

Fabrication of Automatic Agriculture Pesticides Spraying Machine

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Abstract— There are many types of pesticides sprayer pump are available in India. In India the spraying done in farm is by traditional technique. But mostly used sprayer is backpack type sprayer which is used by farmers because it is cheaper, easy to use, easily available and main thing about it is cost efficient. With the help of this machine farmer spray pesticides in their farm, but it requires lot of time and thus high operational cost, low efficiency, health problem and low profit. Also, the farmer which is spraying pesticides is affected by it as it is harmful to human health and human also affect by the lumbar pain and shoulder disorder due to weight of equipment and weight of tank on person's shoulder. This method used lots of time and affects human health adversely. This paper suggests machines which will save time and operational cost. Also saves human from affecting adversely.

Key words: Pump, Nozzle, Piping, Piston, Tyre, Chain Mechanism, Pressure Control Valve

I. INTRODUCTION

India is a country where nearly 70% of people lives in rural area and main source of their income is farming, directly or indirectly. 70% of people in India are connected with farming directly or indirectly, instead of that we are not producing the crop of which we having capacity to produce. Reason behind this is we farmers of our country are not using technology very well. So we have to make machines that can help then to save their time and money and to increase the production rate and their profit. We have to make economic machineries so farmers can purchase it as per capita income of our country's farmers are low and our country per capita 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. According to idea in our project we are making a small one wheel kart or vehicle which is mechanically operated by a slider crank mechanism. Two vertical arms are attached at front side of vehicle and one horizontal arm at top of the two vertical arm. Nozzle is fitted to these arms so that it can spray pesticides both the sides. Even the height of vertical arm can be adjusted manually. As more no of nozzle are there hence spraying is done rapidly and time and money is saved.

II. LITERATURE REVIEW

Literature review is nothing but the work done before the present time on the same topic. So, we know that people doing farming from ancient time for food and other purpose. For better growing of crop they spray pesticides on them. There are many types of pesticides spraying technique available nowadays in India and the entire world. It is difficult to mention all those techniques here. But we tried to mention main techniques used and best known to us. People

in India use backpack type sprayer which is carry on back of the person with 20 lit maximum capacities and one nozzle in one hand while other hand is used to pump the machine to create pressure. Another machine which is developed and supplied in England was manufactured and patented by Holme Farm Supplies Ltd. This machine is consisting of water tank on tractor. This water tank contains liquid pesticides. On back side of it a long rod is attached on which nozzles are attached. This is used to spray pesticides. Also many such machines are manufactured by this company for large scale farming and large size crops.

III. CONSTRUCTION AND WORKING PRINCIPLE

The machine consists of the main body frame, Nozzles, Pipes, Wheels, Tank, piping, pressure control valve, chain and spocket, shaft. This is the single wheel drive machine.. Frame is made up of mild steel. Its width 90 cm, length 180 cm and height is 70 cm. The main frame is covered from all the sides with steel sheets. Vertical arms are attached at end of front side of main frame, carrying horizontal arm. The nozzles are fitted to the pipes which are attached with the vertical and horizontal arm. The horizontal arm is movable on vertical arm. The tank is kept at the backside of the body. The mechanism is kept on the tank.



Fig. 1: Actual Photo of Automatic Agriculture Pesticides Spraying Machine

When vehicle moves forward then at the same time slider crank mechanism activates and the pressure is built in tank. Pump discharges liquid from tank towards the nozzle fitted to pipe. As 4 nozzles are attached therefore pressure in 2 nozzles at each side through which mixture of water and pesticides comes out and form solid spray patter as our nozzle is of solid spray patter and liquid falls on plants. Nozzle angle for spraying is 90 degree so we can cover large area with a single nozzle. If the pressure is increased then we had provided the pressure control valve so we can control the pressure. The unwanted pressure directly goes to tank through pipes.

IV. COMPONENTS

A. Wheel:

Wheel is used to transfer machine from one place to another and activates the mechanism by rotary motion of it. Specifications of wheels are as follows:

- Radius – 30 cm,
- Wheel material - rubber and steel



Fig. 2: Wheels



Fig. 3: Nozzle

B. Nozzle:

Nozzle is the main device in any spraying machine. It decides how much area is covered by spray. It generates spray pattern. Following are nozzle specification :

- Nozzle Type – Solid Nozzle
- Nozzle Angle – 90 degree
- Nozzle radius – 1 mm = 0.039 inch

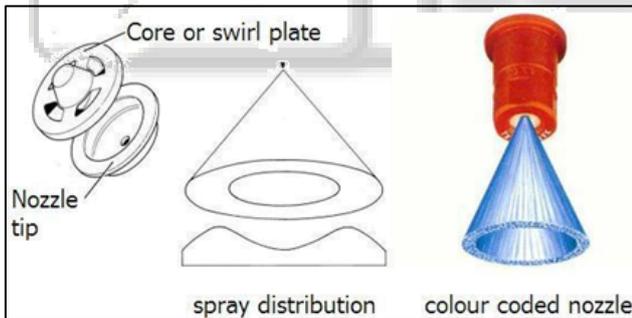


Fig. 4: Spray Pattern form by nozzle

C. Sprocket:

A sprocket or sprocket-wheel is profiled wheel with teeth, cogs, or even sprockets that mesh with a chain, track or other perforated or indented material.



Dimension:

- 1) Big sprocket
40mm inner diameter

- 180mm outer diameter
44 teeth
Material:- Stainless steel
- 2) Small sprocket
35mm inner diameter
75mm outer diameter
18 teeth
Material:- Stainless steel

D. Chain drive:

Those designed for transferring power in machines have links designed to mesh with the teeth of the sprockets of the machine, and are flexible in only one dimension. They are known as roller chains, though there are also non-roller chains such as block chain.

E. Tank:

Tank is the unit where we can store the mixture of water and pesticides. To protect it from corrosion and for long life and to reduce weight it is made up of plastic.

Tank capacity – 15 lit.

F. Frame:

Frame is nothing but the chassis for a machine or vehicle. It is the unit where remaining parts of the machine are fitted. To withstand in heavy weight parts it is made up of Cast Iron.

Length – 180 cm
Width – 90 cm
Height -70 cm

G. Pipe:

Pipe is the unit used to carry water from sump or tank to Pump and from Pump to nozzles. To reduce cart weight and to eliminate corrosion effect it is made up of plastic.

Plastic pipe length = 10 ft.

H. Metallic T & square:

T is nothing but the 3 way joint in which it accepts the liquid flow from one direction and transfers it to other 2 directions and vice versa. Also square is same to it but having 4 directions. Both are made up of metal and having internal diameter 8 mm.

I. Slider Crank Mechanism:

Slider-crank mechanism, arrangement of mechanical parts designed to convert straight-line motion to rotary motion, as in a reciprocating piston engine, or to convert rotary motion to straight-line motion, as in a reciprocating piston pump.

V. CALCULATION

Following are the calculations:

A. Flow rate of Nozzle

$$Q_n = 28.9 * D^2 * \sqrt{P}$$

Where,

Q_n = flow rate of water from nozzle (gpm)

D = Nozzle diameter (inch)

P = Pressure at nozzle (Psi)

$$Q_n = 28.9 * (0.039)^2 * \sqrt{25}$$

$$Q_n = 0.21 \text{ gpm}$$

$$Q_n = 0.79 \text{ lit/min}$$

Description	Conventional Method (10 Acre)	Automatic Pesticides Spraying Machine (10 Acre)
Pesticides	5Litre	4Litre
Pesticides cost	5*2000=10000 Rs	4*2000=8000 Rs
Labor Charge	Rs. 300 / Day	Rs. 300 / Day
Nos. of labors	3	1
Nos. of working days	8	2
No of cycle	5	5
Total charges of labor	300*3*8*5=36000Rs	300*1*2*5=3000 Rs
Machine cost	3000*3=9000	35000
Working charges of battery	-	Rs. 120/day For 5 no of cycle =Rs 600
Total cost	10000+36000+9000=55000	8000+3000+35000+600=46600
We save Rs.8400/ year		

We are using 4 nozzles. There are 2 nozzles on both sides of arm. Hence the final discharge will be $0.79 \times 4 = 3.1$ lit/min.

VI. RESULT AND CONCLUSION

As the vehicle moves in forward direction slider crank mechanism activates and due to it pressure will be generated in the tank and pesticide will be sprayed out from the nozzle. This machine will be operated by pushing the vehicle in forward direction; therefore no harm effect will occur to human health. Also it covers larger area in less time so lots of time will be saved with this and also labor cost will reduce and money saved.

Based on the present work the followings are some important conclusions have been drawn.

- 1) It is found that the existing pesticide spraying machine will be on persons shoulder. That portable backpack sprayer type machine may cause health problems for person as he directly comes in contact with pesticide. Also, the human who is spraying the pesticides faces the problem of lumber pain.
- 2) In advent of avoiding such problems enlisted in first point, an automatic agriculture pesticide spraying machine seems an alternative concept.
- 3) Comparison between the existing machineries and present machine shows that the single wheel operated machine can work very efficiently with respect to

covering area, time and cost of spraying process. Also it seems economical.

- 4) During testing the speed of vehicle varies continuously; it is because of varying track resistance. Further it is assumed that the spraying would be stopped partially but the pressure generated in spraying pump continues to spray the pesticide because the pressure developed in the pump is sufficient enough to spray for few minutes.

Cost Comparison of First Year

Cost Comparison from Second Year

Conventional Method = 10000 + 36000 = 46000 Rs
Automatic Agriculture Pesticides Spraying Machine = 8000 + 3000 + 600 = 11600 Rs

Therefore, automatic agriculture pesticides spraying machine will save large amount of money.

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