

MULTI NOZZLE AGRICULTURE SPRAYER

Karan Thakkar¹, Hem Pathak², Zil Soni³, Dhruv Joshi⁴

¹ Student, Mechanical Engineering, Vadodara Institute Of Engineering, Gujarat, India

² Student, Mechanical Engineering, Vadodara Institute Of Engineering, Gujarat, India

³ Student, Mechanical Engineering, Vadodara Institute Of Engineering, Gujarat, India

⁴ Faculty, Mechanical Engineering Vadodara Institute Of Engineering, Gujarat, India

ABSTRACT

There are many types of pesticides sprayer that are available in India. 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 pest control, liquid fertilizing and plant leaf polishing. Major advantages of using sprayers are such as easy to operate, maintain and handle, it facilitates spread of chemicals.

Keyword: - Multi Nozzle, Reciprocating Pump/, Storage Tank, Control Valve, Sprayer Hoses, Wheel, Adjusted Bar

1. OVERVIEW and OBJECTIVE

Agriculture plays a vital role in Indian economy. Around 65% of population in every state is depending on agriculture. Although its contribution to GDP is now around one sixth, it provides 56% of Indian work force. There are 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 percent 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 percentages, 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. The maximum percentage of farm distribution belonged to small and marginal category.

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 pest control, liquid fertilizing and plant leaf polishing. There are many advantages of using sprayers such as easy to operate, maintain and handle, 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, light or heavy spray, depending on requirement. The objective of the application of pesticide is to keep the pest under check. The pest population has to be kept suppressed to minimum biological activities to avoid economic loss of crop yields. Thorough killing of pest or eradication of pest is neither practical nor necessary. The objective of pesticide application besides keeping the pest population under check should also be to avoid pollution and damage to the non targets.

The success of pest control operations by pesticide application greatly depends on the following factors:-

1. Quality of pesticide

2. Timing of application
3. Quality of application and coverage

2. LITREATURE REVIEW:-

2.1 SPRAYING TECHNIQUES:

Most of the pesticides are applied as sprays. The liquid formulations of pesticide either diluted (with water, oil) or directly are applied in small drops to the crop by different types of sprayers. Usually the EC formulations, wet table powder formulations are diluted suitably with water which is a common carrier of pesticides.

The important factors for spray volume consideration are: The volume of spray liquid required for certain area depends upon the spray type and coverage, total target area, size of spray droplet and number of spray droplets. It is obvious that if the spray droplets are coarse-size then the spray volume required will be larger than the small size spray droplets. Also if the thorough coverage (eg. both the sides of leaves) is necessary then the spray volume requirement has to be more.

On the basis of volume of spray-mix the technique of spraying is classified as:

1. High volume spraying (300-500 L/ha)
2. Low volume spraying (50-150 L/ha)
3. Ultra low volume spraying (<5 L/ha)

2.2 COMMONLY USED PESTICIDES SPRAYERS

1. Hand operated sprayer
2. Foot operated sprayer
3. Motorcycle operated sprayer
4. Lite-trac sprayer
5. Aerial sprayer
6. Rocker sprayer

2.3 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. In order to overcome these difficulties, I 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 reciprocating pump, and nozzles which were connected at the front end of the spraying equipment.

3. EXPERIMENTAL SETUP

3.1 MAIN COMPONENTS

1. Reciprocating Pump
2. Nozzle
3. Storage Tank
4. Control Valve
5. Wheel

3.1.1 Reciprocating Pump

These types of pump operate by using a reciprocating piston. The liquid enters a pumping chamber via an inlet valve and is pushed out via an outlet valve by the action of the piston or diaphragm. Reciprocating pumps are generally very efficient and are suitable for very high heads at low, flows. This type of pump is self priming as it can draw liquid from a level below the suction flange even if the suction pipe is not evacuated. The pump delivers reliable discharge flows and is often used for metering duties delivering accurate quantities of fluid.

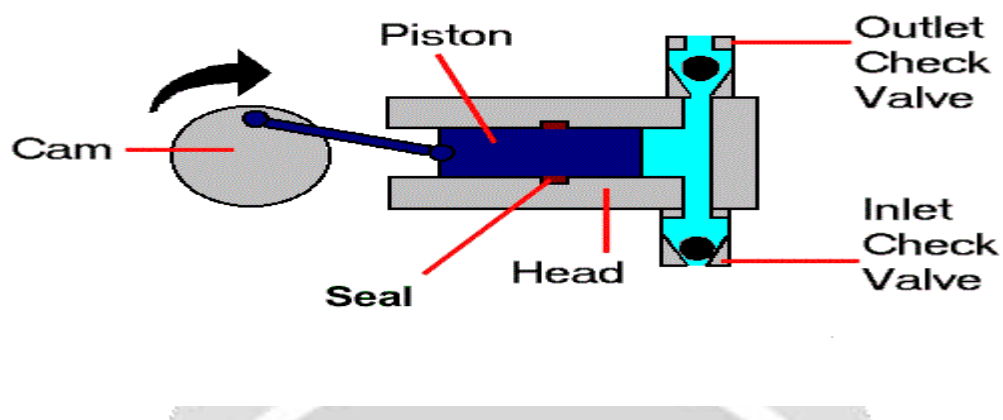


Fig. 3.1 Reciprocating Pump

3.1.2 Nozzle

The nozzle is a critical part of any sprayer. Nozzles perform three functions:

- Regulate flow.
- Atomize the mixture into droplets.
- Disperse the spray in a desirable pattern.

The hydraulic spray nozzle used in the application of pesticides has several functions. One of its main purposes is to convert the spray solution into droplets for efficient target coverage. The target may be foliage, bark, stumps, soil or insects. In association with other variables, e.g. height above target, travelling speed, operating pressure, the nozzle also has a role in spray pattern delivery, volume rate delivered and sprays quality produced. Nozzles are made from several types of materials. The most common are brass, plastic, nylon, stainless steel, hardened stainless steel, and ceramic. Brass nozzles are the least expensive but are soft and wear rapidly. Nylon nozzles resist corrosion, but some chemicals cause thermoplastic to swell. Nozzles made from harder metals usually cost more but will usually wear longer.

3.1.3 Storage tank

Most sprayers have a single tank that holds mixed pesticide ready to be applied. For some larger truck mounted sprayers, there are separate tanks for product and clean water, with a much smaller mixed (injection) tank of mixed product. Some tanks may contain an agitation device, especially those designed to work with insoluble pesticide formulations such as wet-able powders. Tanks are typically made of impermeable plastic, or stainless steel.

Tanks should be designed for easy filling and cleaning. It is a requirement that filler caps be lockable. Further, all tanks are required to be fitted with a device that maintains an air gap to prevent back flow from the tank into a water supply. As an alternative, the fill hose can be equipped with an automatic back pressure shut-off device. The tank is also required by regulation to have an easy-to-read accurate sight gauge or other external means of determining the internal level

3.1.4 Control Valves

The importance of pressure control to the quality of chemical applications has been largely underestimated and under-emphasized by Crop Protection Chemical Companies and knapsack sprayer manufacturers. Some knapsack sprayers come equipped with pressure gauges. However, useful gauges should not be considered a means of pressure control. Some knapsack sprayer brands have an adjustable pressure relief valve. Designed as a pressure limiter, they work by recycling liquid to the tank through a by-pass once the pressure in the pump exceeds a particular setting. Pressure relief valves provide limited pressure control, however pressure fluctuations at the nozzle still occur. Furthermore, pressure relief valves are located on the inside of the tank, exposing the applicator to contamination when attempting to adjust the setting. However, to be utilized for the majority of knapsack sprayers,

such a device needs to be accurate, effective, and durable, have little chance for operator error, and be affordable, especially for small-scale farmers with limited resources. The CF Valve or Constant Flow Valve satisfies all the criteria required of a pressure control device.

3.1.5 Wheel

A wheel is a circular component that is intended to rotate on an axial bearing. The wheel is one of the main components of the wheel and axle which is one of the six simple machines. Wheels, in conjunction with axles, allow heavy objects to be moved easily facilitating movement or transportation while supporting a load, or performing labor in machines. Wheels are also used for other purposes, such as a ship's wheel, steering wheel, potter's wheel and flywheel.

3.2 Design of Experimental Setup

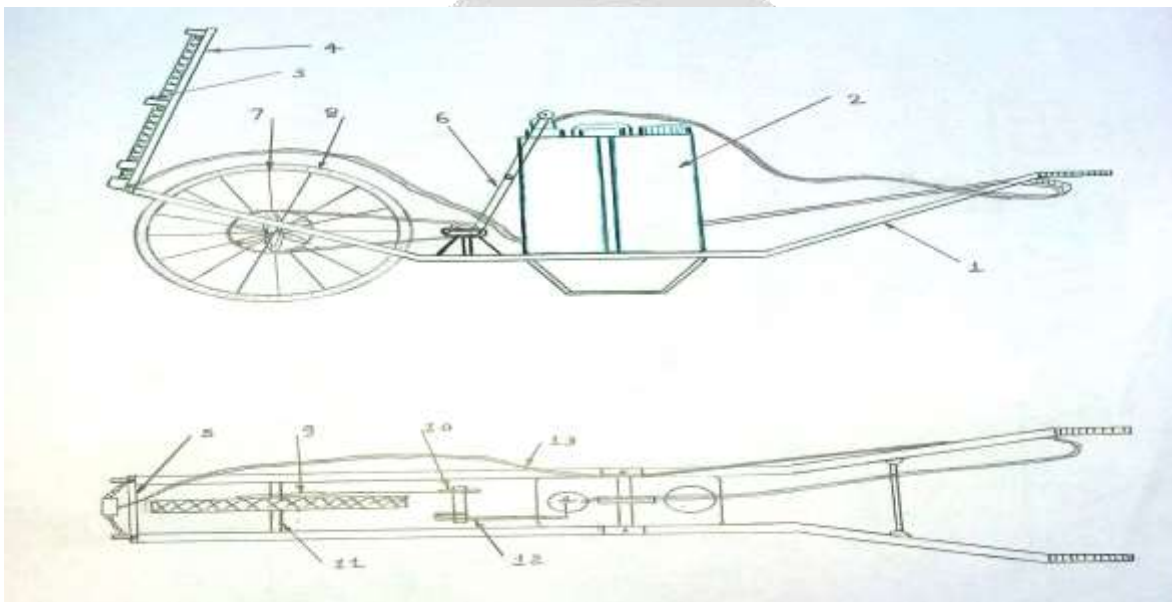


Figure-1 Layout of the system

- (1) Frame
- (2) Tank
- (3) Nozzle
- (4) Nozzle-bar
- (5) Adjuster bar
- (6) Connecting Rod
- (7) Wheel
- (8) Tyre
- (9) Sprocket
- (10) Freewheel
- (11) Shaft
- (12) Wheel shaft
- (13) Hose

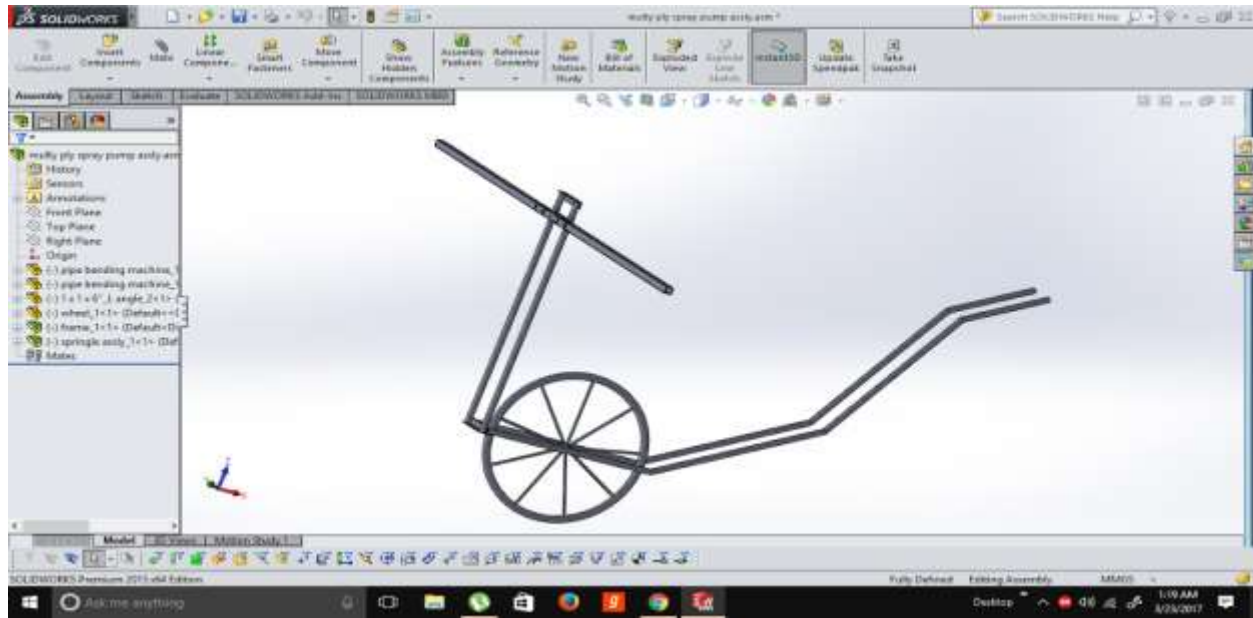


Figure-2 Multi nozzle sprayer Model in SOLIDWORKS

3.3 COMPONENTS WITH THEIR DIMENSIONS AND MATERIAL SPECIFICATIONS

SR NO.	Name of component	Dimensions	Material Used	Material specification
1	Frame	350*900 mm.	M.S.	Cheap, durable, good strength
2	Tank	350*500 mm.	plastic	Light in weight, durable
3	Nozzle	40mm	steel, brass	Pressure up to 3 bar
4	Nozzle bar	L = 3000 mm., W = 25 mm.	Steel	Durable ,light in weight
5	Adjuster Bar	L= 1500mm., W = 25mm	Steel	Durable ,light in weight
6	Connecting Rod		M.S.	Cheap, durable, good strength
7	Wheel	D =500 mm., W=50 mm	Steel	Durable , light in weight
8	Tyre	D=550 mm	Rubber	for friction purpose
9	Sprocket	D=200 mm, W= 5 mm	Steel	Transmit force up to SON
10	Freewheel	D=70 mm, W=4 mm	Steel	Durable , light in weight

11	Shaft	L=200 mm, D=20 mm	M.S.	Cheap, durable, good strength
12	Wheel-shaft	L=250 mm	M.S.	Cheap, durable, good strength

spray angle	Nozzle height		
	20" spacing	30" spacing	40" spacing
65	22-24"	33-35"	MR**
80	17-19"	26-28"	NR**
110	12-14"	16-18"	NR**
120	14-18"	14"	14-18"

4. CONCLUSIONS

1. The suggested model has removed the problem of back pain, since there is no need to carry the tank (pesticides tank) on the back.
2. As suggested model has more number of nozzles which will cover maximum area of spraying in minimum time & at maximum rate.
3. The c.f. valves can also be applied which help in reducing the change of pressure fluctuation and c.f. Valves helps to maintain pressure.
4. Proper adjustment facility in the model with respect to crop helps to avoid excessive use of pesticides which result into less pollution.
5. Imported hollow cone nozzles should be used in the field for better performance.
6. Muscular problems are removed and there is no need to operate the lever.
7. This alone pump can used for multiple crops

6. REFERENCES

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