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DESIGN AND DEVELOPMENT OF SEED SOWING MACHINE

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ABSTRACT— To develop a better agricultural product like rice, wheat, spices, and pulses direct sowing machine can ensure the operational quality of agricultural product direct sowing improve labor productivity, conserve water resources, decrease pesticide and fertilizer application rate, reduce production costs and labor intensity. The seeds need to be sowed into the soil to allow the maximum survival rate of germination. If the sowing depth is too shallow, the seed will not get enough moisture for growing and if the depth is deep, the seed does not have prper energy and oxygen to grow. The germination and beginning of the lifecycle of a plant depends also on the solidity of the soil also depends on the temperature of the soil, but the seed drill has little effect on these parameters

Keywords- Seeds, Sowing, Seed drill, disks, seed distribution etc.

I. INTRODUCTION

Around 50% Indians are farmer. In Indian Economy strucure Agriculture is the main source of income. In Indian agriculture sector 18 per cent accounts of India's gross domestic product (GDP) and 50% employment of the countries workforce. India produces largest amount of rice, wheat, spices and pulses in world.

For better production in products like rice, wheat, spices, and pulses direct sowing machine can ensure the operational quality of agricultural product direct sowing improve labor productivity, conserve water resources, decrease pesticide and fertilizer application rate, reduce production costs and labor intensity, and increase the economic benefits of rice growers therefore it is the market need as well as the urgent need to develop mechanized direct agricultural product seeding. The seeds need to be sowed into the soil, to proper depth in order to allow the maximum survival rate of germination. If the sowing depth is too shallow, the seed will not get enough moisture for sprouting and if the depth is too deep, the seed does not have enough energy and oxygen to survive. The germination and beginning of the lifecycle of a plant depends also on the solidity of the soil and the soil temperature, but the seed drill has little effect on these parameters.

II. LITRATURE REVIEW

Elsevier published a paper in May 2015. Titled "Automatic working depth control for seed drill using ISO 11783 remote control messages". Paper was published by Pasi Suomi.Timo Oksanen study was made on working depth, angle and distance between consecutive seed drill measured by multiple sensors. [2]

Elsevier published a paper in May 2015. Titled "Development and evaluation of the Turbo Happy Seeder for sowing wheat into heavy rice residues in NW India". Paper was published by H.S. Sidhu Manprit Singh, J Blackwell, Shivkumar Lohan, Vicky Singh, Surbjit singh, study made on drilling wheat into rice residues. [3]

ScienceDirect published a paper in May 2010. Titled "Experimental Study on Working Performance of Rice Rope Direct Seeding Machine". Paper was published by LÜ Xiao-rong study made on structure and sowing principles of rice rope direct seeding machine. [4]

III. PROBLEM STATEMENT

It is observed that lots of problems arise in seeding as mentioned below.

i. Dependency on ox driven machines.
ii. Musculoskeletal disorders due to sowing by bending and sowing.
iii. High cost for buying and maintaining the equipment.
iv. Handling of equipment due to excess weight of the machineries.

Due to these reasons, the design and development of "Seed Sowing Machine" has been taken up. It ensures that the cost of the machine, operational cost and maintenance cost are low. Also reduces the weight of the machinery to increase the productivity of crop.

IV. DESIGN OF MAIN PARTS

i. Horizontal disk

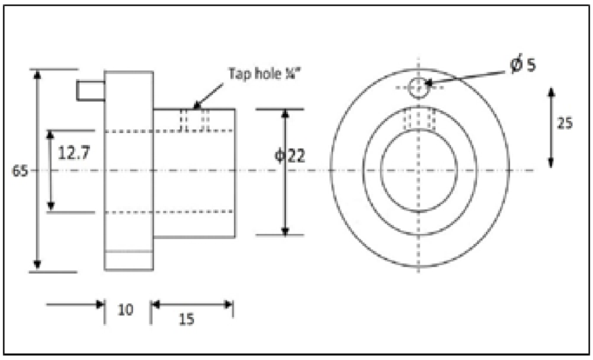


Fig.1 Horizontal disk

ii. Geneva wheel

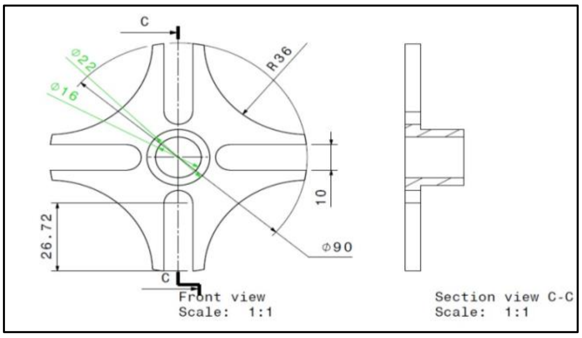


Fig.2 Geneva Wheel

iii. Spur gears

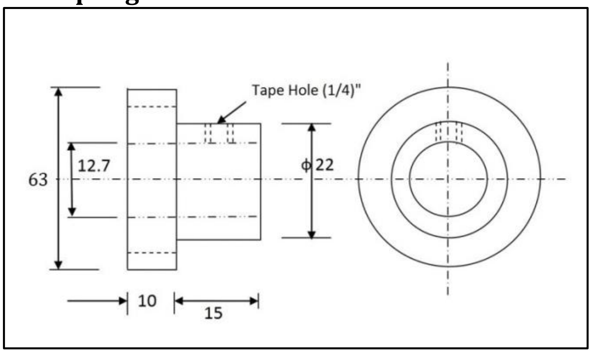


Fig.3 Spur Gear

i. Design of Horizontal disk

The proper design of the Horizontal disk is the most important thing is that how many cells would be developing for desired seed spacing. So the seed metering wheel diameter was calculated by following equation,

$$D_m = \frac{V_r}{\pi N_r} \quad \text{....(1)}$$

Where,

D_m = diameter of Horizontal disk, cm

V_r= Peripheral velocity of Horizontal disk in m/min

N_r= RPM of Horizontal disk.

Peripheral length of Horizontal disk

= 2πr

= 2×3.14×.165

=1.0362m

speed of manually operated multi crop planter (forward) = 2.5 km/h

Speed of small sprocket (rpm)

$$= \frac{\text{Forward speed in metre/min}}{\text{Peripheral length of Horizontal Disk}} \quad \text{....(2)}$$

$$= \frac{41.67}{1.0362}$$

=40.21rpm

Speed of sprocket (rpm) (Large) = Speed of small sprocket × drive ratio

= 40.21 × 0.375

= 15.08 rpm.

So minimum speed for seeds breakage 0.2892 km/h

Diameter of Horizontal disk

$$= \frac{V_r}{\pi N_r} \quad \text{...(3)}$$

$$= \frac{4.91}{\pi \times 15.08}$$

=10.1cm

a) Number of cells in Horizontal disk

To maintain seed to seed spacing, increase or decrease number of cells on periphery of Horizontal disk and drive ratio. The numbers of cells on Horizontal disk was calculated by following equation

Number of cells in Horizontal disk

$$= \frac{\pi \times \text{Diameter of drive wheel(cm)}}{\text{drive ratio} \times \text{plant spacing(cm)}}$$

$$= \frac{\pi \times 33}{0.375 \times 30}$$

=09

b) Power developed by Human power

Power developed by Human power **=** 0.145 For 4 hours

$$HP = 0.35 - 0.092 \log t \quad \text{....(4)}$$

Where, t= operation time in (min)

Now, an average a human can work on the field 1.5-4 hour continuous. So power developed by the operator is 0.14 – 0.16 hp. Now if we take working time 4 hours then the power developed by a human is 0.14 hp.

c) Power developed by Chain Drive

∵ Operating speed of machine = 2.5Kph = 0.7m/s

$$HP = \frac{\text{PushForce(Kgf)} \times \text{Speedofmachine}\left(\frac{m}{s}\right)}{75} \quad \text{...(5)}$$

Push force=15.5357 Kgf

$$HP = \frac{15(\text{Kgf}) \times 0.7(\text{m/s})}{75}$$

HP = 0.14

$$HP = \frac{2\times\pi\times N_w\times T_w}{4500} \quad ...(6)$$

Where,

N_w = Speed of Ground Wheel

T_w=Torque on Line Wheel

$$\because N_w = \frac{\text{Speedofmachine}\times 100}{\pi\times 60} \quad ...(7)$$

$$N_w = \frac{0.7(m/s)\times 100}{\pi\times 60}$$

$$N_w = 0.3713$$

$$T_w = K_w \times W_t \times R_w \quad ....(8)$$

Where,

K_w= Coe. OfRolling Resistance

W_t= Active Weight of the Machine

R_w= Radius of Ground Wheel

$$T_w = 0.3 \times 20(kg) \times 16.5(cm)$$

$T_w = 99$ N-cm

Bending movement of the shaft

In this machine the power is transfer to the system by using the chain drive so for the measurement of the bending moment of the shaft or machine is measured by the theorem of the chain drive system. So load on the chain drive (Q)

$$Q = K_t \times P_t(Kgf) \quad ...(9)$$

Where,

K_t= Coe. Of Chain

P_t= Push Force of the Chain

Q = 1.15 X 15(Kgf)

Q =17.25

Now chain drive is working at an angle φ (35°) with the horizontal

therefore equivalent chain load on the machine is

$$Q_v = Q \sin\varphi$$

$$Q_v = 17.25 \sin 35$$

$Q_v = 9.89$ N-cm

Now, Maximum bending movement of shaft in chain drive,

$$Mb = (\text{weight on Wheel} \times \text{overhung}) + (Q_v \times \text{overhung})$$

Assume the overhung of wheel = 15 cm and

the Overhung of sprocket = 5 cm

$$Mb = (20 \times 20) + (9.89 \times 20)$$

Mb = 597.8 N-cm

Hence;

$$\text{Equivalent bending} = \sqrt{(M_{b^2} + M_{t^2})} \quad ....(10)$$

Where,

$$M_t = T_w \quad ...(11)$$

$$\text{Equivalent bending} = \sqrt{(597.8^2 + 99^2)}$$

Equivalent Bending= 605.94 N-cm

Allowable shear stress = (T_s) = in shaft is 600 kg/cm^2.

$$M_{eq} = \frac{\pi}{16} d^3 T_s \quad .... (12)$$

So from the above equation the diameter of the shaft of the machine is:

$$d^3 = \frac{16}{\pi T_s} M_{eq} \quad ...(12)$$

Where,

d = diameter of shaft in cm.

Allowable shear stress = T_s= in shaft is 600 kg/cm^2

$$d^3 = \frac{16\times 605.94}{\pi \times 600}$$

$$d = 1.726 \text{ cm}$$

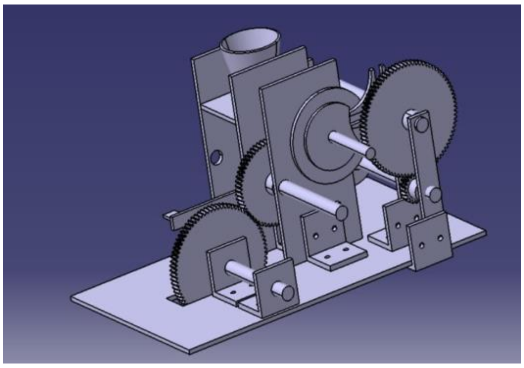


Fig.4 3D Model Of Seed Sowing Machine

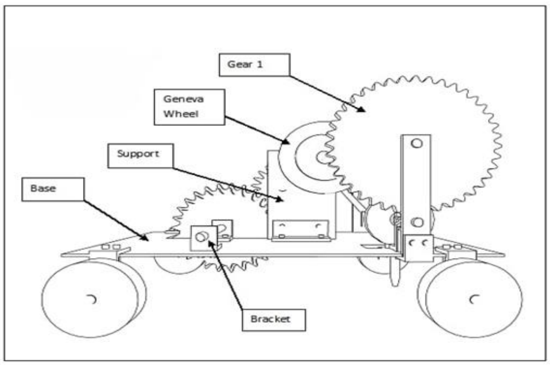
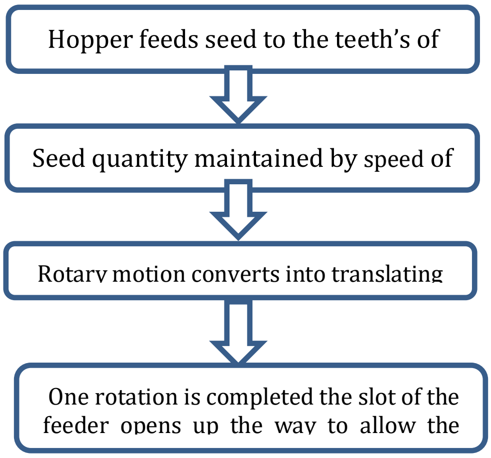


Fig.5 Cad Model

V. WORKING

The hopper is situated at the top mounting which feeds the seeds to the teeth's of the anchor. The quantity of seeds is maintained by means of speed of the wheels. The rotary motion of the wheel is converted into the translating motion by mean of gears and Geneva wheel mechanism. When the one rotation is completed the slot of the feeder opens up the way to allow the seeds to flow. The distance between two consecutive positions of the seed drop is maintained by the diameter of the wheel.

VI. METHDOLOGY



VII. SCOPE

In this paper we proposed the model of fabrication of horizontal Seeding Sowing Machine system which replaces the drawbacks of existing Seed Sowing Machine. This project consists of apart from the existing system this gives correct amount of seeds per unit length. perfect depth at which seed is placed in the soil. Correct spacing between row-to-row and plant-to-plant.

VIII. CONCLUSIONON

This paper was concluded to maintained distance between two consecutive seeds in line; it gives correct amount of seeds per unit length.

IX. ACKNOLEDGEMENT

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