International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 05 Issue: 01 | Jan-2018 www.irjet.net p-ISSN: 2395-0072

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 labour 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.*

KEYWORDS: *Manual method, Mechanized method, Peak working, Crop cutting.*

1. 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. The idea was to create a machine which is cheap and will reduce the labour required to harvest crops. This machine has the capability and the economic value for fulfilling the needs of farmers having small land holdings (less than 2 acres). This machine is cost effective and easy to maintain and repair for the farmer.

1.1 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.

2. PROPOSED SYSTEM

2.1 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

2.2 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.

3. 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.

4. Calculations:

4.1 Design of cutting blade

types of cutter bar - knife edge section

length of cutter bar-800mm

knife section- standard

Blade type-Rectangal

Width-38mm

Thickness-3mm

Angle between cutting edge and axis of knife section-31°

Rake Angle-22°

Material-High carbon steel

4.2 Determine number of blades on reel

Deflection angle Ø =54º

Reel rotational speed=40 Rpm

Rotational velocity of the reel

ω=2ЛN/60=2Л*40/60=4.18 Rad/sec

Peripheral speed of the reel

μ=ω*R=4.18*60=2.50m/s

Reel speed (Vm=u/1.5=2.5/1.5=1.66m/s)

Ro=Vm/ω=1.66/4.18=36cm

By the equation

$\omega t=Sin^{-1}(Ro/R*sin\emptyset)*Л/2-\emptyset$

The angular desplacement bar

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

ωt=73.89°

4.3 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=N1/N2 =100/40=2.5=3

STEP 1- DESIGN OF POWER

Pd=Pr*Kl

Kl=1.4 (moderate shok 24hr/day)

=4.84*1.4

Pd=6.776K

Pd=6.776/0.746=9.0831 HP =10HP

Assume single strand

N1=100rpm

Chain No-100

Number of teeth T1=20teeth

Pitch=31.75mm

PITCH DIAMETER OF SMALLER SPROCKET

Dp1=P/sin(180/T1)

=31.75/sin(180/20)=202.96*10^{-3}m/s

Pitch line velocity

Vp=Лdp1*N1/60

=Л*202.96*100/60

=1.0626m/s

=63.7617m/min

Power capacity/strand

$P=P^2[V/104-V\hat{}1.41/526(26-25COS180/T)]*Kc$

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

P=7.5695KW

P=7.5695/0.746=10.14HP

NO.OF STRAND

No .Of strand=Pd/Power capacity per strand

=10/10.14=0.9861

=1

Hence here assumption of single strand is right

TOTAL POWER

Total power=power/strand*no of strand

=10.14*1=10.14HP

NO OF TEETH ON BIGGER SPROCKET

N1T1=N2T2

100*20=40*T2

T2=50

PITCH DIAMETER OF BIGGER SPROCKET

Dp2=P/sin(180/T2)

=31.75/sin(180/50)

=505.64*10^{-3}m/s

LENGTH OF CHAIN

Lp=T1+T2/2+2C/P+P*$(T1-T2)^2$/40C

C=Dp2+Dp1/2

C=607.12

Lp=(20+50/2)+(2*067.12/31.75)+(31.75*$(20-50)^2$/40*607.12)

=74.97=75

ROLLER CHAIN DIMENSION

Roller chain diameter (dr)=5/8*p=5/8*31.75=19.84

Pin diameter (dp)=5/16*p=5/16*31.75=9.92

Chain width (w)=5/8*p=5/8*31.75=19.84

Thickness of link plate =1/8*p=1/8*31.75=3.96

Maximum hight of roller link plate (Hp)=0.95*p=0.95*31.75=30.1625

Maximum hight of pin link plate=0.82*p=0.82*31.75=26.035

DIAMENSION OF SMALLER AND BIGGER SPROCKET

Width of sprocket for single strand

to=0.85*p-0.15=0.85*31.75-0.15=18.265

Transverse pitch(A)=1.1525*p

=1.1525*31.75=36.5918mm

Corner relief (e)=0.125*p=0.125*31.75=3.96mm

Chamfer radius(r)=0.54*p=0.54*31.75=17.145

5. ENGINE SPECIFICATION

Table 5.1 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

6. DIMENSION OF VEHICLE

Table 6.1 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

9. ADVANTAGE

1) The machine have compact design lead to requirment 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

10. APPLICATION

1) It is used in agriculture field for multipurpose cropping.

2) It is used to crop the paddy of rice ,wheat and soyabin

11. 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

12. 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 were 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

13. ACKNOWLEDGEMENT

Indeed it is a matter of grate felicity and privilege for us to work under the guidance of PROF.AMEY OZARKAR, Department of MECHANICAL Engineering, K.D.K. College of Engineering, Umrer Who constantly supported and encourage us during every step of dissertation. We really feel highly indebted to him for constantly guiding us to continue our work and giving us short term goals, which we acknowledge our gratitude an regards to PROF. D.R. THAWAKAR Head of The Department of MECHANICAL Engineering, K.D.K. College of Engineering Who were kind enough to share there precious time ads well as for there keen interest and continuous support.

We would also like to acknowledgment Dr. A.C. WAGHMARE, Principal, K.D.K. College of Engineering, Umrer for his great cooperation and support

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