

# Design and Fabrication of Harvesting Machine

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**Abstract-** This 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 two stroke petrol 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. This compact harvester is manufactured using locally available spare parts and thus, it is easily maintainable. This harvester might be the solution to the problems faced by a small scale farmer regarding cost and labor implementation. After testing this machine in farm it is found that the cost of harvesting using this harvester is considerably less as compare to manual harvesting.

**Index Terms-** Manual method, Mechanized method, Peak working, Crop cutting.

## I. INTRODUCTION

Recently Vidarbha has seen a shortage of skilled labor available for agriculture. Because of this shortage the farmers have transitioned to using harvestings. Cutting crop manually using labour but this method is very time lengthy and time consuming. The harvestings are available for purchase but because of their high costs, they are not affordable. However, agriculture groups make these available for rent on an hourly basis. But the small holding farm owners generally do not require the full-featured combine harvestings. Thus, there is a need for a smaller and efficient combine harvesting which would be more accessible and also considerably cheaper. The mission is to create a portable, user-friendly and low cost mini harvesting machine.

### I. I Need of harvesting machine

In conventional harvesting process, the crop is cut manually by labour and then this crop is get threshed

by Thresher. It takes time and it is not effective as they can work only 5-6 hours in a day. Even though the small scale farmers who having land less than 5 acres, it takes two to three days to cut and harvest the crops. After plantation of crops, if proper care is not taken then non-required plants also grows with crop. So, to separate this unwanted plant while harvesting is tedious work. Aim of our project is to target small scale farmers who's having land less than 5 acres.

## II. PROPOSED SYSTEM

### II.I Reaper machine

Grain harvesting is the important part in agricultural mechanization. The use of reaper technology in developing countries to minimize the product cost which will be result in economic development of agricultural production. This paper tends to provide the design and development of manually or mechanically operated reaper machine.



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



### III. DESIGN PROCESS

It is the systematic, Theoretical analysis of the methods applied to a study or to the theoretical analysis of the method and principles associated with branch of study.

1. Studying the present mechanisms.
2. Field Survey
3. To identifying the potential problem.
4. Problem definition.
5. Literature review.
6. Design of crop cutter.
7. Calculation.
8. Drawing of project.
9. Fabrication.

### IV. CALCULATIONS

#### IV.I Design of cutting blade

Types of cutter bar - knife edge section  
 Length of cutter bar-800mm  
 Knife section- standard  
 Blade type- Rectangle  
 Width-38mm Thickness-3mm  
 Angle between cutting edge and axis of knife section-  
 31°  
 Rake Angle-22°  
 Material-High carbon steel

#### IV. II Determine number of blades on reel

Deflection angle  $\theta = 54^\circ$   
 Reel rotational speed=40 Rpm  
 Rotational velocity of the reel  
 $\omega = 2\pi N/60 = 2\pi \times 40/60 = 4.18 \text{ Rad/sec}$   
 Peripheral speed of the reel  
 $\mu = \omega \times R = 4.18 \times 60 = 2.50 \text{ m/s}$   
 Reel speed ( $V_m = u/1.5 = 2.5/1.5 = 1.66 \text{ m/s}$ )  
 $R_o = V_m/\omega = 1.66/4.18 = 36 \text{ cm}$   
 By the equation

$$\omega t = \sin^{-1}(R_o/R \times \sin \theta) \times \pi/2 - \theta$$

The angular displacement bar

$$\alpha = \omega t - \cos^{-1}(Z/R + \cos \omega t)$$

$$\omega t = 73.89^\circ$$

#### IV. III Design of chain

Power transmitted = 4.84KW (smaller sprocket at 100rpm)

Speed of chain = 1.06m/s

Reel maximum Torque = 1000N-m

Reel speed = 40Rpm

Reel load = 573N-m

$VR = N_1/N_2 = 100/40 = 2.5 = 3$

#### STEP 1- DESIGN OF POWER

$P_d = P_r \times K_I$

$K_I = 1.4$  (moderate shock 24hr/day)

$$= 4.84 \times 1.4$$

$P_d = 6.776 \text{ K}$

$P_d = 6.776/0.746 = 9.0831 \text{ HP} = 10 \text{ HP}$

Assume single strand

$N_1 = 100 \text{ rpm}$

Chain No-100

Number of teeth  $T_1 = 20$  teeth

Pitch = 31.75mm

PITCH DIAMETER OF SMALLER SPROCKET

$D_p1 = P/\sin(180/T_1)$

$$= 31.75/\sin(180/20) = 202.96 \times 10^{-3} \text{ m/s}$$

Pitch line velocity

$V_p = \pi d_p1 \times N_1/60$

$$= \pi \times 202.96 \times 100/60$$

$$= 1.0626 \text{ m/s}$$

$$= 63.7617 \text{ m/min}$$

Power capacity/strand

$P = P^2[V/104 - V^{1.41}/526(26 - 25\cos(180/T))] \times K_c$

$$= 31.75^2[1.0626/104 - 1.0626^{1.41}/526 \times (1.3077)] \times 1$$

$P = 7.5695 \text{ KW}$

$P = 7.5695/0.746 = 10.14 \text{ HP}$

NO.OF STRAND

No .Of strand =  $P_d/\text{Power capacity per strand}$

$$= 10/10.14 = 0.9861 = 1$$

Hence here assumption of single strand is right

TOTAL POWER

Total power = power/strand  $\times$  no of strand

$$= 10.14 \times 1 = 10.14 \text{ HP}$$

NO OF TEETH ON BIGGER SPROCKET

$N_1 T_1 = N_2 T_2$   $100 \times 20 = 40 \times T_2$

$$T_2 = 50$$

PITCH DIAMETER OF BIGGER SPROCKET

$D_p2 = P/\sin(180/T_2)$

$$=31.75/\sin(180/50)$$

$$=505.64 \times 10^{-3} \text{ m/s}$$

**LENGTH OF CHAIN**

$$L_p = T_1 + T_2/2 + 2C/P + P \times (T_1 - T_2)^2/40C$$

$$C = D_p/2 + D_p/2$$

$$C = 607.12$$

$$L_p = (20 + 50/2) + (2 \times 067.12/31.75) + (31.75 \times (2050)^2/40 \times 607.12)$$

$$= 74.97 = 75$$

**ROLLER CHAIN DIMENSION**

$$\text{Roller chain diameter (dr)} = 5/8 \times p = 5/8 \times 31.75 = 19.84$$

$$\text{Pin diameter (dp)} = 5/16 \times p = 5/16 \times 31.75 = 9.92$$

$$\text{Chain width (w)} = 5/8 \times p = 5/8 \times 31.75 = 19.84$$

$$\text{Thickness of link plate} = 1/8 \times p = 1/8 \times 31.75 = 3.96$$

$$\text{Maximum height of roller link plate (Hp)} = 0.95 \times p = 0.95 \times 31.75 = 30.1625$$

$$\text{Maximum height of pin link plate} = 0.82 \times p = 0.82 \times 31.75 = 26.035$$

**DIAMENSION OF SMALLER AND BIGGER SPROCKET**

$$\text{Width of sprocket for single strand to} = 0.85 \times p - 0.15 = 0.85 \times 31.75 - 0.15 = 18.265$$

$$\text{Transverse pitch (A)} = 1.1525 \times p = 1.1525 \times 31.75 = 36.5918 \text{ mm}$$

$$\text{Corner relief (e)} = 0.125 \times p = 0.125 \times 31.75 = 3.96 \text{ mm}$$

$$\text{Chamfer radius (r)} = 0.54 \times p = 0.54 \times 31.75 = 17.145$$

**V. ENGINE SPECIFICATION**

Table V. I Engine Specification Engine Specification of scooter

Engine Type	Two stroke
Engine Displacement	145.45cc
Engine starting	Kick type
Maximum Power	7.5 BHP@5500 rpm
Maximum Torque	10.8 NM @3500 rpm
Transmission	4 Speed



**VI. DIMENSION OF VEHICLE**

Table VI. I Dimension of machine:

Part of Vehicle	Dimensions/ Weight
Size of vehicle body	2100mm×990mm×1200 mm
Wheel diameter	400 mm
Size of blade	850 mm × 60 mm
Ground clearance	200mm
Total height of machine	1200mm
Size of container	4000mm×950 mm× 480 mm



**VII. ADVANTAGE**

- 1) The machine have compact design lead to requirement of less workspace because of which operator can easily control over the machine handling
- 2) Due to less cost reduces the initial cost of machine allow pure farmers to buy this machine.
- 3) The machine is suitable for small as well as large farms due to its less weight and higher work efficiency.
- 4) As greater diameter of cutter increase the cutting area and also the cutting parameter which includes force torque etc.
- 5) Due to the provision of regulator speed of cutter can be varied according to the load capacity required.
- 6) The greater sizes of wheel allow the machine to move freely on the field

**VIII. APPLICATION**

- 1) It is used in agriculture field for multipurpose cropping.
- 2) It is used to crop the paddy of rice ,wheat and soyabean

## IX. OBJECTIVE

- 1) Design should be 'Simple' to operate and 'Safe'.
- 2) It should have 'Low Cost of Maintenance'.
- 3) It should require Less Man Power.
- 4) The design should be Robust and Reliable
- 5) The design should consist of a threshing unit

## X. CONCLUSION

The main objective was to make simple, compact, efficient and low cost small scale harvester for small land holders. This machine fulfilled all objective and following conclusion was drawn on based of work:

- On the basis of literature review, all specification regarding small scale harvester were meet. - After assembling the machine was tested on field for its efficiency and capability. the result got was as per our expectations from machine

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