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A REVIEW: DESIGN AND FABRICATION OF CROP REAPER MACHINE

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Abstract - **This title presents the concept for design and Fabrication of crop cutter. The crop cutting is important stage in agriculture field. Currently in Indiafarmer used conventional method for the crop cutting i.e. the conventional method for crop cutting is a manually cutting using labors but this method is lengthy and time consuming.This project aim is to design and fabrication of small field crop cutter machine.It has cutting blades which cut the crop in a scissoring type of motion. There are two metal strip (plate) upper cutter plate will be reciprocate by scotch yoke mechanism. The machine consists of petrol engine to operate cutting roller and blade. When compare to manual crop cutting by and this machine has a capacity to cut the crop in faster. This harvester might be the solution to the problems faced by a small-scale farmer regarding cost and labor implementation. This machine to helpful for both the small as well as big farm.**

***Keywords*-Crop Reaper Machine, Mechanized method,Scissoring motion, Scotch yoke mechanism, Crop cutting.**

1. INTRODUCTION

Agriculture is the backbone of India. In India agriculture has facing serious challenges like scarcity of agricultural labour, in peak working seasons but also in normal time. This is mainly for increased nonfarm job opportunities having higher wage, migration of labour force to cities and low status of agricultural labours in the society. In India two type of crop cutting like as manual method (conventional method) and mechanized type of crop cutter. The crop cutting is important stage in agriculture field. In India reapers are costly and only available of very large scale farming. However, agriculture groups make these available for rent on an hourly basis. But the small holding farm owners generally do not require the fullfeatured combine harvesters. Also, these combine harvesters are not available in all parts of rural India due to financial or transportation reasons. Thus, there is a need for a smaller and efficient combine reaper which would be more accessible and also considerably cheaper. The mission is to create a portable, user-friendly and low cost mini harvester taking into account the requirements of current situation; the idea was created to prepare a machine which is cheap and will reduce the labor required to cut crops. This machine has thecapability and the economic value for fulfilling the needs of farmers having small land holdings. This machine is cost effective and easy to maintain and repair for the farmers.

Taking into account the present scenario of corn harvesting we decided to prepare a model of corn reaper with compact construction which will be mostly suitable for farmers having small and for agriculture. The machine prototype will be economical and most convenient for cutting corn stalks and other similar plants having same shear strength than corn.

1.1. Problem Statement

1. Manual labor takes time and is not effective as they can work for 3-4 hours at a stretch.
2. Even if the land holding is small, it takes two or three days to completely harvest the crop.
3. High costs of machines and maintenance, nonavailability of appropriate agricultural machines and equipment that cater to and suit the requirements of small scale farms.

1.2. Objective

1. To formulate an idea to suit our required functionality that is to reap the crops.
2.To develop the idea to suitable mechanical principles and to design the idea into practice.
3. To fabricate the design and the selected material which are cost effective.

1.3. Proposed System

Present method of Crop cuttingis important stage in agriculture field. Currently Indian former used conventional method

- Manual methods of crop cutter.
- Crop cutting by using mechanized.

a. Manual method of crop cutting:-

To the cutting and threshing machine for seed separation this method the crop are remove as mentioned in the traditional method. These method crops are tied together to

from a bundle. These bundles are garnered and taken to threshing machine. This machine separates the seed from the crops.

b. Combine crop cutting machine

The combination of crop cutting machine is to combine the three operations like as cutting, reaping and winnowing into single process. It is combination of crop cutting machine most of the economically labor saving.[2]

1.4. Studying the present mechanism

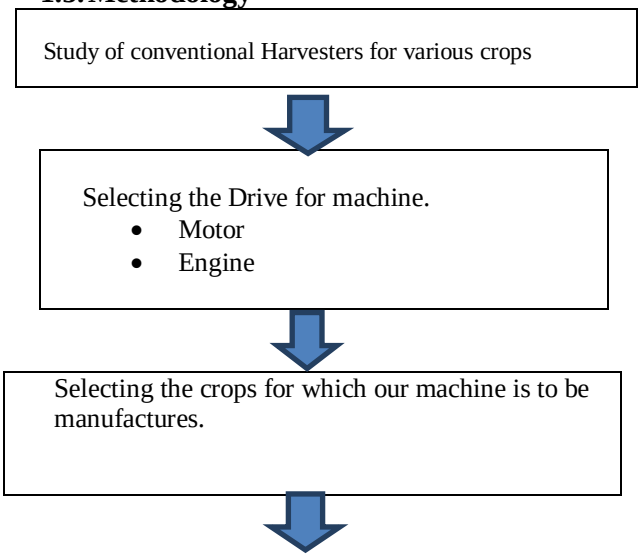
a. Agriculturalfarm Machinery and Equipment:

Manual labor takes time and is not effective as they can work for 3 to 4 hours at a stretch. Even if the land holding is small, it takes two or three day completely harvests the soybean crop. Also the planting is not done with proper care. The machine focus the project is to make combination of harvesting and collecting machine for the small scale farmers in India who have land holding less than two acres, to harvest grain more efficiently.The level of mechanization has been increasing steadily over the year of the joint efforts made by the Government and the private sector. As a result of different programs implemented by the Government of India over the years, the total farm power availability is estimated to have increased from 0.295kw/ha in 1971-72, 1.72kw/ha in 2010-11.[2]

A) Land holding : -

Even though the a adoption of farm mechanization is increasing in India, it is mostly region specific. Farm mechanization has very low growth rate in regions such a hilly and sloppy land. The decreasing trend in operational land holding is also observation the growth of agricultural mechanization. High costs of machine and maintenance, non-availability of appropriate agricultural machines and equipment that cater and suit the requirement of small scale farms, non-availability and difficulty in getting bank credit and small land holding are some of the factors that hinder farm, mechanization and force farmers to follow the traditional ways of agricultural operation. The use of farm machinery is also dependent on infrastructure and services available in the rural areas. India continues to be fed by its marginal and small farmers. Their holding (those below two hectares) taken together account for 84.97% of total holdings in 2010-11 compared with 83.29% in 2005-06, the combined area under these myriad farmed plots is 44.31% of the country's total farmed area (it was 41. 14% in the 2005-2006) [2]

1.5. Methodology



2. LITERATURE SURVEY

Chavan.et.al.(2015) presents the project to help smallscale farmers to meet an increased demand for local grains, by designing a reaper machine to harvest grains more efficiently. Our research work will focusing on ease of harvesting operation to the small land holders for harvesting varieties of crop in less time and at low cost by considering different factors as power requirement , cost of equipment , ease of operation , field condition , time of operation and climatologically conditions. The operating, adjusting and maintaining principle are made simple for effective handling by unskilled operators.[1]

Ghumadwar and Bankar (2016) presents the concept for design and analysis of crop cutter. The crop cutting is important stage in agriculture field. Currently in India former used conventional method for crop cutting i.e. the conventional method for crop cutting is as manually cutting using labor but this method is lengthy and time consuming. This project aim is to design and analysis of small field crop cutter machine for small height crop. It helps to reduce farmer's effort and to increase rate of cutting crop. The machine of consist of petrol engine. This machine is helpful for both the small as well as big farm.[2]

Shivankar et al. (2015) The project is based on developing a machine which focuses on labor problems faced by small scale farmers who have agricultural land. The machine developed can harvest up to two rows of soya bean plant at a time. The

components of the machine comprise of a diesel engine of 3.5hp, pulley, a belt drive, a collecting mechanism and a cutter. The crop is being harvested by a scissoring type of motion. The power from the engine is provided to the cutter through pulley and belt arrangement. Powered by the pulley arrangement a collecting mechanism is being provided to the adjacent side of the cutter to collect the harvested crops. [3]

Chakaravarthi.et al. (2016) presents the machine targets the small scale farmers who have land area of less than 2 acres. This machine is compact and can cut up to two rows of soybean plant. It has cutting blades which cut the crop in a scissoring type of motion. It runs on diesel engine of 3HP, this power from engine, is provided through pulley and gear box arrangement to the cutter. A collecting mechanism is provided for the collection of crops to one side after cutting. This mechanism is also powered by pulley arrangement.[4]

3. CONSTRUCTION AND WORKING

3.1. Construction

It is a walk behind type of harvester which is powered by the 4.5HP, 2800 rpm Engine. With the help of V-belt, drive power is transmitted from gear box. As the required rpm at cutter is as less as 560 rpm, a bevel gearbox is used. Here bevel gear is used to change the direction of drive in the gear system by 90˚ and reduce the speed to required. One of the output shaft of gear box is connected to Scotch Yoke Mechanism which converts rotary motion of shaft into linear motion of cutter blade. Reciprocating cutter blade slides over fixed blade and creates scissoring action responsible for cutting the crops. While, other shaft coupled to run a collecting mechanism consist of flat belt with collecting plates bolted on it. Collecting belt simply carry cut crops sideways.[3]

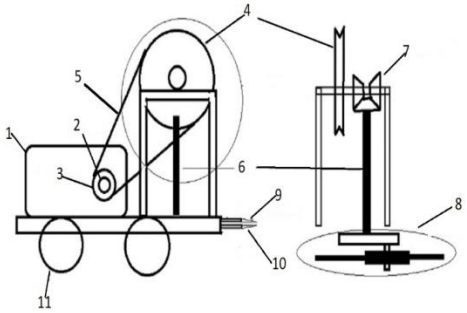


Fig.3.4: Conceptual Diagram

Part No.	Component
1	Engine
2	Engine Shaft
3	Smaller Pulley
4	Larger Pulley
5	Belt
6	Shaft
7	Bevel Gear Box
8	Scotch Yoke Mechanism
9	Moving Plate Of Blade
10	Fixed Plate Of Blade
11	Wheel

3.1.1 Main frame

The required frame must be in light weight and able to sustain weight of petrol engine. The crop cutting machine having dimension (l × b × h) mmis fabricated. For fabrication purpose the mild steel angle section is use to built the frame.

3.1.2 Petrol Engine

Petrol engine is used because we can operate it at different speedPetrol engine is used because of it has good efficiency and easily available in rural areas.

3.1.3. Cutter Assembly

Cutter assembly consists of a sliding and stationary cutter plate. A thick plate is used to give a support at teeth. It has cutting blades which cut the crop in a scissoring type of motion. There are two metal strip (plate) upper cutter plate will be reciprocate by scotch yoke mechanism.

Fig. 3.1: Cutter blades

3.1.4 Bevel gear box

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 mechanisms i.e. scotch yoke mechanism.

Fig.3.2: Bevel gear box

3.1.5 Bearing

A bearing is a machine element that constraints relative motion to only the desired motion, and reduces friction between moving parts.[2]

3.1.6 Scotch yoke mechanism: -

Various mechanism is used for converting rotary motion into linear motion but we use scotch yoke mechanism because it gives quick return stroke. The Scotch yoke (also known as slotted link mechanism) is a reciprocating motion mechanism, converting the linear motion of a slider into rotational motion, or vice versa. The piston or other reciprocating part is directly coupled to a sliding yoke with a slot that engages a pin on the rotating part.[5]

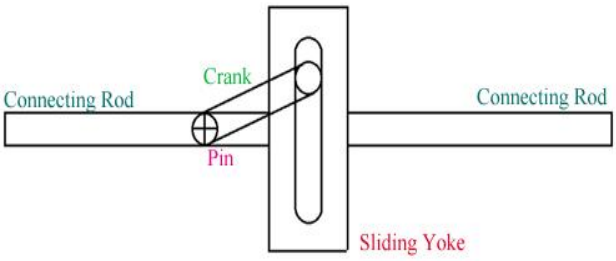


Fig.3.3:Scotch yoke mechanism

3.2. DESIGN PROCEDURE

To prepare any machine part, the type of material should be properly selected, considering design, safety. The selection of material for agricultural equipment application is given by the following factors:-

1) Availability of materials
2) Accessibility of the materials
3) Machinability of the material
4) Cost of the material

As per the above factors mild steel is the most preferable material due to it's availability and machinability.

3.3. Machine Specification

Table 1: Machine Specification

Component Name	Description
Engine	100 cc, 4.35 HP
Pulley	2 pulleys used
Gear box	3 Bevel Gear are used
Scotch Yoke mechanism	To convert rotary motion into linear motion
Cutter Blades	Fixed Blade, Moving Blade

4. COMPARISON OF HARVESTING COST BY TRADITIONAL METHOD AND CROP REAPER

4.1. Harvesting done by Manual Process:

CONTENT	COST
Amount paid to the labour for one day	Rs. 300 per labour
Total number of labour required in general toHarvest 1 acre farm	6
Total amount paid to the labour	6 x 300 = Rs.1800 per acre in one day
Therefore, total expenditure in one day is	Rs.1800

4.2. Harvesting done by Crop Reaper Machine:

CONTENT	COST
Quantity of petrol require for 1 to 1.2 acre	4 litre
Cost of petrol per litre	Rs. 90
Total cost of petrol for 1 acre farm for a day	4 x 90 = Rs.360
Amount paid to the labour	Rs. 300 per day
Total expenditure = Total cost of petrol + Amount paid to the labour + Maintenance	360 + 300 + 100=Rs. 760 ~ Rs. 800
Amount saved by using the harvester	1800 – 800= Rs. 1000 per day per acre.

5. CONCLUSION

Based on literature review, We have concluded that many have worked on comparison and performance evaluation of reaper machine on favour of manual harvesting, semi operated and automatic operated.

1. Labor requirement is reduced.
2. Time consumed is less.
3. Crop cutting cost is reduce.
4. Useful for small scale farmers.

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