

Design and Fabrication of Multi-purpose Agriculture Machine

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Abstract

Agriculture is the science and art of farming including cultivating the soil, producing crops and raising livestock. Generally, cultivation of any crop involves various steps like ploughing, harvesting, sowing, and irrigation. Farmer has to use various agricultural equipment's and labour for caring out these steps, our purpose is to combine all the individual tools to provide farmers with multipurpose equipment which implements all the scientific farming techniques and specifications, suitable for all type of seed-to-seed cultivation with minimum cost as possible. All this can be done in this same machine. This multipurpose agro machine is manually operated & designed and fabricated as a multipurpose equipment which is used for agricultural processes like ploughing, sowing seeds and sprinkling water/Pesticides. This machine works in both directions when it is pushed forward it ploughs the field with the help of plough. The height of the plough can be adjusted, with the help of screw arrangement and the seed feeder is mounted directly to the rear wheel using belt drive mechanism. When we push the agriculture machine in a backward direction, we can pick the plough up from the ground and the pump will start pumping the water from the tank

Key Words: Fabrication, Agriculture, Farming Design calculation, Process mapping Drawing Methodology, diagram, control charts. Prosses sheet.

1. INTRODUCTION

Agriculture is most important thing for humans and also for Countries economy

Agriculture is a branch of applied science.

It is the most important enterprise in the world. Over the years, agricultural practices have been carried out by small-holders cultivating between 2 to 3 hectares, using human labour and traditional tools such as wooden plough, yoke, leveler, harrow, maillot, spade, big sickle etc. These tools are used in land preparation, for sowing of seeds, weeding and harvesting. However now a days the technology has been evolved drastically, which helped farmers to change the traditional way of farming.

1.1 PROBLEM STATEMENT

The seed sowing process also the water spray will be used for watering the corps. 1) The new tools and module increases the production in less time due to maximum operating systems are enhanced on the chassis, when it comes to manual operating of the equipment, it's tough to push the vehicle at required maximum speed on the uneven surfaces so it can be avoided in good way by changing the power transmission system. by adding the motor, the issue of power generation can be solved. at small farms it can be easily handle by the manual operation this equipment performs well for small to medium corps. the hopper size is large enough for deployment of seeds and fertilizers at one time but some time the surface should be very tough and it can damage the tool so we can spray the water first for the easy ploughing during operation

1.2 OBJECTIVE

Multipurpose agriculture equipment can perform number of operations like spraying, seed sowing, cultivation, and leveling with manually operated three-wheeler.

To reduce human effort in the agricultural field.

To perform all four operations at single time, hence increases production and save time.

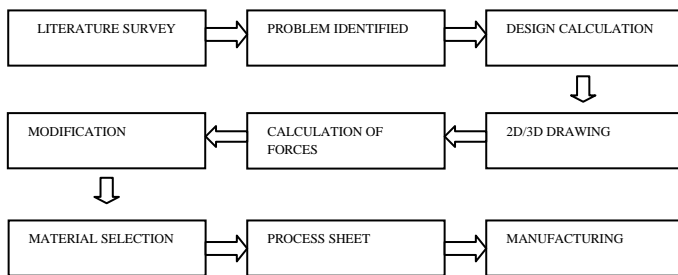
To decrease labor cost by advancing the spraying method.

To complete large amount of work in less time.

2. METHODOLOGY:

Design concept generation refers to the actual conceptual design where the design concept is an approximate description of the technology, working principles and form of the product. It has a detailed description on how the product will satisfy and meet customer requirements. Existing design constraints may even be solved by having a good development in the design concept.

Table -1: Methodology



2.1..DESIGN:-

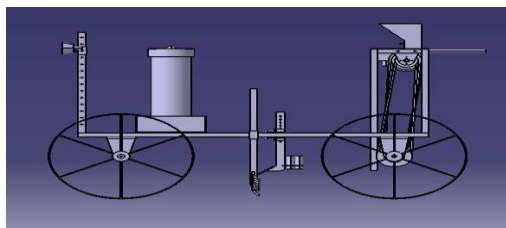


Fig 3.1

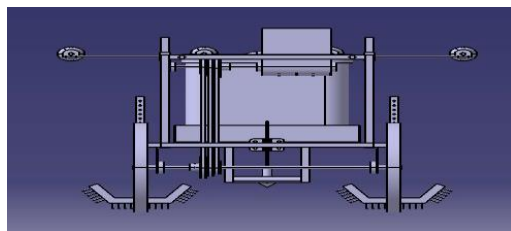


Fig 3.2

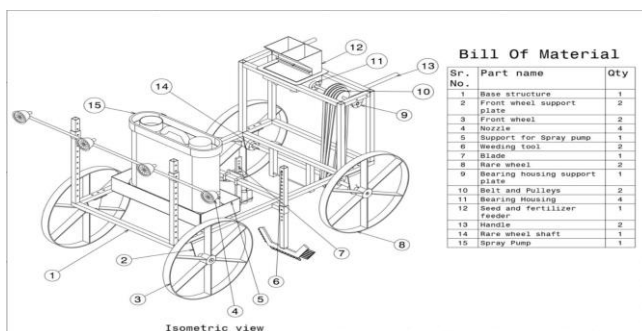


Fig 3.3

2.2. DESIGN CALCULATION

- **multipurpose agriculture machine : step 1 (material selection)**

chassis lightweight but strengthen chassis is expected for manual cultural equipments in engineering materials following are the available choices

1. Ferrous materials.

- a) mild steel

it is abundance in available material and cheaper one costs about 70 Rs. per kg tensile strength 475 Newton per mm square .

density 2850 g /cm³

- b) stainless steel

it is better version of Steel which mainly has anti rust properties as compared 2 miles still having density of 8200 g/cm³

ultimate tensile strength - 945 N/mm²

yield strength 669 N/mm²

costs average is about 230/ kg

2.2.1. load calculations on chassis:

- 1) spray pump weight

spray pump with batteries weighs about 12 KG. ref. GOOGLE

capacity 25 litre ~ 25kg

total weight 37 kg

- 2) spray pump bracket :

spray pump has dimensions about L - 500 mm × W - 350 mm × 500 is expected

considering back it is made up of 2mm MS Sheet

most of the agricultural equipments are made up of cast iron and mild steel here considering the cost and Machinability of mild steel is selected for chassis and other components such as

- 1) shafts wheels
- 2) seed tray
- 3) bearing housings

Pulleys are made up of cast iron and readily available at manufacturer

some other component such as spray pump spray nozzle bearing and battery etc. will be selected from manufacturers catalogue

2.2.2) design of chassis:

chassis should have the following function and provide support for following terms.

- 1) it should precisely coupled to wheels
- 2) rotation of wheels must be free from friction, it should have bearings to rotate wheels
- 3) it should provide mounting of spray pump and spray nozzle
- 4) spray pump height should be adjustable according to need
- 5) chassis should have mountains for seed and fertilizer tray
- 6) ploughing and sowing tools should be coupled to it and height of this systems should be adjustable

depending on these considerations chassis must be designed

$$\begin{aligned} \text{weight} &= \text{volume} \times \text{density} \\ &= L \times V \times B \times \text{density} \\ &= 500 \times 350 \times 2 \times 7850 \times 10^{-9} \\ &= 2.74 \text{ kg} \\ &\text{approx } 3 \text{ kg} . \end{aligned}$$

2.2.3) seed tray and fertilizer tray

seed tray :

minimum 1 kg of soybean should be accommodated in seed tray as assumed

density of soybean 753kg/m³

and average diameter = 7mm

thus for 1 kg of soybean =1 /753kg /m³

will be needed

$$\begin{aligned} \text{volume} &= 1/753 \text{ m}^3 = 1/753 \times 10^9 \text{mm}^3 \\ &= 1328021 \text{mm}^3 \end{aligned}$$

considering length of tray = 100 mm

width of tray = 150mm

$$\begin{aligned} \text{Height of tray} &= \text{volume}/L \times W \\ &= 1328021/100 \times 150 \\ &= 88.53 \text{mm} \\ &\approx 90 \text{mm} \end{aligned}$$

weight of tray

from about cutting layout of tray ,

$$\begin{aligned} \text{weight of tray} &= L \times w \times t \times \text{density} \\ &= 330 \times 280 \times 2 \times 7850 \times 10^{-9} \\ &= 1.45 \\ &\approx 1.5 \text{kg} \end{aligned}$$

2 trays are expected

Thus Tray weight = 3kg

2.2.4) Wheel design —

Wheel diameter is very critical in this design for assumption it will decide the sowing distance should be considered

For soybean distance between two seeds is 50mm to 100mm

For groundnut —150mm to 200mm

For wheat —150 mm to 200 mm

For jawari — 150 mm to 200 mm

Minimum distance to seed sow = 50mm

Maximum distance for seed sow = 200 mm

Iteration 1

Considering minimum distance for every 50 mm seed must be sowed . i.e. seed should dispatched for every 50 mm

Lets consider seed dispatching is carried out by a wheel and drive wheel to seed wheel has ratio of 4 in rotation of wheel 16 seeds will sowed

For 16 seeds , distance Between 1st and last seed is perimeter of wheel

$$\begin{aligned} \text{Thus distance} &= (\text{no of seeds} - 1) \times \text{distance} \\ &= (16-1) \times 50 \\ &= 750 \text{ mm} \end{aligned}$$

Perimeter = πD

$$750 = \pi D$$

$$D = 750/\pi$$

$$= 238.73$$

If diameter of wheel is 240 mm approximately height of chassis will be equal to radius i.e. 120mm

which is very low

During spraying, chassis may cause damage to grown crops or plants hence design is not safe

3 CONCLUSIONS

The various components required for building the multipurpose agriculture machine has been designed as planned

Multipurpose agriculture machine is single system which can perform multi operation like sowing, spraying, ploughing and weeding.

Multipurpose agriculture machine will reduce external charges like fuel, electricity and this will be helpful for poor farmers.

Multipurpose agriculture machine is a single system which contain multi attachment and can be easily assembled and dismantled comfortably all the fasteners used in the equipment are of the same size.

The equipment can do the work of four labors a day which reduce the labor cost of the farmer.

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