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DESIGN AND FABRICATION OF MULTIPURPOSE AGRICULTURAL MACHINE

Mr.Yokesh Kumar.J, Assistant Professor, Dept.Of Mechanical engineering, SNS College of Engineering , Coimbatore-641107
Gokul Kannan. S, Jeevaraj. N, Narendran .M, Sabarishraj .S. UG , Department Of Mechanical engineering, SNS College of Engineering , Coimbatore-641107

Abstract

In this era of advanced technologies in all fields, Agriculture is one of the fields that is vaguely improving with the technology and the current improvised machines. This paper has proposed one of the multipurpose machine technology for Agriculture. Our versatile agriculture machine is used for three purposes namely grass cutting, seed plowing and water or fertilizer sprinkler. A water sprinkler or Fertilizer sprinkler is used to loosen the soil and fertilize the crops. The grass cutter is attached to the back lower part to plow the soil and cut the grass. At a time only one row is plowed. In seed sowing the machine is attached to the main machine and the sprinkler furrows will be placed back of the grass cutter. The seed is stored in the container of the seed sowing machine after storing the seed in the container the seed comes to the soil through a pipe. In the seed sowing operation at a time only two rows are sowed. The versatile agriculture machine is available for all the formers at a budget-friendly price.

Keywords: Agriculture, Multipurpose, Equipment, Design.

I.INTRODUCTION

A major part of the Indian economy has always been agriculture, and it will continue to be so for many years to come. If a man does not eat for three days, he will quarrel, fight for a week, and die within a month.

The field of agriculture falls under the umbrella of applied science. Farming is the art and science of cultivating the soil, raising crops, and raising livestock. There is no enterprise more important in the world than this one. Traditional agricultural practices have been carried out by small-holder farmers cultivating between 2 and 3 hectares with wooden plows, yokes, levellers, harrows, mallets, spades, and big sickles.

Land preparation, seed sowing, weeding, and harvesting can be accomplished with these tools. Small landholders do not use modern agricultural techniques and equipment because they are too expensive and difficult to obtain. It is possible to achieve maximum yields and high quality crops by using scientific farming methods, which will prevent a farmer from going bankrupt. However, many farmers still use primitive farming techniques due to a lack of knowledge or an inability to invest in modern equipment.

Since tractors require resources that many Indian farmers lack, hand tools remain the predominant way of cultivating land in India. Small holder farmers' activities must therefore be considered when assessing the need for agricultural mechanization in India. Small and marginal farmers have a huge gap in technology adoption and implementation. Resource-conserving cropping systems can substantially improve the livelihoods of poor farmers in developing countries.

While most of the necessary components already exist, there is a lack of information regarding the availability and performance of equipment, and farmers and agricultural research and development departments do not communicate effectively.

II.LITERATURE SURVEY:

The project aims on the look, development and therefore the fabrication of the mechanism which places the seed, sprayer to spray medicine, cutter to cut the grass, these whole system of the mechanism work with the battery. More than 40% of the population in the world chooses agriculture as the primary occupation, in recent year the development of the autonomous vehicles in the agriculture has experienced increased interest.

In the field of agricultural autonomous machine, an idea is been developed to analyze if multiple little autonomous machine may well be a lot of economical then ancient giant tractors and human force.

III. METHODOLOGY:

DESIGN OF MULTI AGRI CUTTER

The design of a versatile Agriculture machine is composition of multiple purposes like Grass Cutting, Seed Ploughing and Water and Fertilizer sprinklers. The main motive of this thesis is to establish a new form of technology or machine to reduce the burden of human labourers in agriculture as well as minimizing the need of different equipment for the infrasture development of agriculture. This design enables us to utilize the minimum of power consumption as well as the extended use of the said machine.

Versatile uses of this proposed machine is categorized into three sections. First one is the Grass cutter that is attached in the front of the machine which is used to cut the weeds, grass and unwanted bushes grown in the fields of agriculture. Second purpose is being a water and fertilizer sprinkler which is attached at the back of the machine. This machine can control the pressure of the liquid force which allows us to decide the coverage of the sprinklers. Finally the third part is used to sowing the seeds. Seed chamber is attached in the middle of the machine to sow the seeds in the field. Two rows of seeds can be sowed at the same time with this machine.

IV. COMPONENT:

REQUIREMENTS FOR VERSATILE GRASS CUTTER

Basic requirements of the versatile grass cutting machine are as follows DC Battery, DC motor, Cutter blade, Holder, Windrowing system (bucket), Covering Shield, Stand (hollow rod).

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1)DC BATTERY

Fig 4.1

Energy storage is achieved by using a sealed lead acid battery with a voltage of 12 volts and a nominal capacity of 7 amps. Batteries are free to use and maintain. In the presence of the sun, the battery is charged during the day and used as needed. It is possible to use the battery for up to 5-6 hours after it has been charged.

2) DC MOTOR

Fig 4.2

For driving the cutter, a permanent dc motor of 1000 Watts with a speed of 3000rpm is used. Using the Fleming hand rule, this single phase motor generates electric current, which is then converted into mechanical work, such as rotating the blade and cutting the brush.

3) CUTTER

Fig4.3

For the operation to be done, different types of blades are used, such as cast iron, stainless steel, and carbide steel. For cutting purposes, we use Tungsten cutter blades. In order to gain the cutting action, the blade rotates.

4) HOLDER

Multipurpose cutter is handled by using this handler this is used to support the machine while the user is operating the machine.

5) WINDROWING SYSTEM

This part collects the cutted bushes or grass and leave it separately in the other part.

6) COVERING SHIELD

It is mounted on the blade and acts as a shield to blade as well as protect the excitation of cutting grass towards the user.

7) STAND

All components are assembled on the stand. Insulating materials may be used in stand supports used in high- or low-temperature applications. Stand support assemblies are designed based on the loading and operating conditions.

4.2 REQUIREMENTS FOR MULTI AGRI SOWING

1. Storage tank
2. Sowing disc
3. Seed container
4. Seed compartment
5. Plough

1) STORAGE TANK

Fig 4.4

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Storage tank is used to store the seeds in it for the sowing. The normal seed storage tank have the capacity of 35 to 40 Kg of seeds. It takes nearly 30 to 40 Kg of seeds to sow the whole hectare of land mass. The container capacity is calculated according to that.

2) SEED SOWING DISC

Fig4.5

Sowing disc is used to separate the seeds into grains for the sowing process. Then these grains will be separately planted into the soil. This disc controls the speed of the sowing process.

3) SEED CHAMBER

Fig 4.6

These machine used for germination of different types of seed in laboratories

4) PLOUGH

Fig 4.7

Before sowing seed or planting, a plough or low loosens or turns the soil. This also makes it easier for the farmers to plant the seeds into the land and it helps seeds to take root faster.

4.4 REQUIREMENTS FOR MULTI AGRI SPRAYER

1. Liquid Storage Tank

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2. Flow Controller

1) LIQUID STORAGE TANK

Fig 4.8

This container is used to store either water or fertilizer depending upon the time and type of use. While sowing this container is used to sprinkle water since water dilutes the soil for the sowing process and it also helps the seeds to take root faster. Fertilizer are used in this container when the plants or crops are fertilized for the better yield.

2) FLOW CONTROLLER

Fig 4.9

This is used to control the pressure of the liquid flow from the machine. By controlling the pressure of the sprinklers we can cover larger land mass while watering the plants

V. WORKING PLAN

We make an literature survey regarding our project and the we make an ppt that what we are going to implement, so our next step is to make an miniature demo model of our project.

So we first want to know what are the compounds and how its work is very important to our project so we take an literature survey, the we came to know the purpose of the components that we use in our projects.Then we ready to make ours models of our project, next we assemble the components.Then, finally we bring the output.

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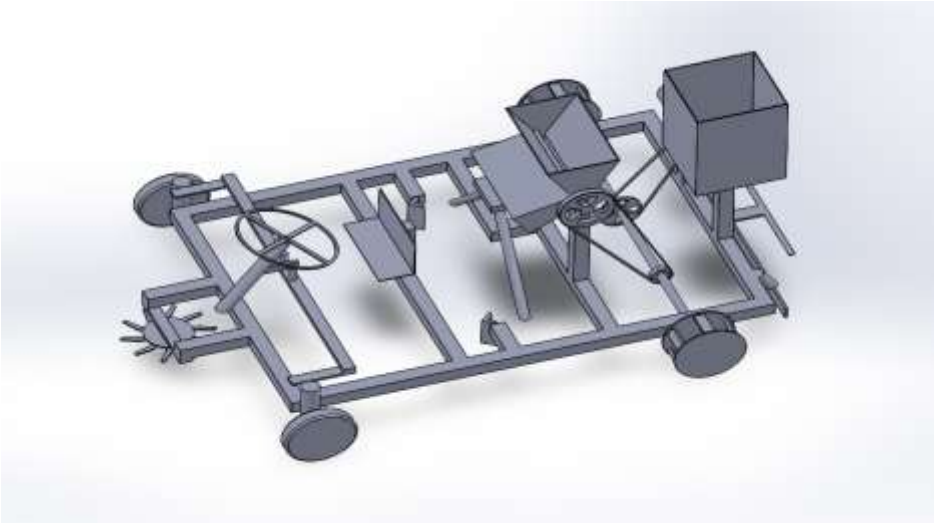
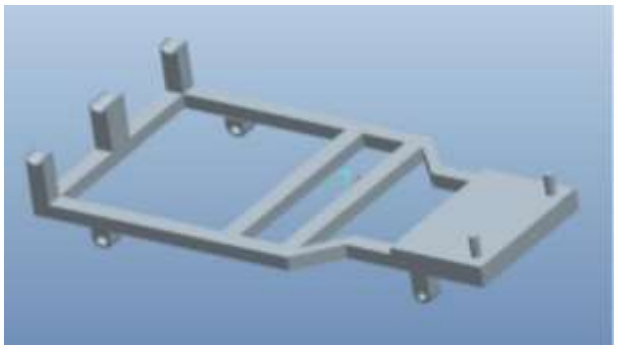
VI. DESIGN OF EQUIPMENT:



Frame of the vehicle

Material selection will be the most important factor for a vehicle. Based on our requirements, there are many materials available; however, it should be light weight, readily available, safe, recyclable, and strong enough for agriculture activities. Steel will be used for the frame. The thermal, mechanical, and chemical resistance of steel makes it a popular material. It is a durable material with wide availability and has the eas of manufacturing.



Various calculations on design

1. Shaft Design

For design of shaft equation of power will be,

$$P=F*V$$

Assume that weight of the assembly will be around 60kg. Force will be acting on wheels. Now maximum force will be acting on rear wheels.

$$F=m*g$$

By taking m=60kg g = 9.8m/s2

Now,

$$F = 60 * 9.8 = 588 \text{ N}$$

Suppose, Velocity is will be 15cm/s i.e. V = 0.15 m/s

Thus

$$\text{Power, } P = 588*.15 = 88.2\text{watts}$$

We can take torque as $T = P*60/ (2\pi n)$

Considering Revolution numbers n=50rpm

Torque will be around

$$T = 88.2*60/ (2\pi*50)$$

$$= 16.23 \text{ x } 103\text{N-mm}$$

For shaft reactions will be,

Vertical reactions on fixed supports i.e, wheels

$$RA = RB = (5+50+5) / 2$$

$$= 30 \text{ kg}$$

$$= 30*9.8 =294 \text{ N}$$

Bending Moment will be around M = 1850 Kg-mm

For this shaft resultant moment will be

$$MR= (M2 + T2)1/2$$

$$= ((18.5 *103) 2 + (9.36 *103)2)½$$

$$= 20.733*103N\text{-}mm$$

Now, shaft diameter can be given as,

$$d = [(MR*16)/ (\pi x\tau)]1/3$$

By Considering shear stress to be $\tau = 55Mpa$

$$d = [((20.733*103N) *16)/ (\pi x55)]1/3$$

$$d = 12.581 \text{ mm}$$

Calculation on cutter

$$P = 2\pi nT/60$$

P = Power, T = Torque, n = Speed of motor

Also, P = V * I Where, I= Current Power input to the motor, V= Voltage

$$Pin = V * I$$

$$Pin = 12*8$$

$$Pin = 96W$$

Power output will be, (Motor to shaft)

$$Pout = T * \omega$$

Motor Efficiency can be given as

$$E = Pout / Pin\ 0.36$$

$$= [T * (2\pi * N/60)] / 96\ T * (2\pi * 65/60)$$

$$= 35.66\ T$$

Calculation for seeding:

Speed = 36 rpm

Row spacing= 25 cm

Seed sowing time= 1.5 sec/per seed

Opening no. = 5

Seed dropping per minute = 5*36= 180 seeds

Hence, If the speed of the wheel is 46 m/min, then for 46 meter 160 seeds will be dropped.

Design for Welded Joint

In welded joint moment will be of pure nature of bending. So, we should design it for bending stress.

We know minimum throat area or weld area

$$A = 0.706 * s * l$$

Where l = length of weld and s = size of weld

$$A = 0.706 * 5 * (70+ 40 + 37 + 58 +30) = 829.55\ mm2$$

For parallel fillet weld bending strength

$$P = A * fb$$

$$Fb = 85N / mm2$$

At the end of the lever load applied will be 260 N.

moment generated will be

$$M = P * L = 260 * 450 = 117000 \text{ N} - \text{mm}$$

We know that

$$M / Z = fb$$

$$Z = \{BH3 - bh3\} / 6\ H = \{403 * 7553 - 353 * 5803\} / 6 * 75 = 308824$$

Induce stress developed will be,

$$Fb \text{ induced} = 117000 / 308824 = 0.3788 \text{ N/mm2}$$

design is safe because induced stress is less than allowable stress, which is 56 N/mm2. Basic vehicle with chemical sprayer

VII. CONCLUSION

It can be concluded from the above study that conventional systems with heavy tractors are less efficient and time consuming than conservative systems with low or medium power tractors.

A machine or equipment designed for grazing, sowing, and spraying can also be used for this purpose. Small to medium farms will benefit from it because it is more efficient and economical than heavy machinery.

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