AUTOMATIC PAPER POT TRANSPLANTING MACHINE

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ABSTRACT

The Automatic Paper Pot Transplanting Machine is distinctive equipment in the field of agriculture and mechanical. It uses the paper chain pots for transplanting the crops or seeds. A single set of paper chain pot contains 264 paper pots; all can be planted in less than a minute. The paper pots in series go through the narrow opening in the front side of the transplanter. The leading paper pot in the beginning of the chain needs to be pulled and staked to hold inside the ground. The Transplanter is then pulled in the backward direction and hence all the seeds or crops along with the paper pot get transplanted inside the farming land. The adjustable plough underneath digs the soil with desired depth. The reaper in the front helps in cutting the crops when the transplanter is moved in forward direction. The transplanter being remotely operated proves to be efficient farming equipment. All these functions can be executed without any bending, kneeling or any other sort of human intervention. This proves to be much precise plantation process with less human effort possible.

KEYWORDS: Paper Chain Pot, Transplanter, Track Wheel & Reaping

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1. INTRODUCTION

Vegetable and plantation holds a great importance in all living creatures especially humans consuming and surviving with the help of these plantations. Along with which the process of growing these vegetables also becomes much important. In the ancient times, people manually sorted out the seeds and then plant them manually inside the land by digging the soil. This was the basic initial method of planting. As the time grew, people invented new creative ideas of improving the plantation process. They came up with different sort of machines and mechanisms which made this process much easier with less effort required compared to previous methods. Tractors equipped with planting mechanism, vertical sowing machine etc. are few examples of it. But all these advancements had some kind of drawbacks and imitations due to which the human problems persisted. The amount of crops planted being less, improper utilization of farming land, high cost of equipments and maintenance, labour and damage to the crops were the prime problems faced by the farmers. Especially in India, the farmers lack awareness in latest plantation techniques and also face financial crisis. Hence, keeping in mind all these factors, a technique was developed – Paper Pot Transplanting and the machine using this technique is Paper Pot Transplanter. The Transplanter is a simple construction made of mild steel which has a tray holder on which the paper chain pots are placed, a handle on the rear side with the help of which the transplanter can be pulled by the wheels and it has a narrow opening on the front side from which each paper pot from the paper chain will pass through it and get transplanted inside the soil when the transplanter is pulled backward. The transplanter works much efficiently and can plant 264 paper pots each having plants or seeds in less than a minute. The operation of the transplanter is very simple as the farmer just needs to load the seedling tray and then pull the transplanter backwards. All the process without bending or kneeling, just standing and pulling the transplanter backwards that's it. This transplanter also faced some problems like prerequisite digging

of soil, depth of plantation, human effort in pulling the transplanter, transplanter getting stuck due to uneven farming land and putting back the dug soil. Hence by developing the transplanter further, we introduced an Automatic Paper Pot Transplanter. The transplanter is equipped with electric motor for pulling it backwards also with the help of remote control which reduces the human effort to the lowest possible. Adjustable plough is provided underneath the tray holder for digging the soil at a desired depth along the ongoing transplantation process and a V shaped ankle in the front which puts back the dug soil after plantation. The adjustable Reaper machine is also attached to the front side of the transplanter which can be used for cutting the crops when the transplanter is moved forward and when the planting process is not to be done.

2. WORKING PRINCIPLE

A paper pot transplanter is a specialized machine used to transplant paper pot seedlings in the field. A common paper pot transplanter requires a seedling tray like a shed roof on which mat type paper pot nursery is set. The paper chain pots are available in sizes of 2", 4" and 6" spacing between two successive crops. The paper chain is loaded on the tray and placed on the tray space provided on the transplanter. The first paper pot from the chain is then manually picked and placed inside the soil that has already been dug for it. The transplanter with the help of remote control is then operated in the backward direction powered by DC geared motors. The adjustable plough underneath the transplanter helps in digging the soil throughout the operation. The depth of plantation can be set initially by adjusting the plough to the desired depth. As a result, the paper pots will set inside the soil as the transplanter moves backward. One by one sequentially the crops will get planted and the soil will also get dug along with it. The paper being biodegradable doesn't harm the soil or the crop. It increases the approximate area that a person can plant from 700 to 10,000m²/day. The human intervention at each and every step of the transplanting process is eliminated, providing an accurate crop plantation. Also the transplanter can be operated within a particular range, away from the transplanter which helps in maintaining the crop and soil quality. The reaper machine is also attached in the rear end of the transplanter. The reaper being adjustable, it sits idle when the transplantation process is being done and doesn't interfere it. But when the necessity arises of cutting the crops after harvesting, the transplanter can be moved in forward direction with the reaper turned on. The reaper will cut the crops. Hence variable operations can be performed with the help of this automatic transplanter.

Figure 1: Conceptual Design.

3. LIST OF COMPONENTS

- FRAME
- SEEDING PLATE
- PAPER CHAIN POTS
- DC MOTOR
- BATTERY
- WHEELS
- NUT BOLT
- REAPER MACHINE
- REMOTE CONTROLLER
- PLOUGH

4. DIMENSIONS OF COMPONENTS

Table 1

Tray	600mm*300mm*30mm
Handle	Length: 1250mm Pipe diameter: 1mm
Wheel	Diameter: 110mm Thickness: 54mm

5. DESIGN OF MODEL

Figure 2: 3D Model Solid Works.

The human intervention in the transplantation process also becomes negligible, resulting to precise transplantation output.

The soil needed to be dug before starting the transplantation process in the conventional transplanter. The Automatic Paper Pot Transplanter is equipped with adjustable plough beneath the machine. The plough can be adjusted according to the required depth of plant. When the transplanter is being pulled, the plough will dig the soil and the plants will also get transplanted both at the same time. This eliminates the digging of soil manually before starting the process.

The Automatic Paper Pot Transplanter is also equipped with adjustable reaper machine on the rear end which can be activated for cutting the crops after harvesting. While transplantation process, the reaper is adjusted up to a certain height and remains idle. When the transplanter is moved in forward direction with activated reaper after adjusting its height, it will cut the crops. This function makes it much easier for the operator to collect the crops after harvesting and move them off.

As compared to other versions, this Automatic Paper Pot Transplanter will prove to be the most efficient transplanter till date, furnished with multiple functions at the ease of the operator.

8. CALCULATION

Dimensions of tray:- Length : 600 mm, Breadth : 300 mm, Height : 30 mm, Area : 180000 sq. mm, Volume : 5400000 mm cube

- Dimensions of handle:- Length : 1250 mm, Pipe used of 1 inch diameter
- Dimensions of wheel:- Diameter : 110 mm, Thickness : 54 mm
- RPM of Motor:- $\text{speed} = 2\pi rN/60$
- $0.417\text{m/s} = 2\pi \cdot 0.055 \cdot N/60$
- $N = 72.26 \text{ RPM}$
- Power of primary motor:- $P = \text{mass} \cdot \text{gravitational force} \cdot \text{linear speed}$
- $= 30\text{kg} \cdot 9.81\text{m/s}^2 \cdot 0.417\text{m/s}$
- $= 122 \text{ watt}$

So the 12V DC geared motor of 10 Amp current will be used for pulling the machine.

9. CONCLUSIONS

The paper pot transplanting machine will work satisfactorily. But, the improvements can be done before introducing to the farmers. The machine is driven by remote control but engine can be coupled to increase the performances. Machine can be developed to transplant the several rows simultaneously. Weight of the machine should be reduced by using light weight, strong and anticorrosive materials. The Reaper attachment can be upgraded with binder mechanism. The human effort and human intervention in the plantation process with the help of this automatic paper pot transplanting machine has been reduced to the maximum possible extent. It will prove to be much efficient and cost saving plantation method in the upcoming future.

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