

# Design and Development of Fertilizer Spraying Machine

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## ABSTRACT

In agricultural sector, generally farmer uses the traditional way of carrying a spray tank on his back and spray onto the crop. This is time consuming, costly and fatigue is also a major concern. These problems can be overcome by using a reciprocating multi sprayer. It facilitates uniform spread pesticides or insecticides. Precision made nozzle tip is used for adjustable stream capable of throwing foggy spray depending on the requirement. we use a slider crank mechanism to convert rotary motion into reciprocating motion to operate the pump. The pesticide is spread through the nozzle giving a continuous flow of pesticide at the required pressure. A special arrangement adjusts the pressure from low to high. We also use a weed cutter for removing the unwanted weeds. By using this agricultural sprayer, spraying time, weeding time and human efforts are reduced and resulting in cost reduction. Aim of the project is that the farmer need not carry the entire pesticide sprayer pump on his shoulders, but just pull/push the mechanism mounted on the trolley to operate the pump to spray. This makes the farmer feel more comfortable, relaxed and less tiresome by reducing human efforts due to the constant pumping action.

**Keywords :** Slider Crank Mechanism, Fatigue Load, Time Consuming, Sprayer Pump, Cost Reduction

## I. INTRODUCTION

Agriculture has been the backbone of Indian economy. But advancement and mechanization of agricultural tools is slow as compared to other sectors. There are many areas in agricultural sector where speed of modernization is quiet slow.

In this agriculture sector there is a lot of field work, such as weeding, reaping, sowing etc. Apart from these operations, spraying is also an important operation to be performed by the farmer to protect the cultivated crops from insects, pests, fungus and disease for which various insecticides, pesticides, fungicides and nutrients are sprayed on to the crops. Farming has undergone a great evolution in the last 50 years. Out of the various reasons, control of diseases of crops is a major one.

## II. COMPONENTS

- Pesticide Tank
- D.C Motor
- Battery
- Control Trigger
- Crank
- Connecting Rod
- Switch
- L-Shape Chanel
- Wheel
- Nozzle
- M.S Shaft
- Pipe
- Bolt & Nut

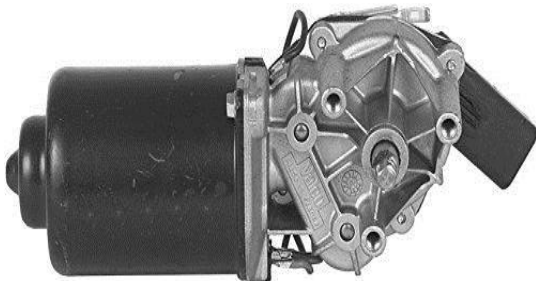
## 2.1 PESTICIDE TANK:



**Fig: 2.1** Pesticide Tank

Tank is device which is used for storing the liquid and solid pesticides. It is rectangular and circular in shape. The size of the tank is selected according to the amount of pesticides used in the tank for spraying. It can used in either agricultural purpose and home appliances.

## 2.2 D.C MOTOR:



**Fig: 2.2** Wipper Motor

Motor and Gear Reduction. It takes a lot of force to accelerate the rotating shaft and cutting blade roller. In order to generate this type of force, a worm gear is used on the output of a small electric motor. The output of the gear reduction operates a linkage that moves the rotate shaft. The worm gear reduction can multiply the torque of the motor by about 50 times, while slowing the output speed of the electric motor by 50 times as well. The output of the gear reduction operates a spindle that rotate shaft of the conveyor roller clock wise direction.

## 2.3 12V BATTERY:



**Fig: 3.4** 12v Battery

For this machine there is a need for the rechargeable battery, so lead-acid battery used here. It occurs the energy through the electric power. Then it accumulate and stores the energy which is utilised to run the machine. After the draining of battery, it gets recharged and reutilised as in the form of cyclic manner.

## 2.4 CONTROL TRIGGER:

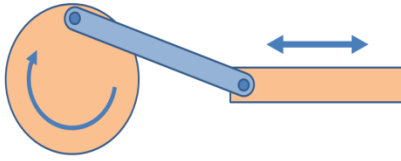


**Fig: 2.4** Control Trigger

It's a nozzle or wand fitted to the end of your hose and that you control with a trigger. You must depress the trigger continuously by hand or lock it in the 'on' position for water to flow. Some models have a discreet switch that can be turned off with a single hand movement.

You should not use any other watering system or sprinklers at any time. You also need a permit from Sydney Water to fill new or renovated pools bigger than 10,000 litres. You should not leave hoses or taps running unattended, except when filling pools or containers.

## 2.5 CRANK



**Fig: 2.5** Crank

A crank is an arm attached at a right angle to a rotating shaft by which reciprocating motion is imparted to or received from the shaft. It is used to convert circular motion into reciprocating motion, or vice versa. The arm may be a bent portion of the shaft, or a separate arm or disk attached to it. Attached to the end of the crank by a pivot is a rod, usually called a connecting rod. The end of the rod attached to the crank moves in a circular motion, while the other end is usually constrained to move in a linear sliding motion.

The term often refers to a human-powered crank which is used to manually turn an axle, as in a bicycle crankset or a brace and bit drill. In this case a person's arm or leg serves as the connecting rod, applying reciprocating force to the crank. There is usually a bar perpendicular to the other end of the arm, often with a freely rotatable handle or pedal attached.

## 3. DESIGN DIAGRAM



**Fig: 3.1** Design Diagram

## III. WORKING PRINCIPLE

When the switch is ON, electric supply goes to the motor from battery. The motor is connected to the crank by weld joint. The crank also rotates and creates rotary motion. The crank is connected to the pump and due to reciprocating motion the pump is operated. Tank is connected to the nozzle and the reciprocating motion helps to feed the fertilizer through the nozzle from tank with the help of a control trigger. Control trigger is a device which is operated manually for controlling the flow of fertilizer from the nozzle and it helps to increase or decrease or stop the flow of fertilizer from the nozzle. Two nozzle spray the fertilizer to the plants. When the handle is moved, the wheels rotate and move the machine. Instead of carrying the machine in shoulder, the machine is placed on the ground and operator.

## IV. DESIGN CALCULATION

### 5.1 D.C Motor

#### Calculate Capacity

$$\text{HP} = \text{Torque} \times \text{RPM} \div 5252$$

$$= 40 \times 50 / 5252$$

$$\text{HP} = 0.38$$

$$\text{Power} = 283.43 \text{ w}$$

### 5.2 L- Shape Channel

#### Calculation of Area

$$A = l \times b$$

$$= 135 \times 2.5$$

$$A = 337.5 \text{ cm}$$

### 5.3 SHAFT

#### Calculation of Torque

$$T = P \times 60 / 2 \times 3.14 \times N$$

$$= 5000 \times 60 / 2 \times 3.14 \times 50$$

$$T = 955 \text{ N-mm}$$

## 6. SPECIFICATION

### 6.1 Specification of D.C Motor

$$\text{Speed} = 50 \text{ rpm}$$

Running Current = 2A  
Shaft Diameter = 100mm  
Material = Aluminium

### 6.2 Specification of Wheel

Diameter = 510 mm  
Width = 60 mm

### 6.3 Specification of Crank

Diameter = 125 mm  
Material = Mild Steel

### 6.4 Specification of Tank

Height = 420 mm  
Width = 300 mm  
Capacity = 20 Ltr.  
Material = Plastic.

## V. PHOTOGRAPHY



**Fig: 7.1** Photography

## VI. ADVANTAGE

- Less Initial and Maintenance cost
- Does not require any External Source of Energy
- Safe operation
- No Fatigue to Operator
- Conventional backpack pump can be used.
- Can work efficiently during all Seasons

## 8.1 APPLICATION

- Insecticides and pesticides application to control insects, pests on crops, poultry farms and barns.
- Fungicides application to control the plant diseases.
- Herbicides application to kill the weeds.
- Spray application to increase the fruit yield.
- Application of plant nutrients as foliar spray.

## VII. CONCLUSION

It is an upgraded design of manually operated sprayer and weeder which will be helpful for small farmers. It consumes less time and saves money as compared to conventional spraying and weeding without power and maintenance.

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