Turmeric Harvester for traditional and mechanized way of cultivation

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Abstract: In the agricultural environment, Turmeric cultivation is one of the major activities. A turmeric can grow up to 1 year to a maximum extent and then it must be cultivated. In our areas majorly traditional way of farmers are cultivating the turmeric. They are facing the major drawback of unavailability of machines to cultivate the crop for traditional cultivation. There are number of machines available for the large-scale cultivation. In order to eliminate the difficulties faced by those cultivators, we decided to design the small-scale turmeric harvester for the crop with low cost and this will help the cultivators to cultivate with less labor charge and reach the industries on time.

Index Terms: Turmeric, Traditional, Cultivation, Better Techniques, Harvester, Worm Gear, Chain Drive, Digger, Conveyer, TMT Rod, Shaft, Storage Unit.

1 INTRODUCTION

India is one of the major agricultural countries in the world.As India's population is growing the demand for food will definitely increase for that better techniques of farming are required to increase production. In India agriculture is facing serious challenges like scarcity of agricultural labour, not only in peak working seasons but also in normal time. This is mainly for increased non-farm job opportunities having higher wage, migration of labourforce to cities and low status of agricultural laboursin the society. In order to eliminate the difficulties faced by those cultivators, we decided to design the mini turmeric harvester for the turmeric crop with low cost and this will help the cultivators to cultivate with less labourcharge and reach the industries ontime.

2 EXPERIMENTAL PART

PREPARATION OFCOMPONENT

FRAME-The frame consists of a number of mild steel rods. WORM GEAR-The 40:1 gear ratio was used in the project DIGGER-Ploughing the turmeric cultivation land CONVEYOR-Transfer the turmeric from digger to storage unit with separation of the sand and stones.

UNIVERSAL COUPLING-Transfer the power from the tractor to harvester.

EXPERIMENTAL SETUP

After the machine was fabricated according to the model, the process gets started. In first step the machine was placed on harvesting ground with digger ploughing theground. The tractor began to move then rotating power transmits to the harvester through the universal coupling and gearbox was provided to attain the required speed. The attached belt drive to the gear box begins to rotate, thus rotating the conveyor system. When digger began to plough, turmeric along with the sand particles arise and flow through the conveyor system. The conveyor system was moved the harvest upwards and removes the major sand particles and the harvest was dropped in the collecting basket. Then the turmeric was collected in storage bin and stored then send to the market.

3 CURRENT DEMAND

1. To fabricate an efficient machine particularly for small scale and traditional turmeric harvesting to help the farmers and To reduce the manual strain on theworkers.
2. To set up a machine that is profitable and have straight forward instrument for ploughing the turmeric at a quickrate.
3. To help the traditional farmers to bring their turmeric gatherers are accessible in huge sizes and that is crops to market on time during theseason.
4. To deliver an affordable machine for

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traditional way of cultivationalfarmers.

4 METHOD OF CULTIVATION

In mechanized method usually harvesting is done by large harvester machine which averagely takes about 6-7 hours per acre with yield of 8-10 tons per acre. The cost of harvest sums around 20,000-25,000 per acre

5 EVALUVATION

In this section, we describe the methodology for evaluating computational software and testing on the field. To totally give a plan of the machine, werejoinedtohaveanappropriatestructuretechnique Plan Conceptualization: In view of necessities of the farmers and the market study led. Various emphases of the structure of machine werereadied.

Estimation and framework approval: arranging stage is basic stage as quality, exhaustion, factor of security, each and every particular point was taken while doing the calculations and arrangement

Torque=(HPx5252)/RP

M Ft=HP*75/v

Model making and testing: In the wake of completing the computations, a three-dimensional get together was made for all intents and purposes on the product inside the real conditions which gave a point of view of this present reality and its quality that permits doing testing of any kind possible

. Fs=σyb/pd

Fd=(6+vmg/6

)Ft

For check the condition stratification, FS>= Fd .

Testing: In the wake of amassing the model, testing was done to check the attainability of the model.

6 RESULT ANDDISCUSSION

Turmeric plant are the main sources of turmeric in the world. Out of total turmeric produced in the world 60 per cent is obtained only from turmeric. Asia is the largest producer of turmeric followed by Europe. Production. India is the largest producer, consumer and exporter of turmeric in the world.The motivation behind building up this paper was to create machine to decrease cost and time and labour required for turmeric collecting. By utilizing this harvesting machine and advance procedures we can increase the production in least cost and time. We can likewise take care of the issue of work deficiency. It will be very useful for traditional way of turmeric farmers. It also has future scopes for harvest onion andginger

7 DESIGNCALCULATIONS

A. POWER REQUIRED TO RUN THEHARVESTER:

Powerrequiredtoruntheharvester

Power=2πNT/60000

=2*π*3000*39/60000=12KW

Torque=(HPx5252)/RPM=(22x5252)/3000=39Nm

Torquerequiredbyharvester=(9550xPower)/RPM

=(9550X12)/1666=38Nm<39Nm,

Hence the design is safe.

B. DESIGN OF SHAFT:

Design Torque, N-m

Diameter of shaft =20mm

Permissibleshearstressofmildsteel Fs=34N/mm2 T=/16*fs*d3,

P=2*3.14NT/60,12831=2*314*2

750*T/60=>T=4Nm,

4=3.14/16*(fs)*(0.02)3,

fs =1.57N/mm2=>fs<Fs

Hence the design is safe.

C. DESIGN OF SPURGEAR:

N2=N1/ı=3000/40=75rpm.

v=Πdn/60000

=π*mx*z2*N2/60000

=π*m*40*75/60000=0.157mx

CALCULATION OF DYNAMIC LOAD:

Ft=HP*75/v

=22*75/0.157mx

Fd=(6+vmg/6)Ft

=19266.5/mx

STRENGTH OF GEAR:

Fs= σyb/p d

FROM DESIGN DATA BOOK,

y=0.392,σ=400kgf/cm2,b=0.75d,d=q*mx

, b=0.75*11*mx

FS=400*0.392*0.75*11*mx2=1293.6mx2

Forchecking,Fs>=Fd,1293.6mx2=19266.5/mx mx=3

FACE WIDTH:

b=0.75*11*mx=0.75*11*3=24.75mm

PITCH RATE VELOCITY:

v=0.157mx=0.471м/s=28.26 m/min.

RECALCULATIONOFTANGENTICALLOAD:

Fd=(6+vmg/6)Ft

=19266.5/mx

=6422.16kgf

RECALCULATIONOFDYNAMICLOAD:

FS=1293.6mx2

=7761.6kgf

FS>=Fd.

Hence the design is safe

DESIGN OF CHAIN:

Design Power=Rated Power×Service Factor

=16×1.25×1×1×1.5×1.25

=38.46KW

Power Transmission

V=PZ1N1/60000

=31.75m/s

N=Qv/102nks

16=Q×31.75/102×18×2.343

Q=2167.81kgf

Fromdatabook

P=15.875,D=7.75mm,pb=2220kgf

pb>Q,

Hence the design is safe.

Lengthofcontinuouschain

z1=14teeth,z2=28teeth

Lp=2ap+z1+z2/2+(z1+z2/2π)2/apap=a0/p=4

00/15.875

=25.196mm. lp=2(25.196)+42/2+0.1972

=71.58mm

Length Of Chain

l=lp*p

=71.58*15.875

=1136.33mm

DIAMETER OF PINION:

D=P/sin(180/z2)

=15.875/sin(180/14)

=71.34mm

DIAMETER OF WHEEL:

D=P/sin(180/z1)

=15.875/sin(180/28)

=141.7mm

8 VIRTUALMODEL

Theconceptualmodeloftheminiturmericharvesteris providedinFigure1.Themaincomponentsofthemachine areframe,shaft,Spurgear,chaindrive,Digger,Conveyor, Shaft,storageunit.

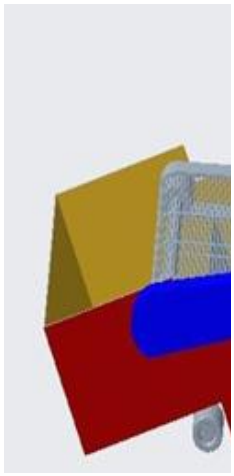
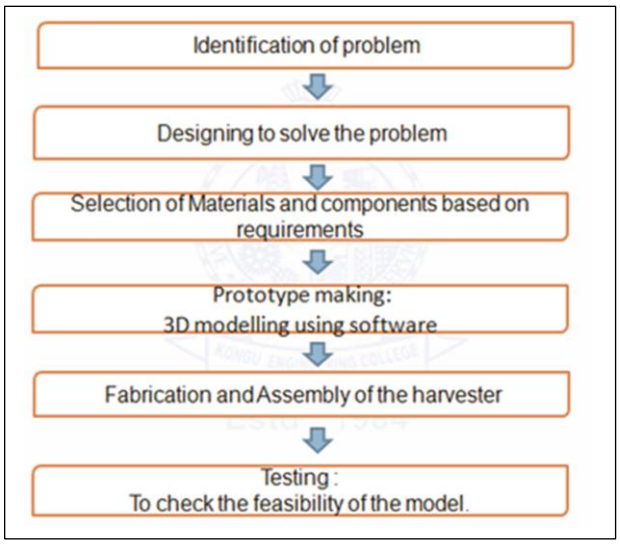


Figure.1*:VirtualModel*

9. ANALYSIS



10WORKING MODEL

Figure2:*WorkingModel*

9 CONCLUSIONS

beenfabricated.Variouscomponentslikeconveyor,digger, frame,chaindrivehasbeendesigned.Thisharvesteris compactandabletoharvestthroughthesmallcultivationarea andwetland.Itisacompactdesignwiththetotalwidthof2feetang4feetlengthcaneasilymovethroughtheharvestarea witha22hptractor.Theworkloadisgreatlyreducedand6hoursperacreandthecostoflabourisalsoverylowcomparedtothelargeharvester.collectorbincancollectupto40kgandfurthermodificationscandonetoincreasethecapacity.

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