

# DESIGN AND FABRICATION OF PESTICIDES SPRAYER

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## ABSTRACT

In order to meet the food requirements of the growing population and rapid industrialization, modernization of agriculture is inescapable. Mechanization enables the conservation of inputs through precision in metering ensuring better distribution, reducing quantity needed for better response and prevention of losses or wastage of inputs applied. Mechanization reduces unit cost of production through higher productivity and input conservation.

Farmers are using the same methods and equipment for the ages. In our country farming is done by traditional way, besides that there is large development of industrial and service sector as compared to that of agriculture. The spraying is traditionally done by labor carrying backpack type sprayer which requires more human effort. The weeding is the generally done with the help of Bulls which becomes costly for farmers having small farming land. So to overcome these above two problems a machine is developed which will be beneficial to the farmer for the spraying and weeding operations.

**Key Words**— Mechanization, backpack type sprayer, weeding, modernization

## 1. INTRODUCTION

Our farmers are using the same methods and of India is set to be an agricultural based country approximately 75% of population of India is equipment for the ages. e.g. seed sowing, spraying, weeding etc. There is need for development of effective spraying and weeding machine for increasing the productivity.

### A. Status of agricultural mechanization in India

Most of the developing countries of Asia have the problem of high population and low level of land productivity as compared to the developed nations. One of the main reasons for low productivity is insufficient power availability on the farms and low level of farm mechanization. This is especially true for India. It is now realized the world over that in order to meet the food requirements of the growing population and rapid industrialization, modernization of agriculture is inescapable. It is said that on many farms, production suffers because of improper seedbed preparation and delayed sowing, harvesting and threshing. Mechanization enables the conservation better response and prevention of losses or wastage inputs applied of inputs through precision in metering ensuring better distribution, reducing quantity needed for better response and prevention of losses or wastage of inputs applied. Mechanization reduces unit cost of production through higher productivity and input conservation. Agricultural implement and machinery program of the government has been one of selective mechanization with a view to optimize the use of human, animal and other sources of power. In order to meet the requirements, steps were taken to increase availability of implements, irrigation pumps, tractors, power tillers, combine harvesters and other power operated machines and also to increase the production and availability of improved animal drawn implements. Special emphasis was laid on the later as more than 70% of the farmers fall in small and, marginal category. It is generally said that mechanization of small farms is difficult. But Japan having average land holding even smaller than ours, with proper mechanization has led agriculture to great heights. In order to minimize the drudgery of small farmers, to increase efficiency and save farmer's time for taking up additional /supplementary generating activities, the use of modern time saving machines/implements of appropriate size needed to be suitably promoted.

### B. Research & Development System

The Indian Council of Agricultural Research (ICAR) is the main organization looking after all agricultural research, including agricultural implements and machinery. It coordinates a number of research projects with centers at different places in the country. Some of the State Governments have also facilitated in setting up of research organizations at state level. Each of the state has at least one agricultural university.

A research program usually concentrates on the development of equipment suitable to a given farming conditions. The objective is to improve upon the performance of indigenous implements or develop a new implement that can either enhance labor productivity or appropriately mechanize the operation where a labor or power shortage hinders completing the task in time.

**Backpack (knapsack) sprayer**

One type of backpack sprayer is a compressed air sprayer with a harness that allows it to be carried on the operator's back

Another type of backpack sprayer has a hand-operated hydraulic pump that forces liquid pesticide through a hose and one or more nozzles. The pump is usually activated by moving a lever. A mechanical agitator plate may be attached to the pump plunger. Some of these sprayers can generate pressures of 100 pounds per square inch (psi) or more. Capacity of both these types of backpack sprayers is usually 5 gallons or less

Hydraulic sprayers consist of a tank, a pump, a lance (for single nozzles) or boom, and a nozzle (or multiple nozzles). Sprayers convert a pesticide formulation, often containing a mixture of water (or another liquid chemical carrier, such as fertilizer) and chemical, into droplets, which can be large rain-type drops or tiny almost-invisible particles. This conversion is accomplished by forcing the spray mixture through a spray nozzle under pressure. The size of droplets can be altered through the use of different nozzle sizes, or by altering the pressure under which it is forced, or a combination of both.



Figure 1: Backpack type spraying

**Lite-Trac**

Lite-Trac is a trading name of Holme Farm Supplies Ltd, a manufacturer of agricultural machinery registered in England and based in Peterborough. The Lite-Trac name comes from "lite tractor", due to the patented chassis design enabling the inherently very heavy machines manufactured by the company to have a light footprint for minimum soil compaction. Holme Farm Supplies Ltd agricultural products, sold under the Lite-Trac name, include tool carriers, self-propelled lime and fertilizer spreaders, sprayers, granular applicators and tank masters. Lite-Trac is currently the manufacturer of Europe's largest four-wheeled self-propelled crop sprayers. The company's products are identifiable by the combination of unpainted stainless steel tanks and booms with bright yellow cabs and detailing. A Lite-Trac crop sprayer, or liquid fertilizer applicator, mounts onto the SS2400 Tool Carrier centrally between both axles to maintain equal weight distribution on all four wheels and a low centre of gravity whether empty or full. The stainless steel tanks are manufactured in capacities of up to 8,000 liters, whilst Pommier aluminium booms of up to 48 meters can be fitted, making these Europe's largest four-wheeled self-propelled sprayers.



Figure 2: Lite-trac spraying

## 2. BACKGROUND STUDY

**Sandeep H. Poratkar, et. al. [1]** worked on “Development of Multi Nozzle 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.

**VarikutiVasantha Rao et. al. [2]** on “Multiple Power Supplied Fertilizer Sprayer” - In this paper, the design and implementation of multiple power supplied fertilizer sprayer has been presented. The proposed system is the modified model of the two-stroke petrol engine powered sprayer which minimizes the difficulties of the existing power sprayer such as operating cost, changing of fuel etc. The two-stroke petrol engine has been replaced by a direct current motor and operated by the electrical energy stored in the battery attached to the unit. The battery can be charged by solar panel during the presence of sun. It could also be operated on direct current during rainy and cloudy weather conditions. This system can be used for spraying pesticides, fungicides, fertilizers and paints.

**Shivaraja Kumar Parameswaramurthy[3]**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. The project is carried out for design & fabrication of pesticide spraying machine used for the agricultural purpose. The manually operated multipoint sprayer pump is worked by operating a pedal lever by the operator. It requires one person to work. The spray liquid is kept in bucket or container and it is sucked by a suction hose through a filter (strainer) due to piston movement used in the bicycle.

**Dhiraj N. Kumbhare et. al. [4]** worked on “Fabrication of Automatic Pesticides Spraying Machine” - This paper suggests machines which will save time and operational cost. Also saves human from affecting adversely. According to idea in our project we are making a small 4-wheel kart or vehicle which is electronically operated by a wireless remote which runs on power source as a DC battery. One vertical arm is attached at center of vehicle and one horizontal arm at top of the vertical arm. Nozzle is fitted to these arms so that it can spray pesticides both the sides. As more no of nozzle are there hence spraying is done rapidly and time and money is saved.

**David McAuliffe et. al.[5]**having paper entitled “Application technology: Problems and opportunities with Knapsack sprayer, Including the cf valves or Constant Flow Valves.” Says, the lever operated knapsack sprayers continue to be the most common piece of application equipment for crop protection in many countries. Its versatility in use with a variety of different chemical products and its relative ease of operation make it well suited for small-scale growers aiming to increase agricultural productivity.

**Paul E. Sumner [6]** having paper entitled “Hand-held and Backpack Sprayers for Applying Pesticides.” that, Hand sprayer skilled operators is to achieve a uniform broadcast application. A simple and quick test is to spray an area on a paved surface with water in your normal spraying manner on a warm day.

**Ms. Ashwini Kambar et. al. [7]**Worked on “Design And Development of Dual Controlled, Solar Powered, Smart Pesticide & Fertilizer Spraying Robot”-There is need of development in this sector and most commonly on fertilizers pesticides spraying technique, because it requires more efforts and time to spray by traditional way. To solve these problems this project deals with the development of dual mode solar powered insecticide and fertilizer spraying machine.

**Joginder Singh [8]** in the paper entitled “Scope, Progress and Constraints of Farm Mechanization in India” says, Mechanization in Indian agriculture is the need of the time but its use has to be viewed from angles of unemployment problems of human and animal force and vast majority of small and uneconomical farms. S. N. Gandhare et. al / Design & Fabrication of Paddle Operated Multi-Point Pesticide Spraying Machine.

## 3. Objectives

- Decrease the operational cost by using new mechanism.
- Work reliably under different working conditions.
- Decrease the cost of machine.
- Decrease labor cost by advancing the spraying method.
- Machine can be operated in small farming land (5 acre).
- Making such a machine which can be able to perform both the operation (spraying and weeding). So considering these points related to spraying and weeding an attempt is made to design and fabricate such equipment which will able to perform both the operations more efficiently and also will results in low cost.

#### 4. METHODOLOGY

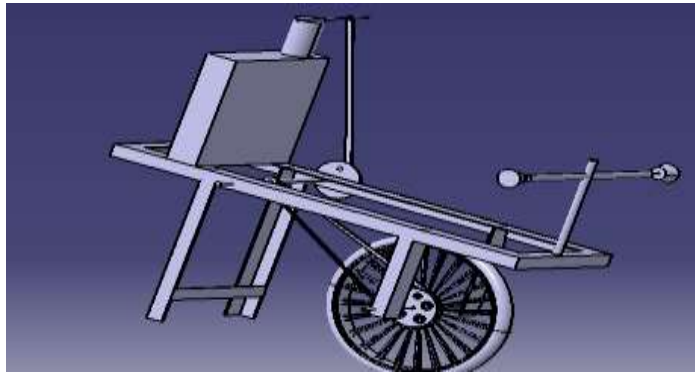


Figure 3: Isometric view of model

The machine shown in figure 3 is designed to perform the operations namely “Spraying”. For Spraying pesticides, the reservoir tank contains pesticides is attached to the reciprocating pump. The outlet of the pump is connected to the spraying nozzle through flexible pipe.

#### 5. Working

When the equipment is push forward by using handles, front wheel rotates and the gear is mounted at the axle of wheel is start to rotate and its rotation is then transferred to the pinion through the chain drive. The rotary motion of the pinion is converted into the reciprocating motion by the single slider crank mechanism, due to this arrangement the connecting rod moves upward and downward which then reciprocate the piston of single acting reciprocating pump mounted at the top of storage tank. During the upward motion of the connecting rod the pesticide is drawn into the pump and during the downward motion of connecting rod the pesticide is forced to the delivery valve, the delivery is connected to the pipe carrying the number of nozzles.

#### 6. CONCLUSION

The equipment is purposely design for the farmers having small farming land say 5-6 acre. It is suitable for spraying at minimum cost for the farmer so that he can afford it. It covers twice area of spray than manually spraying. More no.of nozzle which cover maximum area of spray in minimum time at maximum rate. The suggested model has removed the problem of back pain. The performance of the equipment will increase when it is operates on the smooth surface or less uneven surface and also it will be more effective when it is used on the crops having nearly similar height and having the less space between two crops

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