



Research Paper

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## DESIGN AND FABRICATION OF WHEEL DRIVEN SPRAYER

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### Abstract

In many ways, grasses are cut by machines but the project is focused on rechargeable batteries by using stainless steel metal blades. The fabricated model is beneficial for maintaining the gardening and is used in schools, colleges, and parks to clean the yard. The heart of the machine is a battery-powered DC electric motor lawn mower. The entire prototype model setup was having a plastic base, then attached with a cycle frame with wheel arrangement. This portable lawn mower is used to maintain grass growth in gardens, schools, homes, and colleges. The performance is carried out to find standard cutting efficiency by spending a low cost, minimum time, and less human effort. This portable lawn mower using a DC motor was very useful for grass cutting.

**Keywords:** Lawn Mower; Battery; Grass cutter; Blade

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## 1. INTRODUCTION

### 1.1 Agriculture and pesticides

Generally farmer uses traditional way that is spray carried on backpack and spraying crop this becomes time consuming, costly and human fatigue is major concern. Present day in agriculture the sprayers play an important role in spraying pesticide. Although sprayers varies like motorized, hand operated. Spraying pesticide is an important process in farming. Now days, there are many types of pesticide sprayer already in market. For the different types of pesticide sprayer there are have a different shapes, sizes, method to carry it but the function are same. The current idea on sprayer in our project is to utilize effectively for reducing time of spraying, human efforts and cost of spraying.

The conventional sprayer having some difficulties such as it needs lot of effort to push the liver up and down in order to create the pressure to spray. Another difficulty of petrol sprayer is to need to purchase the fuel which increases the running cost of the sprayer; it produces more vibrations and noise that irritates the farmer and him refuse to do such work repeatedly. In order to overcome these difficulties, we have proposed a wheel driven sprayer, it is a portable device and no need of any fuel to operate, which is easy to move and sprays the pesticide by moving the wheel.



**Fig 1.1(a) mechanical multi nozzle wheel sprayer**

The mechanism involve in this sprayer is reciprocating pump, and nozzles which were connected at the front end of the spraying equipment. A special arrangement is implemented for adjusting the pressure as low and high with the help of adjusting the nut. Also the weeding is done by this equipment. In Agricultural sector use of cheap and beneficial equipment for effective weeding and spraying for increase productivity which is very important for better contribution for India's GDP. We have to make economic machineries so farmers can purchase it as per capital income of our country's farmers are low and our country per capital income is low that of compared to other country as our country is developing country. Present scenario in agricultural field in India related to sprayer is that farmers are using hand operated sprayer or motorized sprayer. According to idea in our project we are making a small agricultural reciprocating multi sprayer which is mechanically operated by a slider crank mechanism. One vertical arm is attached at in front of cycle and one horizontal arm at top of the vertical arm. Nozzles are fitted to this

Fig 2.3: Cutter



arm so that it can spray pesticide both the sides. As more no of nozzle are there hence spraying is done rapidly and time and money is saved.

## **1.2 Agriculture and Indian economy**

Agriculture plays a vital role in Indian economy. Around 65% of population in the state is depending on agriculture. Although its contribution to GDP is now around one sixth, it provides 56% of Indian work force. The share of marginal and small farmer is around 81% and land operated is 44 % in 1960-61. As far as Indian scenario is concerned, more than 75 per cent farmers are belonging to small and marginal land carrying and cotton is alone which provide about 80 % employment to Indian workforce. So, any improvement in the productivity related task help to increase Indian farmer's status and economy.

Farming is the backbone of Indian economy. Agriculture sector includes is a lot of field work, such as weeding, reaping, sowing etc. Apart from these operations, spraying is also an another important operation to be performed by the farmer to protect the cultivated crops from insects, pests, funguses and diseases for which various insecticides, pesticides, fungicides and nutrients are sprayed on crops for protection. Farming has undergone a great evolution in last 50 years. Control of various diseases on crops is an important reason for this evolution.

## **1.3 Problems of current spraying method**

The current backpack sprayer has lot of limitation and it required more energy to operate. The percentage distribution of farm holding land for marginal farmers is 39.1 percentage, for small farmers 22.6 percentage, for small and marginal farmers 61.7 percentage, for semi-medium farmers 19.8 percentage, for medium farmers 14 percentage and for large farmers 4.5 percentage in year 1960-61. Clearly explain that the maximum percentage of farm distribution belonged to small and marginal category. The project is a Pesticide/Fertilizer Sprayer mounted on a Cart which is operated mechanically without any external source of energy. The aim of developing such a concept is primarily because of preventing the 3 majordrawbacks of the pump being used currently Firstly, the farmer has

### **METHODOLOGY:**

Power Sprayer, a modified model has been designed and introduced for effective operation without fossil fuel and minimum physical inputs of operator. In this modified model the tank with compression chamber is placed on the trolley and with the help of some suitable driving assembly and mechanism piston is oscillated to create pressure in cylinder of sprayer. Thus we are trying to reduce the efforts of operator in carrying the sprayer weight during spraying in fields and in actuating lever. The overall view of the modified model fertilizer sprayer and trolley is as shown in fig.

Most of the material which we have used is mild steel. Mild steel is composition of iron and carbon content up to maximum of 1.5% the carbon occurs in the form iron carbide because of its ability to increase the hardness of strength of steel.

CALCULATION:

1. Selection of Wheel

Distance between two plants = 1 feet = 30.43 cm.

Line covered by one rotation of wheel =  $30.43 \times 3 = 91.44$  cm

$152 = 2\pi r$                        $r = 152/2\pi$     $r = 15$  cm                      The diameter of wheel = 30 cm

2. Discharge calculations

Total Discharge through nozzle – 16 liter in 10 min

I.e. 1.6 liter/min =  $1.6 \times 10^{-3}$  m<sup>3</sup>/min

Discharge of single Nozzle =  $1.6 \times 10^{-3} / 6 = 0.266$  m<sup>3</sup>/min

Pump discharge per stroke =  $A \times L$

$$= \pi/4 \times (0.04)^2 \times 0.08$$

$$= 1.005 \times 10^{-4} \text{ m}^3$$

Required speed or stroke  $N = \text{Total Discharge of nozzle/Pump discharge per stroke}$

$$N = 9.25 \times 10^{-4} / 1.005 \times 10^{-4}$$

$$= 9.20 \text{ rpm}$$

Angular velocity of crank

$$\omega_4 = (2 \times \pi \times 9.20) / 60$$

$$\omega_4 = 0.96 \text{ rad/sec}$$

Crank and slotted lever mechanism

$$\omega_2 = \omega_4 \times (l_1/l_2)$$

$$= 0.96 \times (14.3/5.6)$$

$$\omega_2 = 2.45 \text{ rad/sec}$$

$$N_2 = 23.40 \text{ rpm}$$

Human walking speed under load below 50Kg

$$= 3 \text{ km/hrs.}$$

$$N_1 = V \times 60 / D \times \pi \text{ (where } V = \text{m/s)}$$

$$N_1 = 39.78 \text{ rpm}$$

For required reduction in rpm

$$Z_2/z_1 = N_1/N_2 = 39.78/23.40 = 1.7 \text{ (} 3.15 < 3.43 < 4 \text{ DDB } 7.71)$$

No. of teeth on sprocket  $Z_1 = 18$

$$Z_2 = 18 \times 1.7 = 32$$

Pitch = 12.7mm

Optimum central distance = (30 to 50) P

$$= 30 \times 12.7$$

$$= 381 \text{ mm}$$

Selected chain = R1248

Approximate center distance in multiple of pitch

$$a_p = a_0/P \quad a_p = 300/12.7 = 23.62$$

Length of continuous chain in multiple of pitches

$$L_p = 2 \times a_p + Z_1 + Z_2/2 + (z_1 - z_2/2 \times \pi) \times 2/a_p$$

$$= 2 \times 23.62 + (23 + 48)/2 + (48 - 23/2 \times \pi) \times 2/23.62$$

$$= 83.41 = 84 \text{ mm}$$

Length of chain  $L = L_p \times P$

$$= 84 \times 12.7 = 1066.88 \text{ mm}$$

## **7. CONCLUSION**

The equipment is purposely design for the farmers having small farming land say 5-6 acre. It is suitable for spraying as well as weeding at minimum cost for the farmer so that he can afford it. The equipment will results more beneficial when it is subjected to moist soil for weeding purpose, due to moist soil the weed cutter can easily penetrate and dig out the soil and hence will easily accomplished the weeding process. The performance of the equipment will increase when it is operates on the smooth surface or less uneven surface and also it will be more effective when it is used on the crops having nearly similar height and having the less space between two crops.

- The suggested model has removed the problem of back pain, since there is no need to carry the tank on the backbone and solder.
- More no. of nozzle which cover maximum area of spray in minimum time at maximum rate.
- Proper adjustment facility in the model with respect to crop helps to avoid excessive use of pesticides which result into less pollution.
- Imported hollow cone nozzle should be used in the field for the better performance.
- Muscular problem is removed and there is no need to operate lever.
- This alone pump can use for multiple crops.
- After having a trial, we have found that one finds it easy to operate push type machine.
- The pump can deliver the liquid at sufficient pressure where output of the nozzle in 1min is 0.3 and spray width 0.4m from calculation so that it reaches all the foliage and spreads entirely over the spray surface.
- It is little heavy but efficiently working in rough conditions of farm. It is economical therefore affordable for all kind of farmers.



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