

*Research Article*

# Design, Development and Fabrication of Manually Operated Multinozzle Pesticide Sprayer Pump and Seed Sowing Equipment

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## Abstract

*As on today the whole world is facing a problem of energy crisis. If we want to continue for prolonged use of energy then we must try to save it as much as we can whether it is on large scale or small scale. Today we use various spraying and seed sowing technologies involving use of electrical energy, chemical energy of fuels. This fact makes us know that how large content of energy is getting used at such a places where mechanical energy can be used instead of direct energy sources. This is a reason why we have implemented mechanical sprayer getting powered by human effort. Although these are serving the purpose, their range of working is not enough. They take considerably larger time for spraying. Thus what we have aimed is to design such a technology which will run on mechanical power but requiring less time for spraying than those which are hand operated. Thus considering today's demand, we have come up with mechanically operated spray pump and seed sowing which is purely mechanical. This device is having the advantage of taking less time for spraying and seed sowing once it starts. In addition to all this we are implementing soil coulter along with spray pump so we can have double advantage. Mechanical energy can be used instead of direct energy sources. This is a reason why we have implemented some mechanical sprayers and seed sowing equipment getting powered by human effort. Although these are serving the purpose, their range of working is not enough. They take considerably larger time for spraying and seed sowing. Thus what we have aimed is to design such a technology which will run on mechanical power but requiring less time for spraying and seed sowing than those which are hand operated. Thus considering today's demand, we have come up with mechanically operated multipurpose spray pump and seed sowing equipment. As it has huge advantages so this concept should be used in agriculture.*

**Keywords:** Manually Operated Multinozzle Pesticide Sprayer Pump etc.

## 1. Introduction

As on today the whole world is facing a problem of energy crisis. If we want to continue for prolonged use of energy then we must try to save it as much as we can whether it is on large scale or small scale. Today we use various spraying and seed sowing technologies involving use of electrical energy, chemical energy of fuels. This fact makes us know that how large content of energy is getting used at such a places where mechanical energy can be used instead of direct energy sources.

This is a reason why we have implemented mechanical sprayer and seed sowing getting powered by human effort. Although these are serving the purpose, their range of working is not enough. They take considerably larger time for spraying and seed sowing. Thus what we have aimed is to design such a technology which will run on mechanical power but

requiring less time for spraying and seed sowing than those which are hand operated. Thus considering today's demand, we have come up with mechanically operated spray pump which is purely mechanical. This device is having the advantage of taking less time for spraying and seed sowing once it starts. If we want to decrease the spraying time further we just need to increase size of our piston and no. of nozzles with relative change in effort.

In addition to all this we are implementing soil coulter along with spray pump and seed sowing so we can have double advantage. Mechanical energy can be used instead of direct energy sources. This is a reason why we have implemented some mechanical sprayers and seed sowing equipment getting powered by human effort. Although these are serving the purpose, their range of working is not enough. They take considerably larger time for spraying and seed sowing. Thus what we have aimed is to design such a technology which will run on mechanical power but requiring less time for spraying than those which are hand operated. Thus

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considering today's demand, we have come up with mechanically operated multipurpose spray pump and seed sowing equipment. As it has huge advantages so this concept should be used in agriculture.

India is land of agriculture which comprises small, marginal, medium and rich farmers. Small scale farmers are very interested in backpack type sprayer because of its price, versatility, cost and design. But this sprayer has certain limitations like it cannot maintain required pressure; it leads to problems of back and soldier pain. However this equipment can also leads 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 cause environmental pollution and natural imbalance in ecosystem. The manually operated spray pump and seed sowing equipment which will perform maximum rate in minimum time. Constant flow valves can be applied at nozzle to have uniform nozzle pressure. In the modern agriculture, the usage of pesticides is still increasing, moreover the 90% of these pesticides are being applied in the form of liquid spray and mostly by using the pressure gained from direct energy sources like electrical energy, chemical energy. Increasing public concern about the potential damage of chemical and electrical inputs in agricultural spraying systems has challenged industry to develop new and effective methods of spraying which will maintain environment friendly approach.

## 2. Need of Project

For seeking different ways to improve the equipment quality while reducing the direct overhead costs (labour) and capital, the project has been made. Thus, a significant opportunity rests with understanding the impact of a pesticide sprayer seed sowing equipment in an agriculture field. A pesticide sprayer seed sowing equipment has to be portable and with an increased tank capacity as well as should result in cost reduction, labour, seed sowing and spraying time. In order to reduce these problems, there are number of sprayer and seed sowing equipment introduced in the market but these devices do not meet the above problems or demands of the farmers. The conventional sprayer and seed sowing equipment having the difficulties such as it needs lot of effort to push the lever 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 and seed sowing equipment. In order to overcome these difficulties we have proposed a wheel driven sprayer and seed sowing equipment, 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 reciprocating pump, and nozzles which were connected at the front end of the spraying equipment. And for seed sowing equipment the mechanism is chain and sprocket.

## 3. Project Concept

- To overcome the disadvantages related with previous model, we have designed a model Running without any fuel and also easy to operate for a user.
- Pesticide application plays an important role in pest management. Proper technique of application of pesticide and the equipment used for applying pesticide are vital to the success of pest control operations.
- The application of pesticide is not merely the operation of sprayer or duster. It has to be coupled with a thorough knowledge of the pest problem.
- All pesticides are poisonous substances and they can cause harm to all living things. Therefore their use must be very judicious. The application techniques ideally should be target oriented so that safety to the non-targets and the Environment is ensured. Therefore, proper selection of application equipment is necessary.
- The requirement of coverage and spray droplet size depends upon the mobility and size of the pest.
- The mode of action of pesticide, its relative toxicity and other physicochemical properties, help to decide the handling precautions, agitation requirement etc. Further the complete knowledge of the equipment is necessary to develop desired skill of operation, to select and to estimate the number and type of equipment's needed to treat the crop in minimum time and to optimize use of the equipment.

## 4. Literature Review

The Food and Agriculture Organization (FAO) has defined pesticide as: Any substance or mixture of substances intended for preventing, destroying, or controlling any pest, including vectors of human or animal disease, unwanted species of plants or animals, causing harm during or otherwise interfering with the production, processing, storage, transport, or marketing of food, agricultural commodities, wood and wood products or animal feedstuffs, or substances that may be administered to animals for the control of insects, arachnids, or other pests in or on their bodies. The term includes substances intended for use as a plant growth regulator, defoliant, desiccant, or agent for thinning fruit or preventing the premature fall of fruit. Also used as substances applied to crops either before or after harvest to protect the commodity from deterioration during storage and transport. Shivaraja Kumar Parameswaramurthys paper on design and development of 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.

- Sandeep H. Poratkar, Dhanraj R.Raut, Development of Multinozzle Pesticides Sprayer Pump- 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.

- Varikuti Vasantha Rao Sharanakumar Mathapati Dr. Basavaraj Amrapur, Multiple Power Supplied Fertilizer Sprayer As a low volume sprayer suitable for spraying concentrated spray liquid. A blast of air flows through spraying jet of delivery hose and nozzle tube and ejects spray liquid in this blast. Air blast atomizes spray liquid in to fine droplets. Air acts as carrier. Faster the air is pressured more the atomization. These prayers are also used as blowers. Mist blower cause considerable loss of herbicide blower is: by winds. The main advantages of Knapsack are: 1. Portable working, and 2. fast spraying. Suited to post emergence translocate type. Herbicides as low volume spraying is not so uniform with Knapsack blowers. Liquid - 60 litres / ha swath 7 to 8 m.

### 5. Present Situation

- The Indian farmers (small, marginal, semi medium) are currently using lever operated backpack type sprayer consists of tank 10 to 20 liters capacity carried by two adjustable straps.
- Constant pumping is required to operate this which results in muscular disorder.
- Also this backpack sprayer cannot maintain pressure results in drifts or dribbling. Developing adequate pressure is laborious and time consuming. Pumping to perform operation is also time consuming.
- Moreover, very small area is covered while spraying .so, more time is required to spray the entire land.
- Back pain problems may arise during middle age due to carrying 10-20 liter tank on back.
- Cotton is one of the most important commercial crops grown in India. Over 4 million farmers in India grow cotton as their main source as income.
- For cotton about 5 to 6 times spraying of pesticides is done. Cost of bullock driven is about 50000 now a day's which is expensive for small crop area

Therefore we can use designed and fabricated manually operated sprayer to spray at certain height and large crop area with lesser amount.



**Photograph 1:** Present situation of spraying pump

### Objective

- The suggested model can remove the problems of back pain, since there is no need to carry the tank (pesticides tank) on the back and solder.

- We can add more number of nozzles which will cover maximum area in minimum time and at maximum rate.
- Work reliability under different working conditions.
- Decrease the cost of machine.
- Decrease labour cost by advancing the spraying method.
- Machine can be used in small as well as in large crop area.

### Components of spray pump and seed sowing

1. Piston pump
2. Rear wheel roller
3. Roller shaft
4. Frame
5. Roller block
6. Front wheel roller
7. Slider
8. Driven sprocket
9. Drive sprocket
10. Chain
11. Handle
12. Nozzle
13. Hopper
14. Sowing mechanism

### Construction

- Manually operated spray pump has simple structure it consist of 3 wheels, piston pump, bearings, nozzle, shafts, trolley, pipe, crank shaft, freewheel, handle chain drive, etc.
- There is trolley like structure containing 3 wheels one at front and 2 at backside at rear.
- The rear wheels are connected by shaft. Bearings are provided at both sides for smooth motion. The front wheel is mounted at middle of the trolley.
- Freewheel is mounted on shaft connected to rear wheels. The freewheel is connected to crank shaft by chain drive. The crank shaft is then connected to piston pump with connecting rod.
- The piston pump is placed middle of frame which has reciprocating movement.
- The nozzle is mounted on upper side of the tank. Nozzle having flexible pipe which is move or turn any direction. We can also adjust the height of the flexible pipe. We use 2 nozzles in our sprayer.
- The whole assembly is connected to handle.

### Working

- First bring the spray pump at field where you want to use then fill the pesticides or water as your need.
- Then connect the chain drive to freewheel
- When we start applying/running the machine remembers to adjust the nozzle direction and height as per requirement.

- By holding handle when we start pushing the spray pump the wheels start to revolve due to its motion.
- The sprocket/freewheel transfers its motion to crank by chain drives the chain drive is connected to sprocket and crank.
- The crank shaft provides its motion to piston pump it. The pump works vertically reciprocating, through pipe the pesticides or water sprays on crop.

**Calculations**

*Discharge*

Discharge is defined as the volume of water flows or rate of water flow through given cross sectional area is called as discharge.

1. Discharge=Area of piston× stroke length× r.p.s  
 $Q = \pi/4 d^2 \times L \times r.p.s$   
 $= \pi/4 (0.65)^2 \times 0.5 \times 0.6$   
 $= 0.785 \times 0.4225 \times 0.03$   
 $= 0.00994988 \text{ mm}^3/s$

**Discharge (Q)= 0.00001 m<sup>3</sup>/s**

**5.2 Normal speed in r.p.m**

6 revolutions in 10 seconds, then how many revolutions in 1 second.

10 - 6  
 1 - X?  
 $10 * x = 6$   
 $x = 0.6$

The no. of revolution in 1 second is 0.6 then how many rev. in 1 minute (60seconds)

1sec. - 0.6revs.  
 1 minute -x?

$X = 0.6 \times 60$

**X= 36 rpm**

**Normal speed in rpm = 36 rpm**

**Applications**

- It major use in agriculture to spray 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.

**Preliminary Result**

**Advantages**

1. It does not require any kind of non-renewable energy is mechanical, electrical and pressure energy.
2. It reduces the fatigue of operator during the operation.

3. It increases the efficiency of operator.
4. It can cover more area of land during spray.
5. It can adjust the height of spray by using adjustable
6. Its cost is less than electrically and solar operated pump.
7. It has is less air pollution.

**Disadvantages**

1. In irregular area of land it can difficult to operate.
2. In rainy days in muddy environment it is difficult to operate.
3. For irregular crops this pump is difficult to work.

**Project Model till Now**



**Work Plan**

| Date                        | Operation Performed   |
|-----------------------------|---|
| 24/12/2016<br>To 31/12/2016 | we had started our project making   |
| 1/1/2017<br>To 15/1/2017    | Design and development of chassis and handle  |
| 16/1/2017<br>To 25/1/2017   | Chain and piston arrangement  |
| 26/1/2017<br>To 5/2/2017    | Solving problems related piston movement and arrangement of seed sowing equipment on it |
| 6/2/2017 to till            | Solving the balancing problem of equipment  |

**Conclusion**

- 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 are remove 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.
- It requires comparatively less time for spraying so we can get more fields spraying per day. It is cost effective than the existing spraying pumps available in the market as no direct fuel cost or cost for maintenance is needed for this.
- Also it can be used for any crop as its maximum width is not more than one foot. Its nozzles can be adjusted to any height

### References

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