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Semi-Automated Soil Digging Machine for Sapling Plantation

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Abstract-*This paper discusses about the soil digging machine which is used for plantation of smaller saplings. This machine uses the principle of auger drilling machine which is used in pile foundation during construction. The auger drill is made of required size by scaling down its original size as per the requirement. The machine is made automatic by employing a D.C motor which serves as a power source for digging the soil. The motor can be rotated both in clockwise and anti-clockwise direction. This makes the auger to drill hole in the soil and the return back to its original position. There are water tanks which are used to provide continuous supply of water to loosen the soil as well water the saplings after the plantation. The size of the auger is designed as per the sap-ling size. This machine is designed for a preliminary aim of avoiding the use of shovels & levers in plantation of saplings thereby enhancing the plantation process by making it facile.*

Keywords: *Auger, Plantation, Drilling and Motor*

INTRODUCTION

The interest of people towards plantation of sapling is increasing due to global warming, rise in global temperature and many such factors, so plantation is being done at a faster rate through many of the N.G.O'S as well as people. In case of planting sapling in huge number it is difficult to use shovels & levers for the same it makes the process tiresome and takes very long time. This paper focuses on reducing the time for plantation of saplings by employing a semi-automated machine in the place of conventional shovels which will greatly reduce the planting time required. The machine uses the help of auger drill which is primarily used in pile foundations in construction sites. A D.C motor can be fitted to the end of the auger shaft and which can be used both in clockwise and anti-clockwise direction thus enabling the shaft to go deep inside the soil as well as come back after the required size is being achieved. There are water containers provided for loosening the soil as well as watering the plants after plantation. There is a stand provided beneath the motor for arranging the saplings so that it can be planted one by one. The machine can be transported easily since there are wheels which are provided at the bottom of the frame. The machine is made of stainless steel material since it should withstand a higher impact loading. The motor power is brought down to the shaft using spur gear arrangement. The greater advantage in this machine is that it digs only the required area and also does the same in very minimal time.

Literature Survey

Several studies were reported recently due to the awareness created by Government and Non-Governmental organi-zations on the importance of green resources. Swetha S. et al (2015) developed a machine to minimize the working cost and time for digging and seed sowing operation by using solar energy to run the wheels. IR sensors are used to maneuver robot in the field. Ersson B. T. et al (2013)Based on their assumptions and simulations revealed that in-creasing the number of planting heads per crane arm rather than number of crane arms per base machine offers the greatest potential to raise the productivity of intermittently advancing planting

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machines. M. Priyadarshini et al (2015) proposing a sensor guided rover for digging, precise seed positioning and sowing to reduce the human effort and also to increase the yield by remote navigation. Ultrasonic sensors are used to detect obstacles and maps alternative route. Limo Kipkoech Eliudet al (2011) proposed machine is driven by the tractor power take-off (PTO). The PTO shaft will be connected to the vertical shaft by a set of straight mitre bevel gears at 90 degree. The design borrows from Bush hog, auger type drilling units with the auger being replaced by the vertical shaft carrying a cutter pate.

Kyada. A. R et al (2014) proposing for seed to seed spacing and depth of seed placement, using mechanisms such as seed meter mechanism, plunger mechanism, lever fulcrum mechanism, cam shaft and power transmission, pulling mechanism. Joshi S.G et al (2014) presents a high speed solar powered system in cultivation based on robotic platform and artificial agent which is steered by DC motor remote control. The IR sensor is used and the seed block can be detected and solved using water pressure. A. Kannan et al (2014) converted the tractor movement into ground wheel rotation is transmitted to the metering mechanism through the power transmission system depending upon the nature of seeds; we can change the metering mechanism arrangement. The flax blades are used in making holes in the soil. Theseflax blades serves good in removing the soil and throwing it out so that a hole is made in the zone of plantation so that sapling can be easily planted in the soil. The plantation needs only a 1.5" inch diameter hole so that the auger drill is also made of such specification. This avoids making larger holes more than the requirement. On surveying the field of our project it is found that flax blades along with rotating hand wheel and springs are used which requires again a manual operation. One method which uses driller type machine which makes just hole in the ground and also requires in minimum of two members for handling the machine

Experimental Design

Auger Drill

The auger drill is usually made out of shaft which has shovel blades surrounding it as shown in Fig. No. 1. The normal auger drill is usually made for a size of 6" diameter and 8m depth since it is being employed for pile mak-ing purpose. In our case the purpose is to make a small hole of 1.5" diameter so the auger is scaled down to a smaller size having the diameter suited for the above purpose and a depth of 2". The shaft is first made and then the blades are fixed on to it.

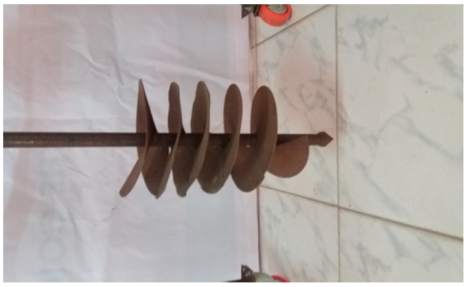

Fig. No. 1

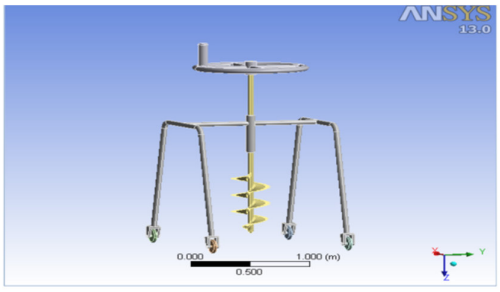

Fig.No.2

Shaft

A shaft is a rotating machine element which is used to transmit power from one place to another. The power is delivered to the shaft by some tangential force and the resultant torque (or twisting moment) set up within the shaft permits the power to be transferred to various machines linked up to the shaft. In order to transfer the power from one shaft to another, the various members such as pulleys, gears etc., are mounted on it. These members along with the forces exerted upon them causes the shaft to bending. In other words, we may say that a shaft is used for the transmission of torque and bending moment. The various members are mounted on the shaft by means of keys or splines.

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The material used for shaft has the following properties:

- High strength.
- Good machinability.
- Low notch sensitivity factor.
- Good heat treatment properties.
- High wear resistant properties.

The material used for ordinary shafts is carbon steel of grades 40 C 8, 45 C 8, 50 C 4 and 50 C 12.

Motor

The power source for the solid digging machine is obtained from AC power supply. Hence AC motor is used to operate the auger drill the motor power is about 0.33 HP and it has an torque about 4.2 Nm sufficiently enough to turn the auger and lift the mud from the ground.

Design Specification of Motor

Housing: rolled steel TNV or TEFC
Service factor: 1.0
CT Speed range: 100-400rpm
Overall speed range: 0-500rpm
Ambient temperature: 40^0C

Table I Specification of Motor

S.No	HP	FL Torque	FL Amps	Housing	Efficiency	Shipping weight
1.	0.33	4.2	3.5	TENV	82	18.6

Experimental Validation

From the Shigley design process we arrived at the design assembled the parts in to machine semi-automatic dig-ging machine and simulated the performance of auger drilling machine using Ansys 14.0 and we found that the simulated results such as maximum stress and deflection are in accordance with analytical calculation.

Conclusion

From the experimental validation and theoretical analyses it is found that the above project is feasible and can be extensively used in Plantation of Sapling. We have identified the best auger drill design and material such that it operates effectively under different types of soils. During the design process we have intuitively guessed the value of torque required to dig a hole and found the guessed the value to be satisfactory.

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