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Multipurpose Bicycle Sprayer

Balajigowda H S¹, Akshayakumar Vaidya¹, Akshay R Hegde¹, Indresh S Katti¹

U.G. Student, Department of Mechanical Engineering, Dr. Ambedkar Institution of Technology, Bengaluru, India¹

ABSTRACT: Modernization of agriculture is unavoidable in order to meet the food needs of a growing population and rapid industrialization. By guaranteeing better distribution, lowering the amount needed for improved response, and eliminating losses or waste of applied inputs, mechanisation enables input conservation. Mechanization reduces manufacturing unit costs by boosting output and utilising resources more efficiently. The same techniques and tools have been employed by farmers for generations. Farming is done traditionally in our country, but there has been significant development in the industrial and service sectors in comparison to agriculture. Spraying is traditionally done with a labor-intensive backpack sprayer that requires more human effort.

KEYWORDS: Mechanization, Agriculture sprayers.

I. INTRODUCTION

Modernizing agricultural industries is necessary to meet the rising demand for food as the global population rises. Costs of production will be decreased. While requiring less input, mechanisation boosts productivity. The same conventional techniques for spraying pesticides and fertilisers are being used by farmers. A sprayer is an instrument used to apply liquids, including water, herbicides, crop performance aids, pest control agents, and ingredients for manufacturing and production lines. A type of agricultural machinery called a sprayer is used to spray fertilisers, insecticides, and herbicides on crops. In general, agricultural equipment is out of reach for most people. Demand for agriculture is increasing fast as population and per capita income rise, as is demand from the industrial sector. As a result, there is an urgent need to determine the severity of the situation affecting the agriculture sector in order to restore its vitality.

Farming has evolved dramatically over the last 50 years. One of the many causes for this development is the suppression of numerous crop diseases. Pesticide use in contemporary agriculture is still expanding, and 80% of these pesticides are applied in the form of spraying, which maintains an environmentally acceptable approach. Farmers would have economic challenges if they use chemical or electrically driven pumps, and they will experience health risks if they use hand operated pumps, according to the argument for using existing traditional equipment. One solution to this problem is to use the equipment designed for pesticide application using mechanical power.

The spray nozzle, occasionally with a spray gun, the fluid tank, the sprayer pump, pressure regulators, valves and gaskets, and fluid piping are typical system components for more complicated sprayers, such as agricultural sprayers. The sprayer pump can be just as significant as the sprayer itself due to the wide variety of sprayer pump design types and their various construction materials, inlet/outlet diameters, and performance requirements.

Some of the common type of the sprayers used are

- Backpack Sprayer
- Tractor Mounted sprayer
- Foot Operated Sprayer
- Compression Sprayer
- Rocket Sprayer
- Knapsack Sprayer
- Electrostatic Sprayer

II. RELATED WORK

Pesticides are defined by the Food and Agriculture Organization 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 and animals, causing harm during or otherwise interfering with the production, processing, storage, transport, marketing of food, agricultural commodities, wood and wood products, or animal feedstuffs, or substances that may be



administered to a human or animal." The term includes substances designed to be employed as a desiccant, defoliant, plant growth regulator, or agent for fruit thinning or preventing early fruit fall. Additionally used to protect crops from deterioration while being stored and transported.

S.R. Kulkarni and colleagues[1] conducted study on "Fabrication of Portable foot operated agricultural fertilizers and pesticide spraying pump." Farmers in India can be categorised as being tiny, marginal, medium-sized, or successful. Three factors influence small-scale farmers' decision to employ traditional, manually operated knapsack sprayers: cost effectiveness, design ease, and user friendliness. However, it cannot sustain the proper pressure and causes lumbar discomfort. However, this technology might lead to chemical misapplication and poor pest management. Pesticides are lost owing to dribbling or drift during application. An investigation was done on "Modeling and development of pedal powered agricultural sprayer" by T. Subbarayudu and Dr. N Venkatachalapathi[2]. The main objective of this project is to increase the manual sprayer industry's pedal operation to pump reciprocation and discharge rate while decreasing human effort. This project might model, build, and construct a foot sprayer. It was also made to be easy to transport from one field to another and utilise this sprayer. It can be used to distribute the applied weight evenly across the operator's legs while both legs are being used simultaneously. In a study titled "Assessing the Effectiveness of Air-assisted and Hydraulic Sprayers," Harold R. Summer and Gary A. Herzog[3] performed research. In comparison to traditional over-the-top sprayers, air-assisted and drop-nozzle sprayers should provide improved pesticide penetration and coverage beneath the plant canopy, where the insects feed. This study investigated the effectiveness of the three sprayers used to apply the pesticide Tracer, a natural insecticide produced by the actinomycete *Saccharopolyspora spinosa* (Dow Agrosciences, Indianapolis, IN), inside the cotton canopy (*Gossypium hirsutum* L.). To find pesticide deposition inside the canopy, a bioassay was conducted using leaves from the top, middle, and bottom of cotton plants. r. Research was conducted on "Technological advancements in electrostatic spraying and their influence on agriculture" by Manoj Kumar Patel[4]. Key research areas in electrostatic force field applications to liquid sprays include painting, printing, thin film coating, medicine, nanobiotechnology, transportation, and other applications. The expected effects of such spraying include uniform deposition onto both immediately exposed (adaxial) and concealed (abaxial) crop surfaces, minimising off-target losses of active ingredients to soil, water, and atmosphere, and offering efficient pest control at a reasonable cost. This paper provides a summary of electrostatic spraying technologies for use in agriculture and perishable fruits and food products, highlighting the crucial role of advanced electrostatic spraying instrumentation, and chronicles scientific advancements in the context of providing affordable and dependable commercial systems, as well as an insight into future research perspectives and directives. A study on "Evaluation and Development of Electrically Operated Knapsack Sprayer" was conducted by J.O. Awulu and P.Y. Sohotshan[5]. Using components that were readily available in the area, an electrically powered knapsack sprayer with a ten (10) litre capacity was built and tested. This technique was developed to solve the issue with conventional knapsack sprayers, which is the continuous supply of energy to the throttle to control air pressure. The major parts are a tank, a 12-volt electric water pump, a 12-volt accumulator battery, a strap (belt), a delivery pipe, and a sprayer handle with a lance and nozzle. A 12 volt, 2.5 amp battery powered Mercedes Benz windscreen washer pump bent to the necessary specifications. Through laboratory and field investigations, flow rate, application rate, and dispersion rate were all identified. Flow rate was established using basic hydraulic principles, whereas application rate was decided by effective usage. A research on the "Design of an Experimental Sprayer for Pesticide Application" was undertaken in orchards by Menzies, D.R. To conduct studies on the spraying of pesticides, an experimental orchard sprayer was developed. Three hydraulically driven, independently controlled, vertically stacked vane-axial fans, three pesticide nozzle manifolds, and the flexibility to alter the air exit form are all part of its design. By using it in experimental programmes, its usefulness has been proven. Development of a Multipurpose Sprayer was studied by A. S. Wankhede and colleagues[7]. Agriculture's usage of automation for spraying has increased farm output. The labour dispute has therefore been settled. But things are different in a country like India. Due to the little amount of agricultural land available, automation in these areas is a difficult task, and the majority of Indian farmers are in subpar economic circumstances. Therefore, the manually driven sprayer is frequently utilised in such circumstances. On Indian farms, spray pumps are used both manually and with fuel.

III. METHODOLOGY

i. MODELLING

Current design iterations are taken into account, and the main mechanism is selected and put on a cycle for user-friendliness. It is easier to operate because the tank and mechanism are built onto the cycle carrier. Since it is used for power transmission, the disc that is attached to the wheel and the connecting rod is made of metal. Plastic has been used to create the tank, pipes, and nozzle to make the device more affordable. A programme named Blender is used for all of the modelling and rendering.

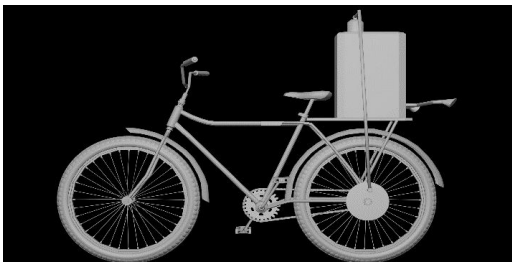


Fig 3.1(a)

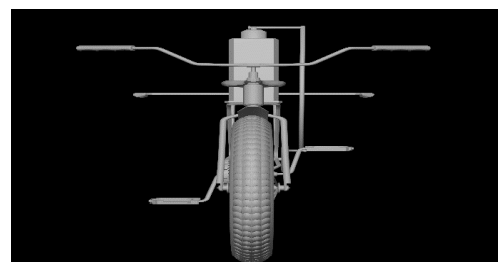


Fig 3.1(b)

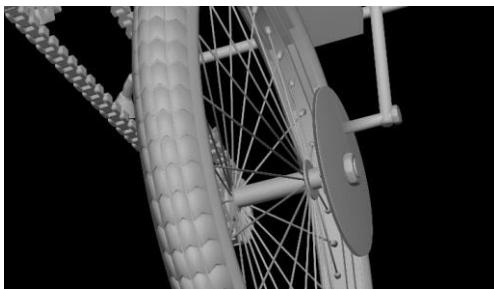


Fig 3.1(c)

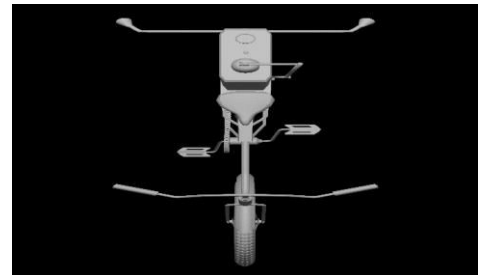


Fig 3.1(d)

Figure 3.1 above depicts the sprayer in various profiles. The side profile is depicted in 3.1(a). The sprayer's front profile is depicted in Figure 3.1(b). The mechanism utilised to convert rotation into the to-and-fro motion for increasing pressure in the tank is seen in 3.1(c). The sprayer's upper profile is shown in Figure 3.1(d).

ii. WORKING

The fluid sprayer's mechanism is based on a straightforward slider crank mechanism. The disc on the rear wheel's extended axil receives the energy produced by the cycle's rear wheel. Using a straightforward connecting rod, the wheel's rotation is then transferred to a plunger, where it is transformed into a to-and-fro motion. When compared to ambient pressure, the to-and-fro motion inside the tank begins to create higher pressure. The air applies pressure on the liquid inside the tank as a result of the pressure differential, and the liquid subsequently escapes out of the nozzle through the pipe. The nozzle is positioned so that they are facing apart from one another, covering a large area with spray.



Fig 3.2(a)



Fig 3.2(b)

The complete render of the sprayer is shown in the previous illustration, fig. 3.2. The coloured side profile is shown in 3.2(a), and the use of the sprayer is shown in 3.2(b).

IV. CONCLUSION

The ergonomic design of this sprayer mechanism attempts to lessen the amount of physical labour required while applying pesticides or fertilisers to agricultural areas. The forward motion of the entire assembly powers this mechanism, which lowers the amount of energy or fuel required to run these sprayer machines. With this design, three sprayers are used to apply fluid over a bigger area in less time, and the nozzles may be replaced as needed. Sanitizers may also be sprayed to walls, floors, and enclosed places using this sprayer.

- Because no fuel or electricity is needed, it is both economically and environmentally sound. In addition, maintenance is reasonably priced.
- It may be used to spray pesticides and liquid fertilisers.
- minimises human labour.
- The presence of two nozzles may allow for the coverage of a larger spray area.

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