

Design and Fabrication of Manually Operated Crop Transplanter Via Suitable Mechanism

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ABSTRACT

Since agriculture is the most important sector of the Indian economy. It is most important source of employment for the majority of the work force in the country. As the large workforce is engaged in this sector, Traditional method is costly, time consuming and labour intensive work. The main objective is not only to resolve the problem but also to manufacture a machine which is also cheap in rate so that it can be used by a middle class person also. A crop transplanter working on suitable engineering mechanism is introduced in the project which is very easy to use and to run. This machine will ease the work of the farmers by planting the crop plants on the wet ground.

Keywords: Four Bar Mechanism, Fork shape structure etc.

INTRODUCTION

Crop being the important food covers about one fourth of the total area and cater food to half of the Indian population. In India, average production per hectare is 2.2 ton. Crop cultivation mainly depends on the following factor (i) age of the variety (ii) availability of moisture (iii) climatic conditions (iv) Availability of inputs and labour. Among these reasons, availability of inputs and labour play a huge role on deciding the method of production of crop. The average amount of human effort and man-force exerted in sowing the seeds is way too much to not affect the efficiency of the labour. The proposed model of the device, in full function, can sow seeds uniformly at suitable distance in a precise row which, on the other hand, can't be done by a farmer.

back injuries and other health problems that can result from lifting heavy loads. A typical hand trolley consists of two small wheels located beneath a load-bearing platform. The hand trolley usually has two handles on its support frame [3]. These handles are used to push, pull and maneuver the device. The handles may extend from the top rear of the frame, or one handle may curve from the back. An empty hand trolley usually stands upright

MECHANISM USED

Four Bar Mechanism

This Proposed design contains four links having four turning pair crank, lever, connecting rod and fixed frame. Crank can revolve 360 degree where as lever can revolve upto limited range of angle. Connecting rod connects crank and lever. Fixed frame is a fixed part in linkage.

Length of crank = 3.5 cm

Length of Lever = 6 cm

Length of connecting rod = 10 cm

Length of fixed frame =8 cm

GRASHOF CONDITION

$$S+L \leq P+Q$$

$$3.5 + 10 \leq 6+8$$

$$13.5 \leq 14$$

Hence, Grashof condition satisfied.

Where,

S is length of crank

L is length of connecting rod

P is length of lever

Q is length of fixed frame

WORKING PRINCIPLE

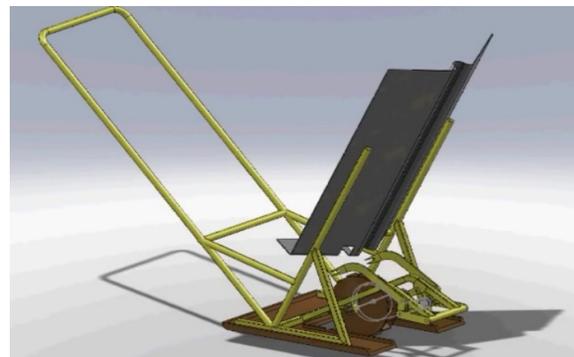


Figure 1. Model Of Crop Transplanter

A transplanter is an agricultural machine used for transplanting plant to the field. This is very important as it **reduces the time taken** to transplant seedling (when compared to a manual transplanting). Seedlings are kept in the tray and allowed to flow down under gravity. The fork which is attached to shaft picks up the plant from the tray and keeps it in the horizontal position on the skid. The motion for the shaft is given by hand using chain and sprocket arrangement. Here, simple four bar mechanism is used to plant

COMPONENT USED

$$i = N1/N2 = Z2/ Z1$$

• CHAIN

The chains are used to transmit the power from handle to the shaft in which forks are attached and it is also to transmit the power to the four bar mechanism

LENGTH OF CHAIN

$$L = Lp * Pd$$

Where Lp is the length of continuous chain in multiples of pitches (i.e. approximate number of links)

Pd = Pitch Diameter

Now to find pitch diameter Pd ,

$$a = (30-50) * Pd$$

• SPROCKET

Sprockets are used for hand driving wheel and in shaft for rotating the fork and four bar mechanism

CALCULATION OF SPEED OF ROTATION

$Z1$ = Number of Teeth on sprocket pinion

$Z2$ = Number of Teeth on sprocket wheel

$N1$ = Speed of rotating pinion

$N2$ = Speed of rotating wheel

We know that transmission ratio is given by

• SHAFT

It is revolving rod that transmits motion or power. Here one shaft contains fork and other shaft contain four bar linkage and power is taken from hand driven wheel by chain and sprockets

SHAFT DIMENSION

Length of shaft = 30 cm

Diameter of shaft = 2 cm

• Fork Picker

Fork is used to pick up the crop seedling from tray and to keep it on skid. There are two forks attached to the shaft and distance between two fork is 30 cm. The motion to the fork is given by shaft. Total length of fork is 28 cm

• Tray

Tray is used to keep the crop seedling on the transplanter. This is the thin rectangular sheet made up of aluminium. This sheet metal formed by an industrial process into thin and flat pieces.

DIMENSION OF TRAY

Length of sheet metal = 53.5 cm

Breadth of sheet metal = 26 cm

Thickness of sheet metal = 0.1 cm

SELECTION OF MATERIALS

In the context of product design, the main goal of material selection is to minimize cost while meeting product performance goals. Systematic selection of the best material (Table 1) for a given application begins with properties and costs of materials.

Table1. Material Selection

Parts of Hand Cart	Material Used
Chain	Cast Iron
Sprockets	Mild Steel
Sheet Metal	Aluminium
Four Bar Linkage	Mild steel
Handle	Mild steel
Nut Bolt	Mild Steel
Skid	Mild steel
Shaft	Mild Steel

PROCESSES INVOLVED IN FABRICATION

•Turning

A single-point turning tool moves axially, along the side of the workpiece, removing material to form different features, including steps, tapers, chamfers, and contours. These features are typically machined at a small radial depth of cut and multiple

passes are made until the end diameter is reached.

• Arcwelding

These processes use a welding power supply to create and maintain an electric arc between an electrode and the base material to melt metals at the welding point. They can use either direct (DC) or alternating (AC) current, and consumable or non-consumable electrodes.

• Grooving

A single-point turning tool moves radially, into the side of the workpiece, cutting a groove equal in width to the cutting tool. Multiple cuts can be made to form grooves larger than the tool width and special form tools can be used to create grooves of varying geometries.

• Drilling

A drill enters the workpiece axially through the end and cuts a hole with a diameter equal to that of the tool.

Cut off

Similar to grooving, a single-point cut-off tool moves radially, into the side of the workpiece, and continues until the center or inner diameter of the workpiece is reached, thus parting or cutting off a section of the workpiece.

ADVANTAGES

- Reduce the human effort to a maximum extent.
- Simple design contain to existing model.
- Easy to repair by farmers itself and maintenance is less.
- Pulling force is greatly reduced by decreasing the weight of model.
- Cost is reduced from other models.

RESULTS

Now it is very easy to plant and planting is not necessary done by the trained farmers only it can be done by the novice people also.

FUTURE PROSPECTS

- This project in the future come across many changes like an automatic or semi automatic system with motor which runs at constant speed attached to the shaft.
- Light weighted solar panel could be attached so that it can be used in night also.
- It can also be made remote control by using various sensors which will help farmers having large area of land.
- Water sprinklers can also be attached in future so that device can make field wet according to its amount of water needed only.

CONCLUSIONS

- Proposed methodology of model is very easy and model can be manufactured very easily once having

the proper dimensions.

- This will help those farmers who are not having enough money to pay to the labours but having a vast land to plant.
- Model gives a proper space to the neighbouring plant by which the neighbour plant gets the sufficient space to grow up.
- It can plant a area of of 3000 square fit in half an hour with the availaibility of only one labour.
- Proposed cost of the project is very less which can be easily affordable by the farmer and model also do not need any kind of fuel to run so can be used anywhere in the plain field.

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