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Manually Operated Height Adjustable Multi Nozzle Pesticides Sprayer

Prof. Naresh G.Metange (Asst Prof & HOD of Mechanical Engg. Dept. STC Shegaon), Mr. Mayur Dhnaokar, Mr. Aniket Dhanokar, Mr. Pratik Katkhede, Mr. VitthalZambre, Mr. Shubham Dhakare, Gajanan chawale

*Students.*Department of Mechanical Engineering,Siddhivinayak Technical Campus,Khamgaon Road,Shegaon,444203,Maharashtra,India.

ABSTRACT

Farmers are the heart of Indian culture. Small scale farmers always prefer manually operated instrument instead of developed instruments. In agriculture there is different field work like weeding, reaping, sowing etc. Along this operation spraying pesticide is a preliminary operation performed by farmers. To protect them from insects, dieses, fungi, and pastes. Now a day's number of technologies is used to spraying pesticide by using solar energy. We can simply use mechanical energy instead of these energies and these saved energies can be utilized at appropriate place. Although using these developed instruments farmers suffer from different problems like less capacity of sprayer tank, less working area, more cost as compare to manual more time consuming etc. to overcome these limitations of number of product are launched in market but they are not able to come over all the limitations at the time.

We find a solution over all these limitation by developing mechanically operated multi-nozzle sprayer pump for which any type of energy or fuel is not required except mechanical energy. Motive of this paper is to generate a low cost sprayer pump for India poor range farmers and reduce the required efforts. An accurate working model has been fabricated. It gives similar nozzle pressure and cover maximum area. We used crank mechanism along with piston pump, which is derived by rotation of wheel.

Keywords- Manually operated, pesticide sprayer

1.Introduction

For an Indian economy the agriculture is basic structure. India being creating country farming and industries in view of agriculture product has prime significance in the national economy. Lion's share of the Indian population relies upon farming and agro- based ventures and organizations. The equipment is intended to play out the three activities to be specific Spraying. The outlet of the pump is associated with the spraying nozzle through adaptable pipe. A cutting plate is connected just underneath the store tank for the weeding reason. By utilizing a responding pump the fluid enters a pumping chamber by means of a gulf valve and is pushed out through an outlet valve by the activity of the cylinder or piston. The water powered spraying nozzle utilized as a part of the utilization of pesticides has a few capacities. One of its fundamental objects is to change over the spray arrangement into droplet for proficient target scope. A wheel is a circular segment that is planned to turn on an axial bearing. A crank is an arm appended at right edges to a rotating shaft by which responding movement is conferred to or gotten from the shaft. The belts are utilized to transmit control starting with one shaft then onto the next by methods for pulleys which turn at a similar speed or distinctive rates. To convert fluids by transforming the rotational kinetic energy with hydrodynamic fluid energy, the alternative pump is used.

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 storageand transport.

2.Literature Review

- R.D. Dhete has worked on "Agricultural fertilizer & pesticides sprayers". In his work he emphasizes on different method of spraying devices
  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 labors carrying backpack sprayer and fertilizers are sprayed manually. The efforts required aremore and beneficial by farmers having small farming land
- Pavan B. Wayzode, Sagar R. Umale, Rajat R.Nikam, Amol D.Khadke, Hemant carried out their working "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.
- Sanded H. Poratkar, Dhanraj R. Rout carried out their work in "Development of Multinozzle Pesticides Sprayer Pump"
  This phenomenon not only adds to cost of production but also cause environmental pollution and imbalance in natural echo system. 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.

2.1 Problem Definition

The farmers who use this types Pesticides sprayer faces many types of problems like fatigue, tiredness, pain in spiral cord and muscles etc. following problem can takes place by use of this Pesticides Sprayer.

2.1.1 Common Problems

1. Poor selection and quality of equipment.
2. Big size of pump causes inconvenience to the operator
3. Heavy in weight causes difficulty in lifting manually.
4. Due to heavy weight the operator may fatigue.
5. This sprayer contains lack of awareness and knowledge.
6. The operator feels tiredness on using this sprayer.

2.2 Objectives

1) This project focuses on the problem of health-related issues of the farmer (operator).
2) Majority of them don't use any precautions like face-masks and hand-gloves against the hazardous chemicals and working direct contact with it.
3) Consequently, this harms the farmer as the spray in the conventional method directly hits the face.
4) Multi-nozzle is used and hence larger area of field can be sprayed at faster rate.

3.Methodology

- Multi sprinkle system work on principle of reciprocating pump. This reciprocating pump uses single slider crank mechanism, in which wheel sprocket works as crank. There are two sprockets which are mounted on two different axles in which one sprocket is directly attached to wheel axle. Connecting rod is attached to another sprocket axle through disc. In this power is given to piston of reciprocatingpump through rotation of wheel.
- When piston reach at top dead center, it creates negative or low pressure inside the cylinder due to pressure difference between reservoir and cylinder space, water moves to fill the cylinder chamber space. In this process suction valve open and delivery valve close.
- When piston reaches at bottom dead center, it creates high pressure inside the cylinder chamber & due to the pressure difference between cylinder & Delivery pipe. Water moves through discharge pipe to sprinkle. In this process suction valve closed and delivery valve open. This process repeats again and again to get desire output.
- Motion transmission by chain and sprockets arrangement.
- Slider crank mechanism.
- Rotary motion converted into reciprocating motion.

3.1 Design and Calculations

Overalllength (mm)	533.4
OverallWidth (mm)	232
OverallHeight (mm)	762
TankCapacity (Liter)	20
Weight(KG)	18
FieldCapacity(he./day)	3 (With 6 Nozzles)

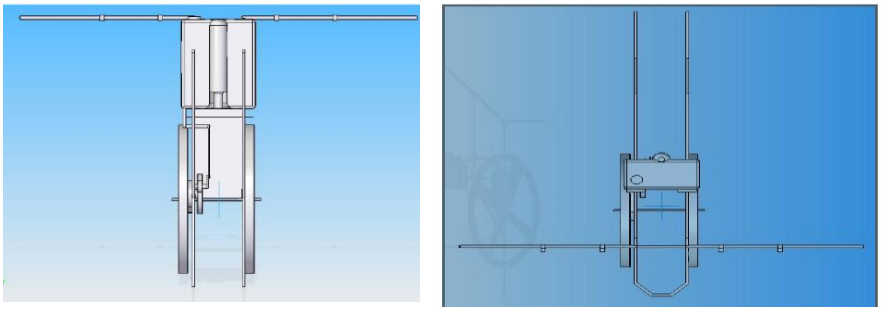

Fig. 1 – (a) Front view of model; (b) Top view of model.

4. Components

4.1 Spray 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 evac

Fig. 2– Spray Pump

4.2 Nozzle

A nozzle is a device designed to control the direction or characteristics of a fluid flow (especially to increase velocity) as it exits (or enters) an enclosed chamber or pipe. A nozzle is often a pipe or tube of varying cross-sectional area and it can be used to direct or modify the flow of a fluid (liquid or gas). Nozzles are frequently used to control the rate of flow, speed, direction, mass, shape, and/or the pressure of the stream that emerges from them. In a nozzlethe velocity of fluid increases at the expense of its pressure energy.

Fig. 3 – Nozzle

4.3 Nozzle Holder

A nozzle holder is a precision device facilitates dispersion of liquid into a spray. In this pipe the chemical liquid distributed through the nozzles.This pipe are made by stainless steel.

Fig. 4 – Nozzle Holder

4.4 Flexible Pipe

A hosepipe, or simply hose is a flexible tube used to convey water. There are a number of common attachments available for the end of the hose, such as sprayers and sprinklers (which are used to concentrate water at one point or to spread it over a large area). Hoses are usually attached to a hose spigot or tap.

Fig. 5 – Flexible Pipe

4.5 Steel Pipe

Steel pipes are long, hollow tubes that are used for a variety of purposes. They are produced by two distinct methods which result in either a welded or seamless pipe. In both methods, raw steel is first cast into a more workable starting form. It is then made into a pipe by stretching the steel out into a seamless tube or forcing the edges together and sealing them with a weld. Steel pipe which is use for frame of sprayer

Fig. 6 – Steel Pipe

5.WorkingDiagram

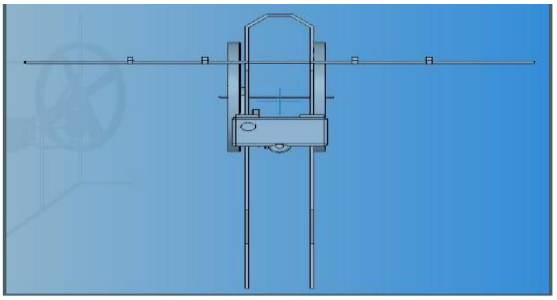

Fig. 7 – Working Diagram

6 .Result & Discussion

The nozzle spray volume was collected in test tubes and evenness of the spray was determined by drawing a pattern graph for different working pressures. The bar graph of spray pattern (graph 03) for 600 kPa followed almost a normal distribution, which is a sign of uniform spray pattern and for other two pressure setting that is 500 and 700 kPa, the pattern tends to deviate from normal distribution as shown . The discharge data of individual nozzle obtained in different pressure level were stored in M.S. Excel and statistical analysis was conducted. The data were analyzed on computer using factorial CRD statistical software packages. After analyzing the data, a set of independent variable giving optimum value of pressure 600 kPa was used for field evaluation.

Spray discharge was collected in still air for a period of 60 seconds. Total discharge of the booms at 500, 600 and 700-kPa pressure was observed to be 13.97, 12.23 and 13.03 l/min in the laboratory as compared to 13.34, 12.10 and 12.79 l/min, respectively in the field (graph 04).The discharge of the sprayer measured in the field was about one l/min less than that of laboratory conditions, which is within acceptable range.

- **Spray angle**

Spray angle was found to be 80^0, $85^o$and 88^o for 500, 600 and 700 kPa pressure settings, respectively (graph 05). The recommended angle of hollow cone nozzle is 65^o to 110^o.

7.Advantages, Disadvantages & Application

- **Advantages**
  - It can cover more area of land during spray.
  - It reduces the fatigue of operator during the operation.
  - It increases the efficiency of operator.
  - It can adjust the height of spray by using adjustable.
  - It does not require any kind of non-renewable energy is mechanical, electrical andpressure energy.
- **Disadvantages**
  - 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 pump is difficult to work.
  - The flow is not uniform so we have to fit a bottle at both ends.
  - The flow is very less and can't be used for high flow operation.
  - Can be used in only hard surfaces.
- **Application**
  - Its 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 and morning during utilize in lawn.
  - Use from spray chemical pesticide in plant in farm.
  - It is used for spray painting in industry.
  - It is used for spray water in garden on the plants.
  - It is used for transfer water from one place to its nearer place.

8.Conclusion & Future Scope

It is an upgraded design of manually operated multiple sprayers which will be helpful forsmall land farmers. It consumes less time and saves many as compared with conventionalspraying and weeding. This machine does not require any fuel or power so maintained is less.This model removes the problems of back pain, vibrations and noise. This alone pump can beused for multiple crops. The model has provided multiple nozzles, which has continues sprayoverthecrop and this process takes less timethan othersprayers for spraying.

This suggested model has removed the problem of back pain, since there is no need to carry the pesticide tank on the back. Health problems from the pesticide during the spray will be zero. This model has more number of nozzles which will cover maximum area of spraying in minimum time & at maximum rate.

FUTURESCOPE

- More number of nozzles can be used.
- A new design can be implemented to eliminate the need for pulling the machine manually.
- Stronger but light in weight materials can be used for the frame.

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