

# **Analysis of Newly Developed Agricultural Multi Nozzle Wheel Sprayer**

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# **Analysis of Newly Developed Agricultural Multi Nozzle Wheel Sprayer**

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requirements for the award of degree of Bachelor of Science  
in Mechanical Engineering



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# ABSTRACT

The design and fabrication of multi Nozzle agricultural wheel sprayer consist of backpack sprayer which is mounted on the tank base of the trolley. A Connecting Rod connected with the tank and when the wheel moves forward then with the connecting rod a pressure create in the tank which Pressurizes the fluid during operations and store in the tank. Using a flexible hose pipe, The Pressurized pesticide is transferred to the multiple nozzles and a farmer can easily spray on the field the required fluid.

There are many types of sprayer that are available in Bangladesh. But mostly used sprayer is backpack type sprayer which is used by farmers because it is cheaper, easy to use and main thing about it is less costly. With the help of this machine farmer spray pesticides in their farm, but it requires lot of time and thus high operational cost. Also, the farmer which is spraying pesticides is affected by it as it is harmful to human health and human also affect by the labor pain due to weight of equipment.

This project idea suggests machines which will save time and operational cost. Also saves human from affecting adversely. The invention of a sprayer brings revolution in the agriculture or horticulture sector, this enables farmers to obtain the maximum agricultural output. They are used for garden spraying, weed and control, liquid fertilizing and plant leaf polishing.

Keyword: - Multi Nozzle, Storage Tank, Connecting Rod, Sprayer Hoses, Wheel,



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# CHAPTER 01

## INTRODUCTION

### 1. BACKGROUND STUDY

Agriculture plays a vital role in Bangladeshi economy. More than 70 percent of Bangladesh's population and 77 percent of its workforce lives in rural areas. Nearly half of all of Bangladesh's workers and **two-thirds** in rural areas are directly employed by agriculture, and about 87 percent of rural households rely on agriculture for at least part of their income. Agriculture is the largest employment sector in Bangladesh, making up **14.2 percent** of Bangladesh's GDP in 2017 and employing about 42.7 percent of the workforce. So any improvement in the productivity related task help to increase Bangladeshi farmer's status and economy. The current backpack sprayer has lot of limitation and it required more energy to operate. Agricultural land (% of land area) in Bangladesh was reported at **70.69 %** in 2018, according to the World Bank collection of development indicators, compiled from officially recognized sources.

Mostly in Bangladesh we used the old method and equipment for the agriculture. For agriculture the pesticide and water is mostly required after the some interval of time to remove the insect from the agriculture land.

### □ 1.1 Frame:

The Frame is used to support all body parts. The main functions of the frame are-To Support chassis components and body and to deal with the static and dynamic load.

### □ 1.2 Water Tank:

Water Tank Capacity is 16 Liter x 02 Nos=32 liter, Which is used to mix chemicals with water and the water tank is connected with a connecting rod to the main wheel for required pressure and also connected with the sprayer.

### □ 1.3.Nozzle:

Nozzle is a critical part of any sprayer. Nozzle performs three functions

1. Regulate flow
2. Atomize the mixture into droplets
3. Disperse the spray in a desirable pattern.

### □ 1.4. Connecting Link rod:

Connecting Link Rod is connected to two tanks with connecting link and a rod is connected with the main wheel, which is created pressure in a water tank with the assistance of the main wheel when the main wheel moves forward.

### □ 1.5. Main Wheel:

Main Wheel Dia is 600 mm, and the used bearing model is 6204. There are the Main Components to perform the sprayer.



Figure 1.5: Agricultural Multi nozzle Wheel Sprayer

## 1.6 THE PROBLEM STATEMENT

The conventional sprayer having the 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. A backpack sprayer consists of tank 10 -20 liter capacity carried by two adjustable straps. Constant pumping is required to operate this which results in muscular disorder. Also the backpack sprayer can't maintain pressure, results in drifts/dribbling. Developing adequate pressure is laborious and time consuming. Moreover, very small area is covered while spraying. So, time consuming process. 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. The mechanism involved in this sprayer is Connecting Rod, and nozzles which were connected at the front end of the spraying equipment.

## 1.7 AIM AND OBJECTIVES

- Work reliably under different working conditions.
- Decrease labor cost by advancing the spraying method.
- Machine can be operated in small farming land (5 acre).
- making such a machine which can be able to reduce spray time.
- Maximum area of spraying in minimum time.
- Proper adjustment facility with respect to crop size & height.
- Attach the multiple nozzle & trolley.
- System is eco-friendly by using a spray guard for spraying

## 1.8 THESIS OUTLINE:

**CHAPTER 01:** At chapter number 01 we discussed our aim and objective, Problem study according to our goal.

**CHAPTER 02:** At Chapter 02 we try to discuss the literature review & tried to express the various types traditional sprayer and their method.

**CHAPTER 03:** At chapter number-03, we tried to discuss the methodology of our selected project and its construction or setup

details, beside that we have discussed here the working procedure with the dimension of various components.

**CHAPTER 04:** At Chapter number -04, discussed analytical things with data table and application of the suggested sprayer.

**CHAPTER 05:** At chapter number -05, discussed the Future recommendations and its limitations which chapter can be expressed as the conclusion Chapter.

**CHAPTER 06:** Reference

## CHAPTER 02

# LITERATURE REVIEW

### 2.1 INTRODUCTION:

Bangladesh is a large population country perspective to his Land Volume or Area and to fulfill the need of food modernization of agricultural sectors 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. 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 Bangladesh there is a large development in industrial sectors compared to agricultural sectors. Conventionally the spraying is done by labors carrying backpack sprayer and fertilizers are sprayed manually. The efforts required are more and beneficial by farmers having small farming land. 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 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 a 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 in contact of the person who sprays pesticides. Weed management is one of the tedious operations in crop production. Because of labor costs, time and fully manual weeding is unfavorable.

Hence effort is made to design and develop efficient Farm equipment to perform weeding without using electric power. In agricultural sector 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, these problems can be overcome by using agricultural reciprocating multi sprayer. It facilitates uniform spread of the chemicals, capable of throwing chemicals at the desired level, precision made nozzle tip for adjustable stream and capable of throwing foggy spray depending on requirement.

In our project we use slider crank mechanism to convert rotary motion into reciprocating motion to operate the pump, thus the pesticide is spread through the nozzle. This work gives continuously flow of pesticide at required pressure and height. By using agricultural sprayer, spraying time, human efforts reduces and results in cost reduction.



## 2.2 Spraying Method

The Objective of Spraying is to deliver an effective, uniform dose of product to a target area in a safe and timely manner. The Most Common type of pesticide sprayer used is mechanical sprayer.

### 2.2.1 Back Pack Sprayer



Figure 2.1 Back Pack Sprayer

This is manually operated, tank capacity is 15 liters, Mechanical and hydraulic agitation, worked with a hand lever to maintain constant pressure, particularly used for spot treatment by small holding farmer and hand treatment .Equipped with a boom.

Hydraulic Sprayers consist of a tank ,a pump, a lance or boom, and a nozzle. Sprayers convert a pesticide formulation ,Often Containing a mixture of water and chemical ,into droplets ,which can be large rain type drops or tiny almost invisible particulars .This conversion is accomplished by forcing the spray mixture through a spray nozzle under pressure. The Size of droplets can be altered through the use of different nozzle sizes ,or by altering the pressure under which it is forced or a combination of both .Large droplets have the advantage of

being less susceptible to spray drift, but require more water per unit of land covered. Due to static electricity ,small droplets are able to maximize contact with a target organism, but very still wind conditions are required .But ,in this type of spraying ,the labor has to carry all the weight of the pesticides filled tank which causes fatigue to labor and hence reduces the human capacity.

### 2.2.2 Foot Operated Sprayer



Figure-2.2 Foot Operated Sprayer

Foot Operated Sprayers are suitable for both small and large spraying operation on crops and plantations. The Sprayer has two discharge outlets and it develops sufficient pressure to operate with two discharge line. The equipment is supplied with 8 m Long hose pipe which is used as delivery pipe and 2 meter long suction hose with

strainer. The Sprayer is less in weight and easy to move. Its potential spray pressure is 17 to 21 kg /cm<sup>2</sup> output and with lance is 1 ha/day. It can spray high volume spray and cover more and high area. Insects and weeds are largely responsible for the crop destruction. In Modern horticulture and agriculture a man-made or natural preparations are used to kill insects or otherwise control their reproduction. These herbicides, pesticides, and fertilizers are applied to agricultural crops with the help of a special device known as a “Sprayer”. Sprayers are commonly used on farms to spray herbicides, pesticides as a means of crop quality control. To produce more output from the farm, mechanizing the equipment is necessary .It gives more productivity in less input.

## 2.3 Existing Sprayer

There many types of sprayers are available in the market .depending on the crops ,area of the farm, type of pesticide and cost of the sprayer ,the sprayer are chosen .Some of the most widely used pesticide sprayers are as follows.

### 2.3.1 Manually operated sprayer

#### 2.3.1.1 Compression sprayer



Fig-2.3 Compression sprayer

Usually considered as the standard equipment for residual spraying .It Consists of a tank for holding a liquid insecticide formulating, which can be pressurized by means of a hand pump attached to it .the Compressed air forces the liquid from the tank via a hose with a cut off valve, a lance and a nozzle .It Consists of following main parts.

The Tank: it is usually made of stainless steel .Most tanks have four opening on top ;a large one for filling ,fitted with a removable cover and opening for the air pump, discharge system and pressure gauge.

The Tank Cover: It consists of a rubber gasket a handle, a PRV, operated by hand or by giving the handle a quarter turn, a chain to prevent the cover from being lost.

An Air pressure Gauge: it is used to measure pressure in the tank.

The shoulder strap: it should be wide enough to prevent it from cutting into the shoulder of the person using the sprayer .it is fastened to the tank with steel buckles .on large tanks 'it is adjustable.

Advantages:

- Low price.
- Convenient maintenance.
- High efficiency.
- Continuous operation.
- Low price of accessories.

Limitations:

- Low efficiency.
- High Labor intensity is not suitable for large area operations.
- Leakage may arise leading to direct contact with the pesticide liquid.
- Repair rate is high.

2.3.1.2 Hi tech sprayer:



Figure 2.4 - Hi tech Sprayer

It is recommended as “ most efficient and comfortable sprayer “ it is ergonomically designed and has capacity up to 16 liters .its pump is centrally placed outside the tank and has smaller piston diameter, which is easy for operation as

Balance is perfectly maintained. it has adjustable shoulder straps which helps to operate it to right or left. The overall construction is very strong and easy in operation.

### 2.3.1.3 Stirrup \ bucket sprayer:



Figure-2.5 Stirrup/bucket Sprayer

The stirrup sprayer is designed to pump the spray fluid directly from, the open container, usually through a bucket .the hydraulic pump will be put inside the bucket and held properly with the help of foot rest.

As the plunger is pulled up, the fluid enters through suction ball valve assembly and when the plunger is pressed down, the suction valve closes and the fluid enters the pressure chamber through a ball valve

assembly. As the plunger is continuously worked, pressure is built in the pressure chamber and the delivery hose. As soon as the required pressure is built up, the spraying action occurs. Stirrup sprayers develop 30-40 psi pressure.

## 2.4 Power operated sprayers:

Various power – operated sprayers are available and range in size from small , hand – carried engine – driven pump units to large self – propelled sprayers. Some of the power operated sprayers are as follows

### 2.4.1 Knapsack power sprayer :



Figure-2.6 Knapsack power Sprayer

Knapsack power sprayer is easy to use and highly durable .designed in sync with the industrial standard,

These sprayers are immensely used for garden spraying – weed pest control, liquid fertilizing and plant leaf polishing.

General technical specification is as follows.

- Spraying capacity: 8 liters / min.
- Capacity of chemical tank: 25 liters.
- Capacity of fuel tank: 1.1 liters.
- Net weight: 10.5 kg.
- Engine type: 2 strokes.
- Petrol displacement: 22cc

However, there are certain limitations of this sprayer. They are,

- Heavy in weight.
- Service life is low.
- Initial cost is high.
- Complicated maintenance.
- Pollutes environment.
- Certain parts can get corroded.

#### **2.4.2 Airless sprayer:**



Figure-2.7 : Airless Sprayer



Airless spray system atomize coating by forcing a fluid through a small orifice at high pressure. They are prized for their high reduction rates that can exceed 2 gallons per minute for large models. Airless sprayers provide pressure from a diaphragm or piston pump unit driven by an electric, gasoline, or air power motors.

Some models use a hydraulic driven pump powered by electricity or gasoline power. The hose is an integral part of the system .its expansion and contraction provide volumetric cushioning of the fluid to provide steady paint flow at the tip .it also conducts static electricity build up back to the sprayer where it can be grounded.

Two things primarily determine the capacity of an airless sprayer. Horsepower and valve opening. Many companies use one pump on a variety of models. The difference comes from the motor and power train with change in horsepower or motor type. Bigger pumps have bigger valves mean more heavily fluids can pass through.

One of the most important rules with airless sprayers is to keep the pump clean. A dirty or rusted piston pump will quickly destroy itself by eroding its pickings, rod ,cylinder and or valves . Greco sprayers are some of the best known on the market. they have a selection of pumps that fill just about every niche one can think of for spraying liquid coatings. Their recent homeowner line, the "magnum" series is an attempt to bring piston pump sprayers to the homeowner / day buyer . these are different than their professional equipment because they are made with less durable materials and a sport only a single action pump.

The feature some of the desirable properties of their larger brethren such as upright carts, hose reel on the handle , manifold filters etc . however ,much of this is light duty from a usage point of view and these were not made for continuous use. In fact parts for the magnum series are limited with pump repack kits not made at all. Stronger motors can push higher loads of paint through larger orifices and production for professional users. Bigger pumps with larger valves are required for heavier viscosity liquids or for fulfilling the needs of large volume users and these take bigger and bigger motors. Sprayers can be powered with electric, hydraulic or air motors.

The professional painting contractor usually uses portable electric motor equipment but for areas where electricity may not be available such as on large warehouse projects, high rises, or new construction, gasoline power is preferred. Air motors are typically used inside factories or shop application where large compressors can keep them going without threat of fire or heat buildup. Hydraulic units are powered by gasoline or electric motors but produce more power in a more compact design with less wear than if an equivalent electric or gas motor. Of course, the hydraulics adds complexity to the overall package and cost at the time of purchase. Specialty units include texture sprayers for application of wall finishes such as spatter coat or knockdown. These combine a specialty pump designed for heavy liquids and an air compressor to spray the material on the wall.

## **2.5 Conclusions**

Above discussions all are existing, there is a some advantages and some disadvantages. Agricultural Multi Nozzle Wheel Sprayer are totally new concepts which is portable and easier for the farm without consume of any non-renewable energy.

# CHAPTER 03

## METHODOLOGY

### 3.1 Introduction:

The Methodology of this Multi Nozzle Wheel Sprayer is based on the principles of motion transmission due to manually push up to forward .The operator first stand behind the Trolley .He will grab the handle and push the trolley forward and for the reason main wheel transmit the force by a connecting rod which is directly connected with main wheel axle. Connecting rod dividing by another two rod which is directly connected with two water tanks. For the transmission power by the connecting rod to water tank piston, The Piston reaches in the up position firstly and reach in the bottom position once again. When the main wheel moves forward this process is occurred continuously and for this reason Mixing water get required pressure .When required pressure create then the water from tank to nozzle .

### 3.2 Construction Dimension:

#### 3.2.1 Top Frame

Dia-1/2 Inch, Length- 4.9 Ft X 02 Nos

Middle Gap-9 Inch

#### 3.2.2. Bottom Frame

Dia -1 Inch, L-3.9 Ft X 02 Nos

Middle Gap-9 Inch

### 3.2.3 Main Wheel (Bicycle Or Rickshaws)

Dia -02 Ft

Bearing-6204 Model X 02 Pcs

Spoke-40 Pcs

### 3.2.4 Supporting Small Wheel (Trolley Model) -02 Pcs

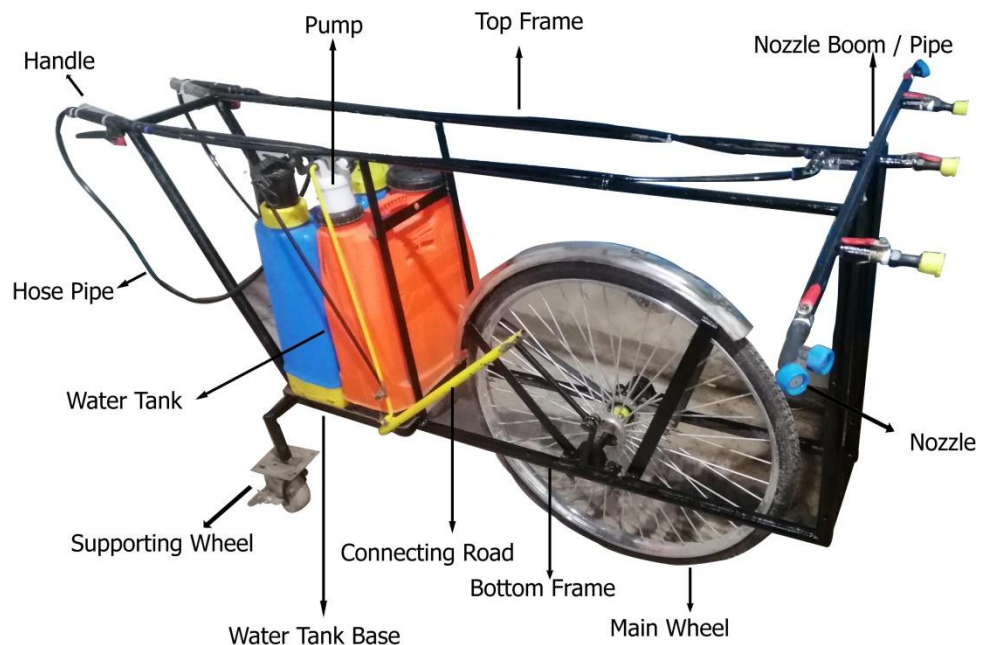
### 3.2.5 Water Tank Base

Length-1.2 Ft, Breadth-1.1 Ft

### 3.2.6 Vertical Distance between Top Body Pipe & Bottom Body Pipe/Frame

Front-1.10 Ft

Back-1.11 Ft



**3.1 Figure: Agricultural Multi Nozzle wheel Sprayer with components**



Figure 3.2 Construction & Dimension

### 3.2.7 Front Nozzle boom/pipe:

**Spacing of each nozzle-9 Inch ,total Length -3 rft**

## 3.3 Set up Description

### 3.3.1 Connecting rod

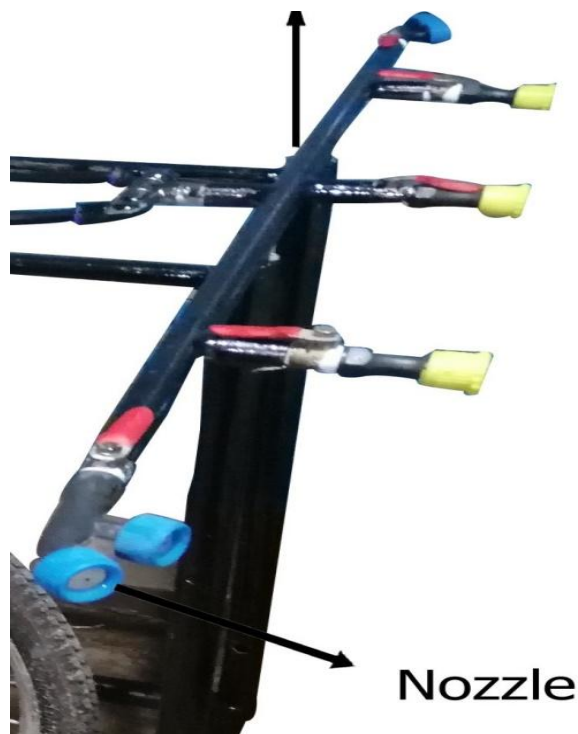
The main function of connecting rod is to convert rotary motion into reciprocating/linear motion. Here connecting rod converts rotary motion of wheel to reciprocating motion of pump and extension rod.



**Figure 3.3 Connecting Rod**

### 3.3.2 Nozzle:

It is a device which converts the pressure energy of fluid into kinetic energy. Spray nozzle is a precision device that facilitates dispersion of liquid into a spray. Nozzle is used for purpose to distribute a liquid over an area.



**Figure 3.4 Nozzle**

### 3.3.3 Main Wheel

Wheel is used to carry the whole assembly and move machine from one place to another by rotary motion of it. A bicycle wheel is a wheel, most commonly a wire wheel, designed for a bicycle. Bicycle wheel is designed to fit into the frame and fork via drop outs, and hold bicycle tire. A typical modern wheel has a metal hub, wire tension spokes and a metal or carbon fiber rim which holds a pneumatic rubber tire. We use a bicycle or rickshaw's tire. Wheel.



**3.5 Figure Main Wheel**

### 3.3.4 Supporting Wheel

Two Supporting wheels are used to keep balance of this sprayer behind side of the sprayer and we use for this trolley wheel which dia is 150 mm





**3.6 Figure Supporting Wheel**

### **3.3.5 Frame**

The main function of frame is to carry whole assembly on it so it has to be strong enough to hold it. The frame is made of ½ Inch pipe and it is formed out of galvanized Steel.

### **3.3.6 Water tank**

We want our tank to carry as much fluid as it can be along with its self-weight as less as possible. We have taken a tank which is almost 16 liter capacity. A material for tank used is plastic fiber. Plastic fiber is very low in weight as compared to other materials. It also has very low cost.



**3.7 Figure Water tank**

### 3.3.7 Hose pipe

Hose Pipe is used to flow the water from the tank to the 05 Nos Nozzle, This is a plastic flexible hose pipe and dia is ½ inch or 12 mm. two valves are fitted in the behind the end of hose pipe and another end fitted in a pipe which pipe fitted with 05 nos nozzle.



### 3.8 Figure Hose Pipe

## 3.4 Selection of components with their material

### Specifications

SL	Name of Component	Dimensions	Material Used	Material Specification
1	Tank	L=350 mm, B=165 mm	Plastic	Cheap, Durable, Good Strength.
2	Nozzle	Size-¼ inch	Plastic	Cheap, Durable, and Good Strength.
3	Nozzle Bar/Pipe	L=915 mm ,Dia = ½ Inch ,or 12 mm		Cheap ,Durable ,Good Strength.
4	Wheel	Dia-600 mm	Steel	Durable ,Good Strength.
5	Bearing		Model -6204	Good Strength.

6	Tyre		Galvanized Steel	For friction Purpose
7	Supporting Wheel	Dia=150 mm	Steel & Fiber	Durable - Adopted from Trolley.
8	Hose Pipe	Dia= ½ Inch or 12 mm	Plastic	Cheap ,Durable ,Good Strength.
9	Sprayer Valve		Plastic	Cheap ,Durable ,Good Strength.
10	Frame (Top)	Dia=12 mm,L=1150 mm	Galvanized Steel	Durable ,Good Strength
11	Frame(Bottom )	Dia=25 mm,L=1150 mm	Galvanized Steel	Durable ,Good Strength
12	Connecting Rod		Mild Steel	Durable ,Good Strength

**3.1 Table :List of components with dimension and specifications.**

### 3.5 Working Procedure

The tank is mounted on the trail the bottom of tank the inlet tube for pump is connected the pump is attached with the tank. The pump is operates by the connecting rod mechanism this mechanism is convert rotary motion .The pump mechanism is connected with the wheel by the Connecting Rod. There the can use the Main wheel and smaller wheel on the crank mechanism. If the trail is moved the wheel is rotates so the Connecting rod operates the mechanism with this the pump is attached due to rotary motion of crank that convert into reciprocating motion.

Due to this arrangement the connecting rod moves upward and downward which then reciprocate the plunger of single acting plunger

pump mounted at the top of storage tank. During the upward motion of the connecting rod the pesticide is drawn into the pump and during the downward motion of connecting rod the pesticide is forced to the delivery valve, the delivery is connected to the pipe. The delivery pipe is connected with the control Sprayer valve. The controls the flow of the pesticides.

If can spray light quantity of pesticides means the control valve is lightly opened so the flow rate is reduced and flow is controlled. If they spray high quantity of pesticides means the control valve is fully opened so the valve allows the fully quality of pesticides to the sprayer and then The spraying side can be changed by rotating the spraying support beam. The outlet of control valve is connected with the spraying nozzle the nozzle ends are connected by the fine sprayer it can sprays the pesticides in fine particles.

### 3.6 Data collection

The agricultural Multi Nozzle wheel spray has been tested on 01.08.2022 at agricultural land and the performance of the agricultural spray is noted. It is noted the agricultural multi-nozzle wheel spray spraying area is 28 Square Feet/ Sec Which is occurred after create the required pressure by moving forward the Sprayer by wheel and Thus the result of the test conducted was desirable and the agricultural spray was properly. It should be noted that we can use this special crop land which height will be up to about 1.5 m.

### 3.7 Governing Equation

To select a specific orifice size, the spray volume, nozzle spacing, and travel speed are needed for the following calculation:

**Equation :**

**Nozzle discharge (gpm) = (travel speed x nozzle spacing x spray volume) /5,940**

where: travel speed = miles per hour

nozzle spacing = inches

spray volume = gallons per acre (GPA)

### **3.8 Conclusion**

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 multi nozzle wheel 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. By using this agricultural Multi nozzle wheel sprayer, spraying 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.

## CHAPTER 04

### RESULT ANALYSIS

#### 4.1 Introduction

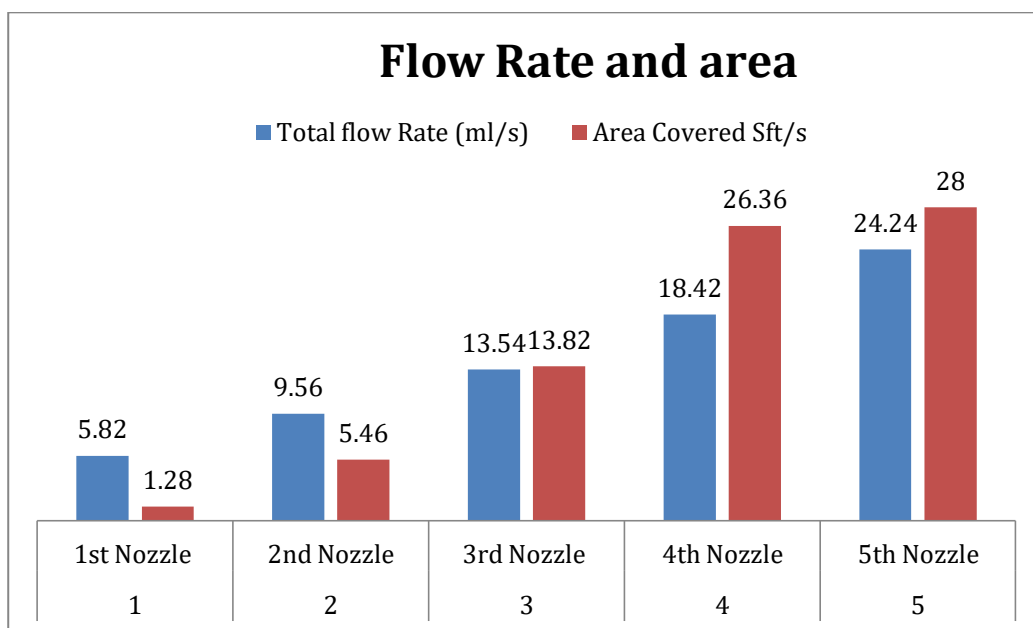
Results of this study revealed that there was a significant difference in total nozzle output for the respective to existing sprayer in our country .Because of its flow rate and 05 Nos Spraying Nozzle. Efficiency of Multi Nozzle Wheel Sprayer is higher than that of Single Nozzle knapsack Sprayer and others Sprayer which is used in our country in difference crop ,plant by farmer and agro farm. The total Needed time to flow the whole capacities is 22 minutes. So the total flow rate of this invention is 24.24 ml/s .

#### 4.2 Data Table

##### 4.2.1 Flow Rate & Area

**4.2 Table: Flow Rate & Area**

SL	Number of Nozzle	Total flow Rate (ml/s)	Area Covered Sft/s
1	1 <sup>st</sup> Nozzle	5.82	1.28
2	2 <sup>nd</sup> Nozzle	9.56	5.46
3	3 <sup>rd</sup> Nozzle	13.54	13.82
4	4 <sup>th</sup> Nozzle	18.42	26.36
5	5 <sup>th</sup> Nozzle	24.24	28



Graph/Chart 4.2:Flow rate and area

#### 4.2.2 Validation

As the Comparison between traditional sprayer and developed sprayer it covers the maximum area of crop.

Sl	Parameters	Single Sprayer	Multi Nozzle Sprayer
1	Nozzle	1	5
2	Time	3 hrs. /Acre	26 Min/Acre
3	Covered Area	Minimum	Maximum
4	Effort	More	Less
5	Operator fatigue	More	Less
6	Cost	Low	Medium
7	To Operate	Difficult	Easy

4.2 Table: Validation



## 4.3 Result Analysis

### 4.3.1 APPLICATIONS

- Its major use in agriculture to spray Mixture Water fertilizer.
- In city and urban area, it can use for spraying water on lawn.
- It may be exercise device at morning during utilize in lawn.
- Use from spray chemical Pesticide in plants in farm.
- It is use for spray painting in industry.
- It is use for spray water in garden on the plants.
- It is use for transfer water from one place to its nearer place.
- For the insecticides application to control insect pests on crops and in stores, houses, kitchen, poultry, farms, barns, etc.
- For the fungicides and bactericides application to control the plant diseases.
- For the harmony sprays application to increase the fruit set or to prevent the premature dropping of fruits.
- For the application of plant nutrients as foliar spray.
- For applying the powdery formulation of poisonous chemicals on the crops and for any other purposes.
- It can be used hugely for disinfected spraying for some disease as like COVID-19 ,Dengue fever etc. on the road

## 4.4 Conclusions

While conclusion this paper we fill file quite contended in having completed the project assignment well on time we had enormous practical experience on fulfill of manufacturing schedule of working project module we are therefore happy to state the calculations of mechanical aptitude proved to be very useful purpose agriculture pesticide sprayer is designed to reduce human effort is used to agriculture field by spray pesticide now a days farmer more used pesticide in farm to get better crop.

The motive behind developing this equipment is to create mechanizations which will help to minimize effort of farming. It is suitable for the spraying at minimum costs for the farmers so that; he can afford it of the many product available. Also we will reduce the operator fatigue and cover the maximum area within minimum time as compare to single sprayer.

# CONCLUSION AND RECOMENDATION

## 5.1 Introduction

It is upgraded design of manually operated sprayer which will be helpful for small land farmers. It consumes less time and saves money as compared with conventional spraying and weeding. This machine does not require any fuel or power so maintenance is less.

## 5.2 Limitations

- ✓ The Sprayer is little bit heavy, So there is a little bit difficulties to carry it.
- ✓ In irregular area of land, it can difficult to operate.
- ✓ In rainy days in muddy environment, it is difficult to operate.
- ✓ For irregular crops this sprayer is difficult to work.
- ✓ The flow is not uniform.
- ✓ The flow is very less & Can't be used for high flow operation
- ✓ This is not tested homogeneously.
- ✓ This sprayer has certain limitations like it **cannot maintain required pressure.**
- ✓ Not suitable for applying most commercial pesticides.
- ✓ This is not tested homogeneously

### 5.3 Future recommendations

The regulations in this Order concern limiting the pollution of soil, groundwater and surface water with plant protection products as a result of the filling and washing of sprayers or tractors used commercially for the application of plant protection products. Conditions that are more far-reaching than the provisions in this Order may be laid down in decisions of the finally, Environmental Protection Act. The quality and precision of the operations are equally significant for realizing higher yields harvesting and threshing need a high degree of precision to increase the efficiency of the inputs and reduce the losses. Thus, it only results in the shifting of the labor from one vocation to the other. As production increases with mechanization the farm operations, it creates a good scope for commercialization of agriculture. Some Future Scope or recommendations are given below.

- ❖ Work reliably under different working conditions.
- ❖ Decrease labor cost by advancing the spraying method.
- ❖ Machine can be operated in small farming land (5 acre).
- ❖ Making such a machine which can be able to reduce spray time.
- ❖ Maximum Area of spraying in minimum time.
- ❖ Proper adjustment facility with respect to crop size and height.
- ❖ Attach the Multiple Nozzle & Trolley.
- ❖ System is eco friendly by using a spray guard for spraying.
- ❖ It can be used hugely for disinfected spraying for some disease as like COVID-19 ,Dengue fever etc. on the road
- ❖ It can be motorized for more commercial using.

- ❖ We can modify the nozzle and boom for different spray and spraying accuracy.
- ❖ Nozzle may be inadvertently moved to provide a different stream or spray
- ❖ It can produce pressure to poison or water.
- ❖ If we research more and used more mechanical accessories it can be suitable for applying most commercial pesticides.

## 5.4 Conclusion

- ✓ The Suggested Model has removed the problem of back pain, since there is no need to carry the tank on the back.
- ✓ As Suggested model has more number of nozzles which will cover maximum area of spraying 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.
- ✓ Different type of nozzle should be used in the field for better performance.
- ✓ Muscular Problem is removed and there is no need to operate the lever.
- ✓ This Sprayer can use for multiple Crops.
- ✓ It is little Bit heavy but efficiently working in rough conditions of farm. It is economical therefore affordable for all kind of farmers.
- ✓ This machine does not require any fuel or power so maintenance is less.

## CHAPTER 06

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