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ECO-FRIENDLY MULTI SEASONAL HARVESTING MACHINE WITH ADDITIONAL CULTIVATION TECHNIQUES

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ABSTRACT

Multi Seasonal harvesting machine with additional cultivation techniques is apparatus which is used for cutting the various type of crops like Wheat, Rice, Maze, Soybean, etc. and this machine also incorporated with a vertical type rotary tiller which helps in cultivation of field and also in digging action. By this Machine we target small farmers who can't effort today's harvesting techniques. The cutting blades in front which cut the crop in a scissor type of motion. The main advantage of this machine that it is manually operated, in this machine we are not uses any motor and any type of engine. This machine works on shaft and gear arrangement. By the help of gear power is transmitted to cutting blades or vertical rotary tiller. A mechanism is also used for convert the rotary motion to reciprocating/linear motion which is crank and slotted lever mechanism. By this invention small and medium range farmer can harvest their field by themselves and cultivate too.

Keywords: Harvesting, cultivation, scissor, crank, motion, reciprocating, manually.

I. INTRODUCTION

Harvesting and cultivation plays very important role in the field of farming. In now days there are many type of machine which is use for the harvesting and cultivation. But the harvesting and cultivation cost of such type of machine is so high and by the virtue of this high cost small farmers can't afford this method of harvesting and cultivation and until this modern time they are depend on manual harvesting and manual harvesting is performed by the help of sickles and manual cultivation is performed by the help of oxen, spades, plough, etc. The manual harvesting is quite risky in comparison to mechanized harvesting. Some time the small farmers cut their hands with sickles accidently and some time small farmers cut their legs with spades accidentally. So for the safety and better output small farmers always needs these kind of apparatus which makes their work easier. As per the agriculture census of 2015-16, the majority of land holding in India which is 86% are small and marginal farmers most of the farmers are depend on the manual harvesting and manual cultivation. As per 2018 agriculture employed more than 50% of the Indian work force and contributed 17-18% to country's GDP. So by these data we can see that how vast is our Indian agriculture sector.

II. LITERATURE REIVEW

Gonzalo Berhongaray and O. El. Kasmioui; [1] studied the operating process and operation cost of various type of harvesting machine. Manjeet prem, et al; [2] Performed a critical study on crop harvesting machine in which they explain old to modern harvesting techniques. Ratih Dyah Kusumastuti , et al; [3] Review the literature on crop related agri chains to avoid food wastage. Weslay F. Buchele; [4] studied for research in developing more

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efficient Harvesting machinery and utilization of crop Residues. In this they trying to exact information of a true measure of his productivity. Ms. PRATIKSHA YADRAVKAR, et al; [5] Developed such kind of machine which is able to cut the crops and minimize time and labour cost of the farmers. H Mohamed suhail et al; [6] Developed a smart multipurpose agriculture companion for the small farmers which get power by solar energy and perform various operations such as, ploughing, harvesting and land levelling. M. RAJYA LAKSHMI, et al; [7] developed a manually operated machine which is used for harvesting. This machine makes harvesting so easy for the small farmers. Prof. P.B. chavan, et al; [8] developed a kind of reaper which is used to cut the different types of crops with less labour cost and within less time.

Denesh B. Shinde, et al; [9] developed a machine which use petrol engine for the harvesting. Andrey Invanov [10] studied the tillage of soil with minimum energy consumption can be achieved by breaking the bonds between soil aggregates with tensile deformation.

K. J. shinners et, al ; [11] studied the performance characteristics of a tillage machine with active passive components. By this study they found on experimental tillage machine that combines active, rotary – powered tillage elements with conventional passive chisel tines was field tested and these type of configuration could improve the efficiently of tillage machine.

From the above literature review we found the most of the researcher had been tried to make only harvesting machine or only tillage machine. But in our project we made a compact combo of harvesting machine and rotary tiller and also our project is manually operated and uses crank and slotted lever mechanism.

III. METHODOLOGY

In this project we developed a manually driven reaper with a vertical rotary tiller. The reaper is used for cut the grains and the vertical rotary tiller is used for cut the residual part of the grain and vertical rotary tiller is also used for the cultivation of the field. The objective identified to accomplish the goal where, studying and identifying the current mechanism for harvesting and cultivation.

Collecting data on basis of various survey-

- Interpreting data as the problem definition.
- Developing conceptual design with the help of cad software.

3.1 Harvesting

Harvesting is the operation of cutting the mature crop from the field. The main crop is to cut by harvesting operation are Rice, Wheat, Maize, Soybean, etc.

3.2 Method of harvesting

- **Manual harvesting-**

Manual harvesting is perform by the help of sickles. This type of harvesting is time taking little risky in comparison to mechanized harvesting. This type of harvesting is not beneficial for today's era. Manual harvesting is particular, popular in small and medium range farmers.

Figure 1: Manual harvesting

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- **Mechanized harvesting-**

This type of harvesting is performed by the help of machines known as combine. Mechanize harvesting is less time taking in comparison to manual harvesting. Combine harvesting has almost all the qualities of implements. It is a mixed form of reaping, threshing and winnowing. Harvester are getting popular among Indian farmers because of makes work effective and efficient. Harvester are perfect for the Indian fields that are range in size from 0.5 to 10 acres. But the cost of this machine is very expensive when we see around the small and medium farmers. The cost of combine harvester is about 10 to 26 lacks in India.

Figure 2: Mechanize harvesting .

3.3 Cultivation

It is the operation of cultivating the field. The cultivation can be perfume by mainly two way the first one is manual cultivation the second one is mechanized cultivation. There are many type of apparatus is used for cultivation some of these given below-

Cultivator, Rotary tiller, Spades, etc.

3.4 Cutting Blades

In this project we use reciprocating blades. There are two blades is used in this project which is move one of another. The down blade is static blade and the upper blade is movable blade which moves in reciprocating motion upon the down blade.

Figure 3: Blade .

3.5 Working Principle

When we press the pedal of our machine then the apparatus is started moving. The motion from little sprocket is transferred to the big sprocket by the help of the chain drive. And then circular motion of the sprockets is changed by a mechanism into the reciprocating motion. The name of mechanism is crank and slotted lever mechanism which converts the circular motion of sprocket to the reciprocating motion. This reciprocating motion is goes to the reciprocating blades and its works in scissor type action.

Figure 4: Crank slotted lever mechanism .

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IV. MODELING AND ANALYSIS

Figure 5: 3D view of Multi seasonal harvesting machine.

Table 1. Components

SN.	Components	Number	Weight in Kg
1	Crown wheel	1	1
2	Vertical rotary tiller	5	5
3	Sprockets	2	0.75
4	Cutter	2	3
5	Bearing	5	1.5
6	Frame	1	20
7	Wheel	4	8
8	Chain	1	0.5
9	Axle/Shaft	2	5
10	Bevel Gear	1	1

Total weight of vehicle = 45.75 Kg

V. RESULTS AND DISCUSSION

Calculation-

Assuming vehicle is maintained at 50 RPM

No. of teeth on small sprocket = 18

No. of teeth on driven sprocket = 44

Diameter of driving sprockets = 0.084m

Diameter of the driven sprockets = 0.18m

Gear ratio of the crown wheel and pinion = 1:4.1

Speed of the crown wheel = 50 RPM

Speed of pinion = Speed of the driven sprocket (n_2) = 50 x 4.1 = 205

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$$\text{Velocity ratio of chain drive} = \frac{n1}{n2} = \frac{z1}{z2}$$

From this speed of the cutter is determined –

$n_1 = 0.41 \times 205 = 83.86$

$n_1 = 84$ RPM

Total width of the vehicle = 0.75m

Total length of the vehicle = 1.5m

Diameter of the axle wheel = 0.3m

Distance travelled by the vehicle for one revolution of the wheel = $\pi d = \pi \times 0.3 = 0.94$m

1 acre = $4046.9m^2$

1 hectare = $10000m^2$

No. of revolution made by wheels to cut 100m length = 106

No. of rows the vehicle has to travel to cover 100 m length = 133.33

$$\text{The time taken to cut 1 hectare} = \frac{\text{Total no. of revolution made by the wheel to cut 1 hactare}}{\text{Speed of the vehicle}}$$

$$= \frac{14133.33}{50x60} = 4.71 \text{ hours}$$

Result-

This project is mainly made for the small scale farmers. If a farmer depend on sickles based harvesting than its takes to much time and too much labour cost in comparison to our machine. If the farmer is goes for combine harvesting then its cost too much which is not beneficial for the small and medium range farmers. But by the help of our multi seasonal harvesting machine farmer can done harvesting in less time and less cost in comparison to other method.

VI. CONCLUSION

The multi seasonal harvesting machine with advance cultivation technique we have designed with a new concept in which many action performed like harvesting, cultivation and vertical rotary tiller also ruined the residual stubble which later works as fertilizer. There is no such type of compact machine present in the market till. This machine mainly designed for small scale farmers. This machine is a eco-friendly machine because this is manually operated and by the virtue of there is no use of petrol, diesel and such type of hazardous fuel. For the operation of this machine there is no need of highly skilled labour.

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