A Review On Design and Fabrication of Finger Millet (Ragi) Cutting Machine

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Abstract: This project addresses a crop cutting machine, which is fabricated with very simple mechanisms at low cost. Basically the Problems faced by farmers, who work on small fields, while harvesting is that, the crop takes a lot of time, the availability of labor and their cost during cutting season is also very high. Although various agricultural machines are available in the market but they are quite large and costly. It becomes uneconomical for small farmers to afford such kind of machines. In order to overcome the situation, we have introduced a new simple machine that is more efficient for small farmers. The design and working of a simple ragi cutting machine is discussed here, which is operated on the principle of slider crank mechanism by varying the length of cutting grains. And especially the machine targets the farmers who have land area of less than 2 acres. Hence this project might be the solution to the problems faced by a small scale farmer regarding cost and labor implementation.

Keywords- *Cutting Blades, Slider-Crank Mechanism, Dc Gear Motor, Battery*

I. INTRODUCTION

Agriculture is the science and art of farming, including cultivating the soil, producing crops and raising livestock. Ragi is also known by the name finger millet. It is an important small millet food and fodder crop which is extensively cultivated in Asian countries like India, Malaysia, chine and Nepal. In India finger millet is cultivated over an area of 1.19 million hectares with a production of 1.98 million ton giving an average productivity of 1661 kg per ha.

Harvesting is the process of gathering a crop. In ragi, harvesting refers to the cutting and gathering of earheads along the stalks. When the earheads turns brown color or at maturity stage, cut the earheads alone or cut the stalk along with ear heads by using sickles. The earheads are heaped in sun on the threshing floor for 1-4 days for drying, and then machine winnows and cleans the Ragi after threshing. The crop cutting is important stage in agriculture field, over many years, agricultural practices have been carried out by small-holders cultivating between 1 to 2 hectare, using human labor and traditional tools such as wooden plough, yoke, leveler, harrow, mallet, spade, big sickle etc. Here we design and analysis the crop cutting machine which is to help the Indian farmer especially to small farm. It will reduce the cost of crop cutting in field. This machine cuts earheads separately and store it. Due to this, farmer can feed straw to the domestic animal easily without any heavy efforts more over it is simple in design. It will help to increase economical standard in Indian farmer.

Presently for harvesting of finger millet manual procedures are adopted as the fingers will not mature evenly, the entire crop is not been harvested but only the fingers in the crop is separated from the straws of the crop. Traditionally, finger millet harvesting is done manually using sickles which involves 3-4 man days per hectare. Scarcity of labor and higher wages during harvesting season is the serious problem. In Manual harvesting crop is harvested by hand, Here individual heads are cut off with a sickle leaving a few centimeters of stalk attached or the whole crop is harvested at base level. Leaving a few centimeters of stubble on the ground. 200 man hours are required to harvest one hectare of finger millet. One man can harvest 0.005 hectare per hour with an efficiency of 99 percent.

II. PROBLEM FORMULATION

- Basically problem faced by farmers, is modern agricultural techniques and equipment's that are not used by small land holders because these equipment's are too expensive and difficult to acquire.
- The survey has been carried out by going through various journals, articles, and information's from the internet.
- Thus understanding the need, it is very essential to bring in a machine which is cost effective, compact and easy to use for low end farmers.

III. OBJECTIVES

- To design and develop different concepts to meet functional requirement of farmers.
- To fabricate a low cost finger millet cutting and collecting machine as per design.
- To analyse the performance of finger millet cutting machine for cutting of earheads and to store it.
- To minimize the human effort.

IV. DESIGNING OF MODEL USING SOLIDEDGE V19

The assembly modeling is a technology and method used by computer-aided design and product visualization computer software systems to handle multiple files that represent components within a product. The components within an assembly are represented as solid or surface models.

The designer generally has access to models that others are working on concurrently. For example, several people may be designing one machine that has many parts. New parts are added to an assembly model as they are created. Each designer has access to the assembly model, while a work in progress, and while working in their own parts. The design evolution is visible to everyone involved. Depending on the system, it might be necessary for the users to acquire the latest versions saved of each individual component to update the assembly.

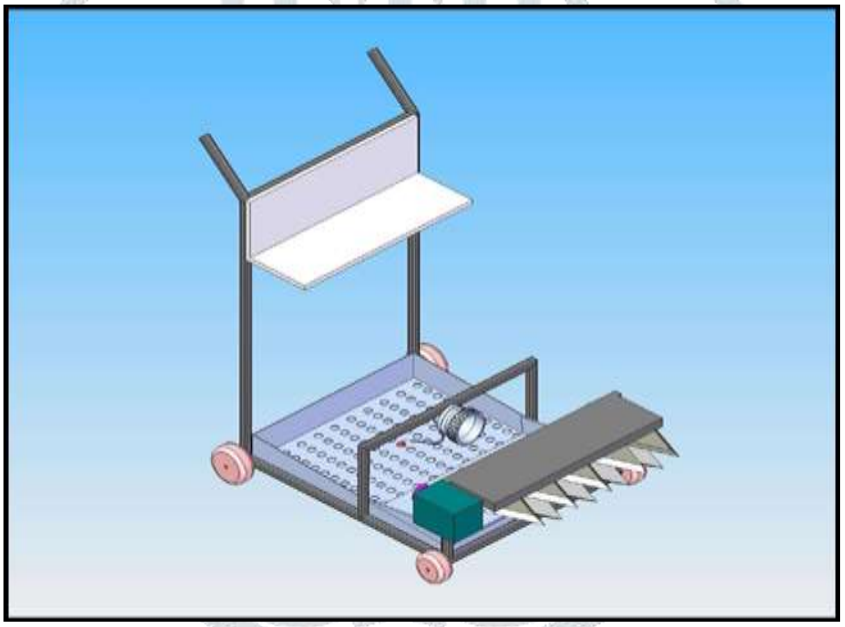

Figure 1 –Design of Finger Millet Cutting Machine

V. HARVESTING MECHANISM

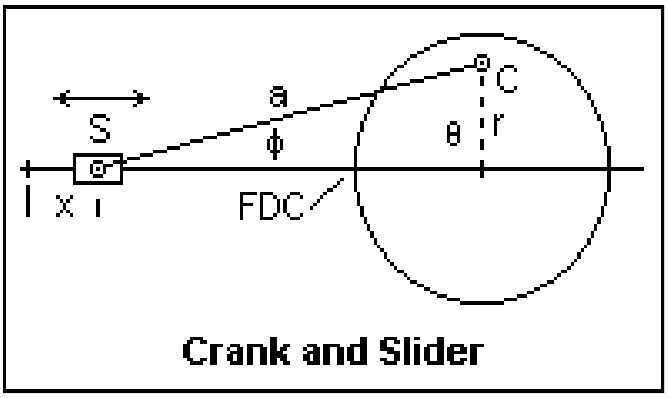

Figure 2- Crank and Slider

For the motion of cutting mechanism of blades a simple "Slider-Crank Mechanism" is employed which has fixed blade, movable blade, rotating disk, rocker arm and coupler in which the fixed blade and moving blade has prismatic joint, coupler and rocker

arm has revolute joint, the coupler and rotating disk has revolute joint and the rocker and moving blade has fixed joint. This mechanism is used to convert rotary motion into the reciprocating motion. This can be achieved by mounting the coupler off set from the center of rotating disk as shown in the Fig.2.

In the Fig.2 the circle represents a rotating disk of thickness "t" , radius "r" and "cs" represents the length of the coupler positioned off sated in rotating disk at a distance "r". When the coupler and the dotted line indicating distance "r" gets collinear at one end the minimum stroke and in the other end maximum stroke is achieved and thus the displacement "S" takes place

For this mechanism, the power for driving the cutting mechanism, is transmitted from the motor with the help of the shaft which is connects motor and coupler. The motor which is running at a 60rpm, which gives rotary motion to coupler and then converted to linear motion, this motor is driven with electric battery of 6V.

Figure 3- Fabrication of Finger Millet Cutting Machine

VI. ANALYTICAL CALCULATION

The maximum displacement of the cutting blades and the velocity of the blades are calculated. The distance by which the slider moves per stroke is given by the following relation.

$x = a(1 - \cos \varphi) + r(1 - \cos \theta)$

Where, x is the linear displacement
a is the length of the connecting rod
r is the length of the crank
φ is the angle subtended by the connecting rod with the horizontal.
θ is the angle subtended by the crank with the horizontal.

The above mentioned relation was used to determine the distance as shown below:

$X = a(1 - \cos \varphi) + r(1 - \cos \theta)$

$= 0.304(1 - \cos 30) + 0.0762(1 - \cos 30)$

$= 0.0407 + 0.01020$

$= 0.0509$ m or 50.9 mm

From this, it can be seen that the upper blades will move by a distance of 50.9 mm for one full rotation of the disc. The speed of the cutter is determined using the following procedure:

$V = r*\omega$

Where, r is the radius of the crank
ω is the angular velocity in rps.

V = 0.1524*0.0762

= 0.0116 m/s.

From this, the speed of the cutter is determined to be 0.0116 m/s or 11.6 mm/s.

VII. COSTING

Table 1. Estimations

SL. NO.	PARTICULARS	RATE	QUNTITY	COST
1	DC Gear Motor	1200	1	1200
2	Battery	650	2	1300
3	Blower Fan	1350	1	1350
4	MS Hollow Pipes	75/kg	7	525
5	MS Sheet Metal	61/sq. ft.	3	266
6	Cutting Blade	40	10	400
7	Form Board	300	1	300
8	Wheels	70	4	280
9	MS Bolts & Nuts (10mm)	25	6	150
9	Welding Charges	-	-	2000
10	Paint Charges	-	-	200
11	Transportation Charges	-	-	500
12	Miscellaneous	-	-	1500
Total		**9971/-**		

VIII. CONCLUSION

The main focus of this project is to obtain designed and fabricated finger millet cutting machine under certain constraints. Mainly this project is developed to reduce the burden of small scale farmers, using this finger millet machine by increasing their profits and reducing labor and machinery cost. The farmers can use this machine with further upgraded in cutter mechanism, especially adjusting the height of the cutter for a certain level and more over this system reduces the cost of machine (up to 15%-25%). And the machine can be operated by the single labor. This is very useful in the areas where labor scarcity is there, and more over skilled labor is not essential for operating the machine. Thus the machine is operated manually using power source and hence maintenance is minimized, meanwhile the service can also be achieved easily and this can give a huge impact in agriculture sector.

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