

# Design and Fabrication of Agriculture Multi-nozzle Spray

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**Abstract-** Agriculture is the backbone of the Indian economy. The 70% of Indian peoples depends on the outcome of farming. Due to increase in population farm's distributed among the family and due to this farmer are classified into 3 groups such as small, medium, rich farmers. Small scale farmers are poor so, they are interested in manually lever operated knapsack backpack sprayer. But this sprayer has certain limitations like problem of back pain or shoulder pain; it cannot maintain constant required pressure. However this equipment can also lead to misapplication of chemicals and ineffective control of target pest which leads to loss of pesticides during application. This can cause the environmental pollution and imbalance in natural ecosystem. This paper suggests a model of pesticides battery operated Multi-nozzle Sprayer. This is work with the help of motor and 12v battery. It can help to remove the problem of back pain and perform spraying at maximum rate in minimum amount time which should be faster than traditional method of the spraying.

**Keywords** - Multi-Nozzles, Pesticides, Pump, Sprayer.

## I. INTRODUCTION

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, 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.

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/trolley which is operated automatically using motor or battery. The aim of developing such a concept is primarily because of preventing the 3 major drawbacks of the pump being used currently Firstly, the farmer has to carry the entire weight of the pesticide Spraying (approx. 20+ kg) pump on his shoulder; secondly, he has to continuously use his one hand to pump Using the handle; thirdly, reduction in spraying time. All these factors

have been taken care of in this project Along with being cost effective, light in weight and good in strength

## II. PROBLEM SUMMERY

The farmer who use backpack sprayer faces many types of problems like Pain in Spinal Cord and Muscles, Tiredness etc. Following problems can take place by use of this automatically type of pump.

### Common Problems:

- Fatigue to the operator due to heavy weight
- Due to heavy weight during spraying, operator feels very tiredness and fatigue which reduces Efficiency
- Use of this old equipment in farm has led to unacceptable risks to environment and Human health

## III. LITERATURE REVIEW

### 1. R.D. Dhete has worked on "Agricultural fertilizer & pesticides sprayers". In his work he emphasizes on different method of spraying devices

Day by day the population of India is increasing and to fulfil the need of food modernization of agricultural are important. Due to chemical fertilizers the fertility of soil is decreasing. Hence farmers are attracted towards organic farming. By mechanization in spraying devices fertilizers and pesticides are distributed equally on the farm and reduce the quantity of waste, which results in prevention of losses and wastage of input applied to farm. It will reduce the cost of production. It will reduce the cost of production. Mechanization gives higher productivity in minimum input

Farmers are using same traditional methods for spraying fertilizers and pesticides. Equipment is also the same for ages. In India there is a large development in industrial sectors compared to agricultural sectors. Conventionally the spraying is done by labours carrying backpack sprayer and fertilizers are sprayed manually. The efforts required are more and beneficial by farmers having small farming land.

### 2. According to literature published on flow control of agricultural spraying machine by massey University Newzeland on different spraying mechanism are studied

New Zealand relies heavily on its agricultural industry. A large portion of this industry is pastoral farming,

Where livestock are raised to graze on pasture. This includes beef, sheep and dairy farming. An important aspect of this style of farming is maintaining pasture quality. In order to increase growth fertilizers are often applied to the pastures. This increase yields in both meat and milk production.

However, the increased application of fertiliser is linked with diminishing water quality. While the effects of Nitrogen leaching and the best ways to manage fertiliser use are still being investigated, it is clear that control over the application will become more and more important. The Tow and Fert is a range of fertiliser machines designed and built in New Zealand by Metalform Dannevirke.

The Tow and Fert range is capable of spraying a wide range of fertilisers including both soluble and non-soluble fertilisers. The Tow and Fert is unique in its ability to spray fertiliser slurries consisting of mixture ratios of up to three-parts fine particle fertiliser to one-part water. This is achieved by the use of a recirculating system. Currently there is next to no control on the flow rate of the machines and the application rate is determined by the speed the operator maintains. The purpose of this thesis is to design and build a flow control system for the Tow and Fert product range and investigate the effect of the changing flow rate on the spray characteristics.

The ability to spray such a wide range of fluids with drastically different properties presents many challenges. Many flow meters were considered and a low-cost ultrasonic sensor (TUF2000M) was installed and investigated. After limited success of the ultrasonic sensor, a simple turbine flowmeter was installed. A flow controller was developed and tuned. Based off a PID control loop, the controller was able to maintain flowrate well between 10 L/min and 25 L/min depending on the installed nozzle.

**3. Pavan B. Wayzode, Sagar R. Umale, Rajat R. Nikam, Amol D. Khadke, Hemant carried out their work in "Design Fabrication of Agricultural sprayers, weed with cutter"**

Chemicals are widely used for controlling disease, insects and weeds in the crops. They are able to save a crop from pest attack only when applied in time. The chemicals are costly. Therefore, equipment for uniform and effective application is essential. Dusters and sprayers are generally used for applying chemicals. Dusting, the simpler method of applying chemical, is best suited to portable machinery and it usually requires simple equipment. But it is less efficient than spraying, because of the low retention of the dust.

In this work we have proposed an equipment that is wheel and pedal operated 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 and also peddling the equipment. In this equipment using reciprocating pump and there is an accumulator provided for the continuous flows of liquid to create necessary

pressure for the spraying action. This wheel operated pesticide spray equipment consumes less time and avoids the pesticide from coming from front of the nozzles which will be in contact of the person who sprays pesticides. Weed management is one of the tedious operations in crop production. Because of labour costs, time and fully manual weeding is unfavourable. Hence effort is made to design and develop efficient farm equipment to perform weeding without using electric power.

**4. Sandeep H. Poratkar, Dhanraj R. Rout carried out their work in "Development of Multinozzle Pesticides Sprayer Pump"**

India is a land of agriculture which comprises of small, marginal, medium and rich farmers. Small scale farmers are very interested in manually lever operated knapsack sprayer because of its versatility, cost and design. But this sprayer has certain limitations like it cannot maintain required pressure; it leads to problem of back pain. However, this equipment can also lead to misapplication of chemicals and ineffective control of target pest which leads to loss of pesticides due to dribbling or drift during application.

This phenomenon not only adds to cost of production but also causes environmental pollution and imbalance in natural ecosystem. This paper suggests a model of manually operated multi nozzle pesticides sprayer pump which will perform spraying at maximum rate in minimum time. Constant flow valves can be applied at nozzle to have uniform nozzle pressure.

#### IV. OBJECTIVES

- Aim of this 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 and spray the pests. This makes the farmer feel comfortable, relaxed and less tiresome.
- To reduce human efforts due to the constant pumping action for creating pressure inside the pesticide and thereby provide a suitable environment for the user reducing the fatigue load acting on the body. As discussed previously, the farmer has to continuously keep on pumping using one of his hands and spray the pests on the crops using the other hand. This at a long run is a tiresome and cumbersome job and the farmer slowly loses interest from it.
- This project focuses on the problem of health-related issues of the farmer (operator). Majority of them don't use any precautions like face-masks and hand-gloves against the hazardous chemicals and work in direct contact with it. Consequently, this harms the farmer as the spray in the conventional method

Directly hits the face. Multi-nozzle is used and hence larger area of field can be sprayed at faster rate.

- Maximum area of spraying in minimum time. Proper adjustment facility with respect to crop size & height. System is eco-friendly by using a spray guard for spraying

V. METHODOLOGY

- The motor and pump are used so that the water is pressurized and the water gets higher flow rate and velocity. The connection of motor and pump is given to the water tank. And output is connected to nozzle and valve of water tank.
- When we switch on / off the motor and pump will suck the water from the water tank, and the water flows through the pipe then it goes into the nozzle.
- The nozzle is fitted on an adjustable strip as you can increase or decrease the height of the nozzles according to the crops.
- This is a simple mechanism. It is very useful for small framers and its cost is also low. There will be more and faster work in less time



Fig.2 Wheel

3. Nozzle strip

$$\begin{aligned} \text{Height} &= \text{Height of plants} - (\text{Wheel radius} + \text{height of frame} + \text{excess}) \\ &= 1500 - (325 + 130 + 50) \\ &= 996.5 \text{ mm} \\ &= 1000 \text{ mm} \\ \text{Width} &= 30 \text{ mm} \end{aligned}$$

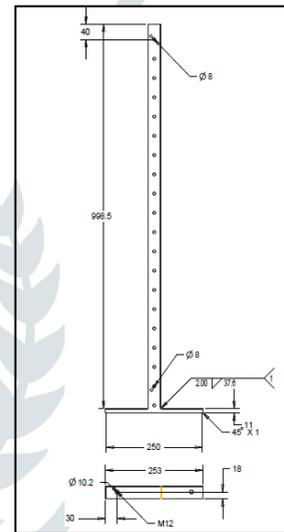


Fig.3 Nozzle Strip

VI. DESIGN & CALCULATIONS

1. Frame

$$\begin{aligned} \text{Length of frame} &= \text{Tank Width} + \text{Wheel Diameter} + \text{Excess} \\ &= 300 + 500 + 300 \\ &= 1100 \text{ mm} \\ \text{Width of Frame} &= 300 \text{ mm} \\ \text{Height of Frame} &= 95 \text{ mm} \end{aligned}$$

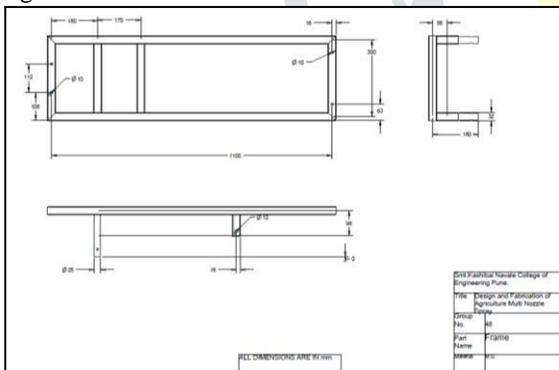


Fig.1 Main Frame

2. Selection of wheel

Distance between two plants = 20 inch = 508 mm  
 Let, in one rotation wheel covered 4 plants  
 $4 \times 508 = 2032 \text{ mm}$  (c = 2032 mm)  
 To find Diameter of Wheel  
 $C = 2\pi r$   
 $2032 = 2\pi r$   
 $r = 323.40 \text{ mm}$   
 $d = 646.8 \text{ mm}$   
 $d = 650 \text{ mm}$   
 We choose diameter of wheel = 650 mm

4. Storage Tank

Storage tank Are generally use to store chemical pesticides. Storage tank capacity is 25 lit. & made up of plastic.



Fig.4 Storage Tank

## 5. Pump

Pump is a device which is used to lift, transfer, or increase the pressure of a fluid  
Volt – 12V, Pressure – 130psi

## 6. Battery

A Battery is equipment which contains an electrochemical cell with Connections affixed to it, which is mainly used for several applications. The battery here we choose a 12v battery.

### • Assembly & Exploded View

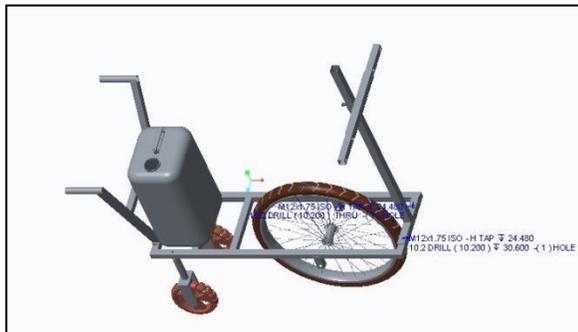


Fig.5 Assembly view

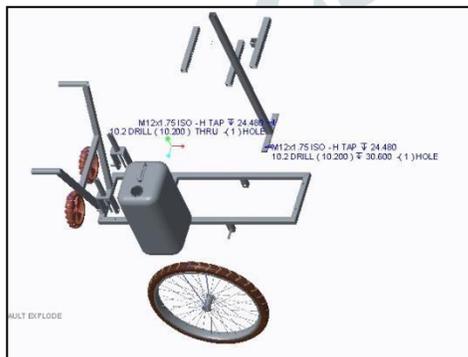


Fig.6 Exploded View

## VII. CONCLUSION

- This model removed the problem of back pain, since there is no need to carry the tank on the shoulder.
- Muscular problem is removed due to no need to operate lever.
- This pump is suitable for different types of crops.

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