DESIGN AND FABRICATION OF REAPER MACHINE FOR WHEAT AND RICE CROP

Abstract

The remaining goal of agriculture or farming in India isn't best limited to developing of plants but is likewise associated with the monetary growth of farmers and labours. Small scale farmers regularly face the problem of labour shortage or are unable to find the money for the wages to be paid. It's miles therefore, critical to adopt the mechanical strategies in order that the timeliness in harvesting operation might be ensured .Considering different factors as strength requirement , value of system , ease of operation , field circumstance , time of operation and climatologically conditions. It runs on two stroke petrol engine of 3HP, this energy from engine, is provided via pulley and equipment field arrangement to the cutter. This compact harvester is manufactured the usage of regionally to be had spare elements and as a result, it's far effortlessly maintainable. This harvester is probably the solution to the troubles faced by a small scale farmer regarding fee and labour implementation.

Keywords: Agriculture, Reaper, cutting Blade.

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I. INTRODUCTION

Agriculture is the backbone of India. In India agriculture has going through serious demanding situations like shortage of agricultural labour, in peak running seasons however additionally in normal time. That is especially for increased nonfarm activity possibilities having higher salary, migration of labour force to towns and occasional status of agricultural labours in the society. In India sort of crop reducing like as guide technique (traditional method) and mechanized sort of crop cutter. The crop reducing is essential level in agriculture subject. Currently Indian former used conventional technique for crop cutting i.E. Cutting crop manually the use of labour however this method is very prolonged and time eating. To design and analysis the crop cuter system that is help to the Indian former which is in ruler side and small farm. It'll lessen the cost of crop cutting in discipline. It's going to assist to growth inexpensive trendy in Indian former. In modern times, powered machinery has changed many jobs previously done by guide labour or through operating animals such as oxen, horses and mules. The history of agriculture consists of many examples of tool use, including the plough.

Mechanization entails the usage of an intermediate tool among the strength supply and the paintings. This intermediate device usually transforms movement, along with rotary to linear, or affords a few type of mechanical gain, together with pace boom or lower or leverage. Modern mechanized agriculture consists of using tractors, vans, combine harvesters, airplanes (crop dusters), helicopters, and other cars. Cutting-edge farms even from time to time use computers along side satellite tv for pc imagery and GPS steering to boom yields. Reapers are used for harvesting of vegetation broadly speaking at floor stage. Reapers are labeled on the idea of conveying of plants. It avoids gas intake, labour requirement. Because the population of India will increase each day, there may be increment of meals, vegetables so need of farm mechanization additionally will increase, machineries presents extra operations in much less time, however the machineries are very pricey for the commonplace guy, it is not less costly for them ,so manually operated machineries, system's are also the most essential thing. Reaper harvesters then again are different opportunity harvesting equipment, furnished straw is taken into consideration as economic derivative for animal feed and/or commercial applications. Keeping these in view, a feasibility observe became undertaken to lessen the value of harvesting in paddy crop via mechanization of harvesting and operated by hand reaper is more vital it, this type of reaper can without difficulty be operated by way of unmarried man or woman, handiest the pushing efforts are required in less financial system, easily inexpensive for farmers for maintaining the better farming.

The reaper may be very compact and consumer friendly low value mini harvester and collector machine so that you can simultaneously carry out each jobs of harvesting and collecting the harvested plants. This gadget is value powerful, smooth to hold and may be surely synthetic because it incorporates of domestically available spare parts. Manual labour takes time and isn't always effective as they are able to paintings for three-four hours at a stretch. In line with oral survey, on a mean five labours are required to reap 1 acre of wheat crop and rice crop in an afternoon. Despite the fact that the land holding is small it takes about four-5 labours and they will take a time of or three days to absolutely harvest the wheat and rice crop by the use of this harvesting system, hassle of the labour crises may be decreased. As compared with manual harvesting only 1-2 labours are required. This makes the procedure quicker consequently reduces maximum of the harvesting time. So, it reduces

the labour price. Sincerely this machine can be utilized by maximum quantity of fanners. Farmers can conquer the labour crises trouble. The productivity is also improved. In the usa like India wherein the principle supply of profits is agriculture. Desires to concentrate in some components like how to increase productivity and income, how to reduce price and a way to remedy and simplicity the troubles of employees. To conquer this a

New operated by hand cutter is fabricated for cutting of multiple sorts of crop in the course of harvesting. It possesses 4 criterion ease in manufacturing, ease in dealing with, low cost and mild weight. There are a few strategies involved in fabrication of this device which include fabricating prototypes, cloth & aspect choice, and so forth. Slow agricultural boom is a hobby for policymakers as -thirds of India's human beings rely upon rural employment for a living. The agricultural practices which might be currently hired are neither economically nor environmentally sustainable and India's yields for many agricultural fabric are relatively low. The time saved turned into almost 1/third to that of guide harvesting.

1. **Hassle Announcement:** Manual exertions takes time and is not powerful as they can work for 3-four hours at a stretch .Even if the land conserving is small, it takes two or three days to absolutely harvest the crop. Excessive prices of machines and upkeep, non-availability of suitable agricultural machines and system that cater to and match the necessities of small scale farms. In traditional harvesting system, the crop is cut manually by using labour and then this crop is get threshed by way of Thresher. It takes time and it isn't always effective as they can paintings only 5-6 hours in a day. Despite the fact that the small scale farmers who having land much less than five acres, it takes to a few days to reduce.

2. **Goal:**

   - To reduce the time required for slicing crop manually.
   - To increase the capability of the operating and reducing and it is able to viable the maximum crop reducing within minimal time.
   - To lessen the fee of reducing crop within the agriculture, it is able to reduce crop in cheap rate as it saves the worker price .
   - To keep away from harms to the labour's.

3. **Scope:** This system also can be used for slicing other plants including cotton stalks and maize. As the sphere is choppy, the cutter top varies from mode to node, so a slider mechanism may be used to vary the peak of cutter on occasion.

II. LITERATURE REVIEW

1. **Amar B. Mule,** etc All, Jan-2018,layout and Fabrication of overall performance in Reaper device says The reaper, first developed in 1830 via a Virginia farmer, Cyrus McCormick, cuts the wheat at a particular peak and leaves the reduce stalk in rows beside the mattress. Men then follow collecting the bundles into sheaves (reaper windrower), or the reaper bundles the sheaves itself (reaper-binder) (Dvorak, 2009). Relying on their creation functions (adjustability of top, width of cutter, whether or not self-propelled or tractor established), the paintings ability of those machines range from three-20 h/ha with grain losses lower than 2 percentage. The thresher basically separates the grains from the

straws. The primary degree involves setting the bundles of stalk into the feeder, which controls the feeding fee of the gadget to prevent overloading. The combine harvester, being the maximum common and efficient device for harvesting crops, is capable of doing the 3 simple harvest operations (slicing, threshing and winnowing) multi-function, therefore the name combine harvester. The basic devices for the design of a combine harvester are the cutting, conveying and threshing devices.[1]

2. **ImrulKaes**, etc All (2017), design and analysis of Arm of Reaper and Binder system, says until the 19th century, most grain changed into harvested with the aid of cutting with a sickle, scythe, cradle or manual mowers then manually flailed or crushed to interrupt the bond of the grain with the stalk, then winnowed to split the grain from cloth other than grain. Inside the developing world, these practices or the use of small stationary threshers are nonetheless in use for grain harvesting. A sickle is a curved, handheld agricultural tool typically used for harvesting grain plants before the appearance of contemporary harvesting machinery. The interior of the curve is sharp, in order that the person can swing the blade against the base of the crop, catching it inside the curve and reducing it at the identical time. Scythe is a comparable tool with the sickle used to reap grain crops. The most considerable difference among a sickle and the scythe is the form of the blade of which the Scythe blade is more linear whereas a sickle blade is greater inside the form of a C with a factor at the pinnacle. Cradle is a greater advanced tool for reaping and harvesting. It includes an association of hands connected by way of a light frame paintings to the take hold of of a scythe. Its reason is to gather the straw as it's miles reduce and deposit it in a swath. On the end of the cutting stroke, the cradle is tilted to drop the straw in a pile. Additionally, appreciably more grain may be reduce in an afternoon with the cradle. But, loss due to shattering (grain dislodged from heads due to shock) is more with the cradle which makes to keep using the sickle to reap grain. Reapers are harvesting-machines used for slicing grain-vegetation. They either deliver the grain to 1 facet in gavels geared up to bind into sheaves, or elevate the gavels upon platform where two operators bind them into sheaves through hand. Throughout the nineteenth century, mechanical reapers and binders have been evolved to cut and windrow grain for subject drying. The sheaves had been then hauled to stationary threshers. Round around the begin of the twentieth century animal drawn machines, “combines,” were evolved that included cutting, threshing, and separating wheat and small grains.[2]

3. **C. Aravind C,** and many others All (2015), design and Fabrication of Agricultural reaper says et. Al paper made via student of BNM Institute of era, Bangalore. They supplied layout concept of Paddy harvester and calculation among conventional and modern harvester.[3]

4. **Mr. P. B. Chavan,** and many others All (2015, overall performance assessment of reaper-binder in rice crop says Dhondg. Diverse approaches had been proposed for improving mechanized sort of crop cutter in agriculture area. Designing a reaper machine to reap grains extra effectively. The studies paintings specializing in harvesting operation to the small land holder to slicing styles of crop in much less time and at low Fee with the aid of considering the element as electricity requirement, ease of operation , discipline circumstance , time of operation and climatologically situation.[4]

5. **Laukik P. Raut,** and so on All, (2014), design, improvement and Fabrication of a Compact Harvester, say et. Al venture made by scholar of GHRCE Nagpur. They made current reaper at low fee which is useful and green for small land holder.[5]

III. DESIGN METHODOLOGY

1. **Frame:** A truss of body can be defined as a shape, made up of several bars, riveted or welded collectively. Those are made from attitude irons or channeled segment and are referred to as member of body or body structure.

   Specifications
   Body size =l*b*h=eighty*50*eighty cm
   Cloth =mild metallic

2. **Engine Specifications:**

   Four-stroke petrol engine
   Engine electricity-1HP
   1HP= 746 Watt
   RPM=6000

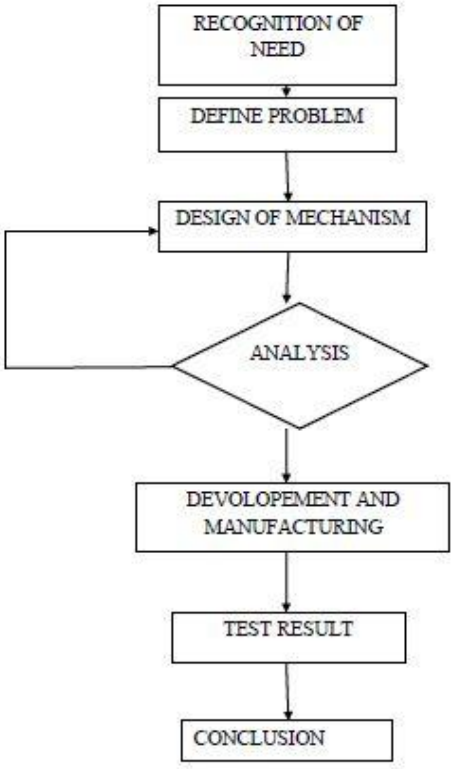

Figure 1: Design Methodology of Fabrication of Reaper Machine for Wheat and Rice Crop**.**

- **V-Belt Pulley:** V Belts are used due to the fact its benefits over flat belts in compact transmission Design. Engine power is transmitted to their spur gear field with the assist of belt power

Specs
N1=Engine RPM=6500
D=dia of small pulley
D=dia of large pulley
N1*d=N2*D
6500*2.Five”=N2*6”
N2=2708 Rpm

- **Spur Gearbox:** The principle advantage of gear pressure is that it transmit equal velocity ratio and also it's far used to transmit a very massive energy with superb dependable carrier.

  Specifications
  Pinion=19 enamel
  Tools=sixty eight enamel
  T2=No of enamel on pinion
  N3=Output rpm
  T3=No of tooth on tools
  N2*T2=N3*T3
  2708*19=N3*sixty eight
  N3=756 rpm

- **Bevel Gearbox:** Bevel gear box is used to exchange course of movement with the aid of 90 degree. This sort of tools field is used due to the fact there was a need to transmit power to 2 mechanisms that is slider crank and gathering mechanism.

  Specification
  Pinion=10 teeth
  Equipment=sixteen tooth
  N4=N3
  T4=No teeth on pinion
  T5=No of tooth on equipment
  N4*T4=N5*T5
  756*10=N5*sixteen
  N5=472 rpm

- **Belt Drive for Engine:**

  N1=6500 rpm
  N2=2708 rpm
  Carrier element for engine=1.2
  Small pulley dia=2.Five”
  Massive pulley dia=6”
  C=centre distance =6+2.5=8.5”
  C=215.Nine mm
  L=period of belt=2C+1.Fifty seven(D+d)+1/4C*(D-d)^2α=sin^-1)
  α=eleven.88
  Ɵ=π-2α=156.24

Fc=belt period correction element=0.63
Fd=arc of touch of correction issue=0.94
Pd=design power=fa*p
=1*0.7 =zero.7 Kw
Z=no of belt=p/ pd*Fd*Fc=1.77=2.

- **Gathering Mechanism:** The amassing belt is used to carry out crops sideways proper amassing of crop is very essential to reduce grain losses.

  Specifications
  Dc=dia of small pulley=2”
  Dc=dia of huge pulley=3”
  C=dc+Dc=5”
  L=duration of belt=2C+1.Fifty seven(D+d)+1/4C*(D-d)^2
  =19.89”=505 mm
  α=sin^-1(D-d/4C)
  α=5.Seventy three
  Θ=π-2α=168.54
  Fc=0.59
  Fd=zero.97
  Zc=0.7/07*zero.Ninety seven*zero.59
  Zc=1.Seventy four=2
  D/d=n/N
  3/2=n/472
  N=708 rpm

- **Cutting Mechanism Specification:** Cutter blade is riveted on 3 mm plate and in desk bound cutter blade having thickness 5 mm.

  V=π**d*n/60
  V=1.88 m/sec
  Vc=1.88 m/sec

  H. Shaft
  Material=40C8 medium carbon metallic
  Syt=380 N/mm^2
  Sut=660 N/mm2
  Nf=factor of safety=2
  Shear stress
  τ=zero.75*zero.18*Sut
  =89.1 N/mm2
  τ=0.Seventy five*0.18*Syt
  =eightyfive.Five N/mm2
  P=2IINT/60
  T=2.46*103 Nmm
  τ =16T/πd
  D=10 mm

This is by theoretical consequences, however in real practice we're the usage of d=12mm which is Safe for layout.

Diameter of large sprocket =12mm
Assuming thing of protection = 2
Shear stress = 7 N/mm2
Shear pressure of the Shaft
Fs = a hundred and seventy N
T=F*R
F=4.44 N
As per Calculation.
Feet=0.3097 N
Fa=zero.1546 N
Fr=zero.2109 N
Take moment at factor A
ΣMA=90×one hundred twenty-Rb×410-zero.3097×500-5=zero
∴ Rb=34.Seventy five
ΣY=0
=RA-ninety+RB+zero.3097
=RA-ninety+34.Seventy five+zero.3097
∴ RA=54.Ninety four
Moment at point B
MB=fifty four.94×205=11537.Four N.Mm
Second at factor C = 432 N.Mm
Max MB=11537.4 N.Mm
Bending second at point B
ΣMB=0.2109×180=18.981 N.Mm
Max Bending moment
=((18.981)2 +(11537.4)2)(half)
=11537.4 N.Mm
Wherein,
Kb=1.5
Kf=1.5
Te=((Kb M)2+(Kt T)2))(half)
Te=((1.5×(11537.Four)2+1.Five(26.69)2)(half)
Te=17.30 N.M
Layout of shaft is safe.

3. **Bearing:** A bearing is a gadget element that constrains relative movement and decrease friction between shifting components to simplest preferred motion . The design of the bearing may additionally, for example, offer without cost linear motion of the shifting part or free of charge rotation round a set axis ; or ,it can prevent a movement with the aid of controlling the vectors of regular pressure that endure at the transferring element . Bearing is subjected to radial as well as axial loading. Decided on bearing as in line with general table.

Duration of shaft = 50cm =500mm
F=((Fr)2+(Fa)2)(1/2)

Wherein,
Fr=Radial force in ,N
Fa=Axial pressure in,N
Fa=fb=F/2N
Equal Dynamic Load
Pe=Vfa×Ka
Pe=1.Five×f×1.25
Pe=1.875 F
Rating life
L20= (Lh20×60×n)/106
Total Load acting on Bearing
F=F1+F2
= 1404.22 + 782.561
= 2186.Seventy eight N
RA=RB=F/2
= (F1+F2)/2
=2186.78/2
=1093.39 N
Radial Load on Bearings
Fr=RA=RB
Equivalent Dynamic Load on Bearing
Pe=Fr×Ka
=1093.39 × 3
=3280.1715 N
Score existence
Lh05= (30000×60×60)/(10)6
108 million revolution
L05= (four.48×L10(Loge 1))/(Rn) (1/1.Five)
L10=174.Sixty two million revolution
L10= C/(Pe)a
174.Sixty two= C/(1093.39)3
C = 6111.38 N
C = 6.Eleven KN
Dia of Shaft = Bore dia.(D) = 12 mm
Bearing No = 6001
Outdoor Dia.Of Bearing(D) = 28 mm
Width of Bearing(B) = eight mm
Static ability of Bearing (Co) = 2.36 KN
Dynamic potential of Bearing(C) = 5.Four KN
Maximum pace = 6000 RPM

4. Cutter:

Specs
Cutter Materail = 35C8 undeniable Carbon steel
Thickness-3mm
Angle = 60°
Blade length = 702 mm
Shaft = 500 mm

Unmarried Blade = seventy eight mm
Shear strain Required for cutting Crop,
Max.Shear stress = 5 to six N/mm2,for dry vegetation.
= 7 to twelve N/mm2,for moist vegetation.

Maximum Shear electricity we get an perspective 35 to 45 diploma
Cutting speed V = 1.88 to 2m/s
Bending pressure = forty.Five to 45 N/mm2
Carbon harden tempered steel cloth is used , but we use MS sheet fabric in actual.

Okay. Wheel
A wheel is made up of rubber with the diameter of 210 mm and width 35 mm. Two wheels is used in this gadget for the movement. Distance between two wheels is 300 mm. Internal diameter of wheel to connecting of shaft is 12 mm.

5. **Crank and Lever:** Kind of crank and lever utilized in machine is single slider crank chain . It is a amendment of the primary 4 bar chain wherein one sliding pair and turning pair is included it converts rotary motion into reciprocating motion and vice versa.

σd=(F×four×d2)/π
σd= (F×four×(12) 2)/π
σd=3.38 N/mm2
σb=(Max Shear stress)/Nf
=42/1.25
= 33.6 N/mm2
Layout is secure.

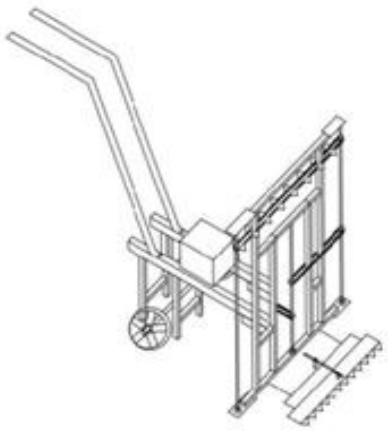

Figure 2: 3D CAD Model of Reaper Machine.

IV. ACKNOWLEDGMENT

THE PREFERRED SPELLING OF THE WORD “ACKNOWLEDGMENT” IN AMERICA IS WITHOUT AN “E” AFTER THE “G.” TRY TO KEEP AWAY FROM THE STILTED EXPRESSION, “ONE FOLKS (R. B. G.) THANKS …” INSTEAD, TRY “R.B.G. THANK YOU …” PUT SPONSOR ACKNOWLEDGMENTS IN THE UNNUMBERED FOOTNOTE ON THE FIRST WEB PAGE.

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