning the injuries taking place due to fodder cutting machine , the paper explains various safety measures to avoid the injuries taking place due to chaff cutter.

Zakiuddin Syed Kazi [3] This project was made by students of Mechanical Engineering, Anjuman College of Engineering, Nagpur ,They made a human energized chaff cutter working on pedal power technology they generate the energy by pedaling mechanism and stores it in flywheel and uses the stored energy of flywheel for the

chaffing operation , the human energized chaff cutter in very effective in areas where there is scarcity of electricity and the machine is economical and low maintenance as well.

Indian standard specification for power operated chaff cutter [4] This book provides all the necessary information related to the construction of chaff cutter it helps in finding all the standard dimension of blades size and shape , bearings , nuts and bolt . It is very helpful for construction of any kind of chaff cutter.

Aravind C[5]This project was made by students of mechanical engineering BNM institute of technology Bangalore ,they made a mini paddy harvester understanding the problems faced by the small scale farmers regarding labours scarcity and wages . Hence they made an economic machine running on 2hp petrol engine which cuts the crop and collect it on one side.

Chinmay Bandiwadekar[6]this project was made by the students of D.Y.Patil college of engineering ,ambi, They referred the project of human energized chaff cutter and found that the effort required to drive the mechanism can be reduced , hence they made a machine with new cutting mechanism which is safer and less power consuming.

3. PROPOSED DESIGN OF MOBILE CHAFF CUTTER :

The data that obtained from the interviews and research is used to finalize the specifications of chaffing machine; this included general size and functionality. On the basis of information collected from farmers, manufacturer and researchers the following objectives being set;

1. Designing a compact machine
2. Decrease the cost of machine.
3. Decrease the labour requirement for fodder cutting and chaffing
4. Decrease the efforts required for overall work
5. Using proper collecting mechanism to increase the efficiency of harvesting

So considering these points related to chaff cutting and fodder collection an attempt is made to design and fabricate such equipment which will able to perform the operations more efficiently and also will results in low cost.

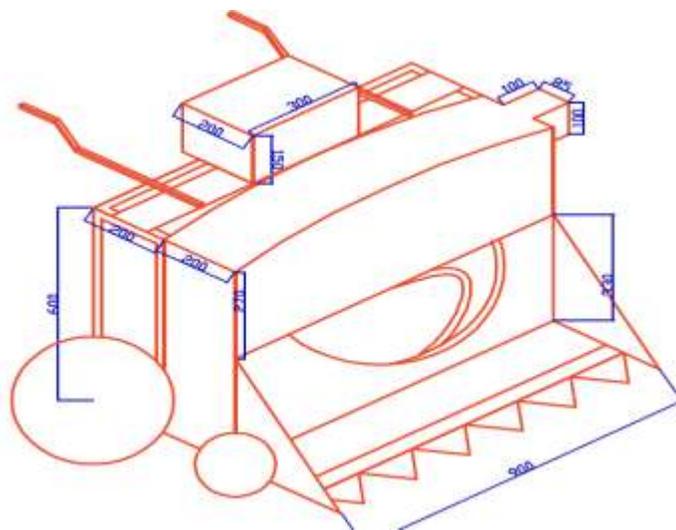


Fig1: CAD model of mobile chaff cutter

The machine performs three operations namely ‘cutting, chaffing and collecting’. In cutting operation there are two cutter blades; one is moving and another is stationary. The slider crank mechanism is used to convert rotary

motion to linear sliding motion. Scissoring action is obtained due to reciprocating movement of cutter blade over stationary blade is used to cut the crops.

It is a walk behind type of mobile chaff cutter which is powered by the 2.2Kwatt (3HP), 3000 rpm diesel engine. With the help of V-belt, drive power is transmitted to gearbox. As the required rpm at cutter is as less as 200 rpm, it is reduced using belt drives and gear drives. A spur gearbox and a bevel gearbox is used. Bevel gear box is used to reduce the velocity as well as to change the direction of gear system by 90° . for cutting mechanism one end of this output shaft is connected to slider crank mechanism which converts rotary motion of shaft into reciprocating motion of cutter blade. Reciprocating cutter blade slides over fixed blade and creates scissoring action responsible for cutting the crops. Once the crops are cut down it moves inside the machine where the chaffing action takes place. After chaffing the chaffed crops/fodder (kutti) moves out through the mouth, and collected in a sac bag.

4. DESCRIPTION OF PROPOSED PARTS:

4.1 Main frame:

Firstly, the frame of the chaff cutter with the dimension $700 \times 900 \times 600$ (l \times b \times h) mm³ needs to be constructed. The mild steel angle section is used to build the frame. The frame is light and strong enough to sustain weight of diesel engine. After frame is developed we need to mount the engine on it

4.2 Diesel engine

Diesel engine of 2.2 KW, 3000 rpm and it rope start type of engine is used. Diesel engine is selected because diesel engine has good efficiency, power and fuel is easily available at ruler areas.



Fig2: Diesel engine

4.3 Belt Drive:

The belt drives primarily operate on the friction principle. i.e. the friction between the belt and the pulley is responsible for transmitting power from one pulley to the other. In other words the driving pulley will give a motion to the belt and the motion of the belt will be transmitted to the driven pulley. V- Belts are used because its advantages over flat belts in compact transmission design. Engine power is transmitted to the spur gearbox with the help of belt drive.

4.4 Spur Gearbox:

For compact transmission design it is desirable to use gears. It is very compact, takes very less space which is required in this machine. The main advantage of gear drive is that it transmit same velocity ratio and also it is used to transmit a very large power with very good reliable service.



Fig 3: Belt Drive



Fig 4: Spur Gearbox

4.5 Bevel Gearbox:

Bevel gearbox is used to change the direction of motion by 90° . This type of gearbox is used because there was a need to transmit power to two mechanisms i.e. slider crank mechanism.



Fig 5: Bevel Gearbox

4.6 Cutter Assembly:

Cutter assembly consist of a sliding cutter plate and a stationery cutter plate. The cutters used are of triangular shape. In sliding cutter plate, cutter blade is riveted on 3 mm plate and in stationery cutter plate; cutter blade is riveted on 5 mm plate. The stationary cutter plate can be directly bolted and fixed on frame. Sliding cutter blade is provided with 2 slots of 80 mm on its ends; it allows sliding motion to be in straight line.



Fig 6: Cutter assembly

5 PROPOSED MECHANISM:

5.1 Cutting Mechanism:

Slider crank mechanism is used in cutting mechanism to convert the rotational motion into linear motion , one of the blade is fixed and the other mechanism is connected to slider hence perform linear motion due to which scissoring action takes place which cuts the grass.

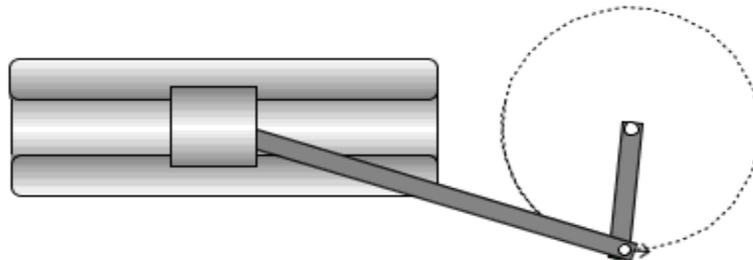


Fig 7: Cutting Mechanism

5.2 Chaffing Mechanism:

S-shape chaff cutter blade is used in chaffing operation, as it covers larger surface area and accommodated in low space, and has good reliability, once the grass is cut it moves inside the machine hence chaffed into small pieces this types of blades comes under flywheel type chaff cutter.

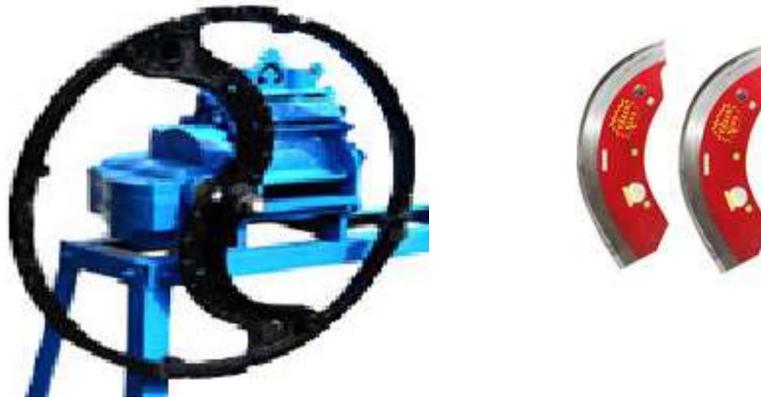


Fig 8: Chaffing Mechanism

The cutter arrangement moves with velocity of 300-350 rpm, and the size of cut of fodder is 10 -14 mm

6. ASSEMBLY:

All the components were brought together and then bolted on the frame. First engine is mounted on the frame using nut and bolts. Then spur gear box is bolted to the frame, and with the help of pulley system, engine and spur gear box is connected. Then two shafts from spur gear box come out. One is connected to bevel gear box by coupling and the one to shaft on which flywheel is mounted through pulley

7. POWER REQUIRED TO DRIVE MECHANISM:

The power required to drive the mobile chaff cutter must be such that

- [1] It must carry variable load during constant running of machine.
- [2] According to studies done on various grass type fodder the reciprocating speed should be 0.8 to 1.2 m/s.
- [3] Scissoring action is used to cut the crop.
- [4] Speed given to chaffing mechanism will be more than the reciprocating mechanism.
- [5] The frame must sustain the weight of engine and gearbox.
- [6] Along with crop strength, strength of miscellaneous items such as weeds stems etc.

So, keeping these objectives in mind, the power required to drive the load is according to the requirement of machine. It must be 2HP to 3HP. So, being on the safer side diesel engine producing power of 3HP is selected.

CONCLUSION:

The new machine designed is a special purpose small scale machine, targeted at farmers who have requirement to feed their cattle on daily basis in small to medium basis. This machine is different from other chaff cutters as this machine is portable and performs three operations at a time ie. cutting ,chaffing and collecting

This new machine reduces the efforts required by the farmers , reduces the labour requirement and makes the work in more systematic way.

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