

# **DESIGN AND FABRICATION OF MULTI-NOZZEL PESTICIDES SPRAYER**

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## **ABSTRACT**

*India is a land of agriculture which comprises of small, marginal, medium and reach farmer. Small scale farmers are very interested in manually labor operated knapsack sprayer because of it's versatility, cost and design .But this sprayer are certain limitation like, it cannot maintain required pressure, it lead do problem of back pain and foot pain . However this equipment can also lead to misapplication of chemicals and ineffective control of target pest which leads to loss of pesticides due to drift during application .This phenomenon not only adds to cost of production but also cause environmental pollution and imbalance natural eco system .This paper suggest a model of manually operated multinozzle pesticides sprayer pump which will perform spray at maximum rate in minimum time*

**Keywords:** Nozzle, Pump, Solar panel, Battery

## **INTRODUCTION**

This project is created to solve the problem of traditional and inefficient spraying methods adopted by farmers. The fertilizer sprayer used by 60 to 70% farmers in India is the "Backpack Knapsack" Fertilizer sprayer. They need to carry it on their back and then cranking it by hand. This type of pumps can't create high pressure. This may cause many plants to get missed from the spray. Because only one nozzle is there and the operator needs to move the nozzle over each and every plant. One person can cover 2 to 3-acre area in one day. As efforts are required and continuous cranking by single hand causes serious pain in the hand of operator. He also needs to balance himself with the weight of the sprayer and Pesticides. In muddy area it's difficult to maintain balance as, operator can slip in muddy areas. Our solution tries to solve above issues so that efforts of farmer gets reduced and time is also saved. We have used manual operate our product.

In India, agriculture and agriculture-based products have received great importance in the Indian economy. The 2010 world statistics of agriculture says, India to be the world's highest producer of several vegetables, fresh fruits, major spices, milk and also some fibrous crops. Lack of mechanization or automation is one of the major roadblocks

to improving the productivity of agriculture. With agriculture facing a shortage of manpower, the need for automating the various activities in the field arises or it is becoming the need of the day. With this in mind, a simple machine has been designed and fabricated for removal of pest and unwanted plants between the rows of sugarcane plants. As the sprayer is portable, it is hanged at the shoulder and pesticides are sprayed by the farmer.

A pest is usually characterized by rapid growth and It typically replaces another more desirable disease. Some pests, such as crabgrass, are considered weeds everywhere they grow, but many plants are considered pests in some regions and not in others. Although most pest damage cultivated plants by competing with them for sunlight, water, mineral nutrients, some pest are parasites that infect directly on other plants and thus either weaken or kill them. Many pests are also hosts for disease- causing organisms. For example, some of the fungi diseases that infect food crops spend part of their life cycle on a pest that typically grows near the crop. In addition to harming cultivated plants, many pests, such as Canada thistle, can poison livestock if eaten. Although livestock poisoning is not a serious problem in the eastern United States, the western states, having many poisonous species, report a considerable loss each year.

For example, the wild onion, although not poisonous, spoils the flavor of milk produced by cows that consume this weed. Although generally harmful or undesirable, weeds can also provide benefits for agriculture. Pests prevent or retard soil erosion in open pastures and stabilize the thin, fragile soils of tropical farmlands. They conserve water in semi-arid and Mediterranean climates by enhancing water storage, increasing shade, and breaking up the soil with their root growth. This prevents a condition called hard cap, in which rain puddles that set on sun baked soil rapidly evaporate without ever penetrating the ground. Some pests may provide a source of food. The tender shoots of weeds such as dock, pokeweeds, field mustard, and dandelion are considered as tasty and nutritious as garden greens. Archaeologists have uncovered evidence that prehistoric Native Americans cultivated weeds, such as knotweed and little barley. Alongside traditional crops such as corn ,beans and squash. In addition to their agricultural uses, many pests such as tansy, Chicory, and smartweed have medicinal properties and are used extensively in homeopathic and naturopathic medicine.

### **ADVANTAGES**

- The mechanism is a simple one.
- One Labor is enough for operation.
- Working is very easy compared to the primitive work method.
- Time consumption is less compared to manual weeding.
- It reduces the labor problem.
- It is portable for the farmers having small land.

### **DISADVANTAGE**

- Can be used in only hard surface.
- Smaller tank capacity.
- Limited adjustability

## **APPLICATIONS**

Mainly it is used in groundnut field and also other fields where there is a gap of 5-12 inches between the plants.

Other fields such as tomato, cotton etc., can be made weed-free.

The sprayer ought to become a helpful machine within the internal improvement of crops that having a tiny low distance between them like groundnuts, sugarcane, legume bin crops, cultivation of paddy and most helpful for the smaller farmers.

## **LITERATURE REVIEW**

**Gururaj P.** et.al stated that in a today's world, we use many different spraying technologies involving the use of Energy like electrical energy, solar energy, and chemical energy of fuels. This fact makes us know how a large amount of energy is getting used at such Place where mechanical energy can be used instead of direct energy sources. Farmers are facing enormous problem while spraying the pesticide like tank Capacity is very small, high cost and spaying time took more. In order to reduce these problems, many different types of sprayers have been introduced in the market, but these devices do not meet the above problems or demands of the farmers. To overcome all the difficulties ahead, a new design of the mechanism is really needed and to be developed. So in this paper, a mechanically operated sprayer driven by the wheel is designed and fabricated. The higher advantages of this machine are, it is portable and won't utilize any fuel to operate, makes it sustain. The working of this machine is simple when the wheel rotates, the pesticide is being sprayed. Here they use a piston pump with a crank mechanism which is also driven by the wheel. Thedevice has been validated with the user group and got good feedback from the user. S.

**T. NangareS.**et.al, has been completed the Design and Fabrication of Multi Nozzle Agriculture Sprayer. Predominantly, India is an agricultural-based country that consumes 75% population which purely depends directly or indirectly upon agriculture. There should be a change in spraying systems in India to increase the productivity level in farming. One of the pointed out problem because of low productivity in both lacks of power and lack of mechanization in croplands and farming. To face the current problems and need of requirements, steps should be taken on upgrading irrigation pumps, cost affordable tractors, good power tillers also to produce new electricity operated machines to have more production and availability of high and good animal- driven implements. It ensuring good quality on one hand while saving energy on the other hands, decreasing manpower and also making it environmentally friendly. Agriculture is the back bone of human civilization.

**C. U mayaa let** al, studied the exposition of how robotics can be applied to the various phase of agriculture. It is Very important the efficiency and productivity of agriculture by replacing labors with an intelligent machine-like robot using latest technologies. This paper also proposes a new way of technology to replace human farmers in several agricultural operations such as Pesticide spraying, Pest detection etc. So, it provides safety to farmers and farms by spraying a proper and essential amount.

**Poratkar et al** designed manually operated multi Nozzle pesticides sprayer pump are based on the principles of motion Transmission due to chain and sprocket arrangement and plunger cylinder arrangement. The operator first stands behind the trolley. The handle of this machine will be grabbed by the farmer to lift when the trolley is being pushed forward, the wheel will automatically rotate in a clockwise direction. Similarly, a sprocket is the same shaft of that wheel which also rotates in a clockwise direction. By the way, the applied motion is transferred to our free wheel by placing a chain drive arrangement. So freewheel, sprocket, shaft and wheel all together rotate in the clockwise direction. A big spur gear placed on the shaft, will start rotating in the clockwise direction.

**A.S. Wankhede et al**, made equipment specially made to Work in row crops such as cotton pulses etc. Of an agricultural field. The economic condition of farmers and the cost of labor, owing to such conditions, this equipment can find its application. The equipment is intended to perform three important operations done in fields, namely, Spraying Pesticide, spraying herbicide and applying urea. All three operations can be performed simultaneously or individually. All the current equipment only focus upon spraying pesticides and urea to the plants, but not involved in providing efficient results. Moreover, whatever methods are available for applying urea results in high wastage of urea, we have focused on the same.

Aim of this project is that the farmer need not carry the entire pesticide sprayer pump on his shoulders

But just pull/push the mechanism mounted on the trolley to operate the pump and spray the pests. This makes the farmer feel comfortable, relaxed and less tiresome. To reduce human efforts due to the constant pumping action for creating pressure inside the pesticide sprayer and thereby provide a suitable environment for the user reducing the fatigue load acting on the body. As discussed previously, the farmer has to continuously keep on pumping using one of his hands and spray the pests on the crops using the other hand. This at a long run is a tiresome and cumbersome job and the farmer slowly loses interest from it. This project focuses on the problem of health-related issues of the farmer (operator). Majority of them don't use any precautions like face-masks and hand-gloves against the hazardous chemicals and work in direct contact with it. Consequently, this harms the farmer as the spray in the conventional method directly hits the face. Multi-nozzle is used and hence larger area of field can be sprayed at faster rate.

## **COMPONENTS**

Different components of the electrically operated sprayer are given below.

1. Tank 2. Nozzle 3. Pump 4. Filter 5. Pipe 6. Battery 7. Solar Panel

**TANK** -The tank is a huge part of this electrical sprayer. The storage capacity of the pesticide sprayer tank is 10 liters. It allows storing pest killing liquid. And it is made up of Polyethylene Terephthalate.

**Nozzle**-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 liquid (liquid or gas). Nozzles are usually used to manipulate the speed, flow, shape, and other parameters. It is made up of Brass.

**Pump**-A Pump is a equipment that moves fluids or other slurries by mechanical action. Pumps operate by some mechanism and utilize energy to perform mechanical work by moving the liquid.

**Filter**-A Water filter removes impurities by lowering contamination of water using a thin layer of net. This net help to remove unwanted and waste particles in the pesticide liquid.

**PIPE**-It helps to pass the pesticide the tank to the nozzle with high pressure. This pipe is generally made up of high-quality Polyvinyl chloride (PVC).

**BATTERY**-A Battery is equipment which contains an electrochemical cell with connections affixed to it, which is mainly used for several applications. The battery here we chose is a 12v battery. When the battery is supplying electric power, its positive terminal acts as cathode whereas negative terminal acts as an anode.

**SOLAR PANNEL**- A solar cell panel, solar electric panel, photo-voltaic module or solar panel is an assembly of photo-voltaic cells mounted in a framework for installation. Solar panels use sunlight as a source of energy to generate direct current electricity. 10 watt solar panel is mostly used to charge small batteries. A 10 watt solar panel can provide you enough power for small appliances. This mini version of the solar panel is efficient enough to power small 12V appliances.

### **Working Principle of Solar Sprayer:**

- The “solar sprayer system”, is a device used to spray the pesticide on the crops. The project involves converting a regular Hand Spraying Pump into an automatic Solar Powered spraying Pump
- The project includes designing, assembling, and testing of solar sprayer which is used to spray pesticides on the crops and also for other spraying purpose. The main component of the system is solar panel, battery, pump, container, hoses, and auxiliary switches etc.
- Solar radiation can be converted directly into electricity using semiconductor devices, which are known as Photovoltaic (PV) cells.
- The light energy is converted into electrical energy by solar PV cells a part of the light is absorbed and it is converted into Electrical Energy by means of Electron Movements and is stored into a lead acid battery (12V/7.2amp). The battery drives a pump (12V/2.2amp) by converting the electrical energy into mechanical energy. The pump is connected to the outlet pipe hose which in turn connected to nozzle.
- This pump draws the fluid (pesticide) from the reservoir and pushes it via nozzle at different rates. • The nozzle in turn sprays it on to the field.
- The energy stored by battery can also be used for other purpose like lighting led bulbs and charging mobile phones and etc.

Table: Working details of sprayer

<b>Sl no</b>	<b>Parts</b>	<b>Operation</b>	<b>Machine</b>	<b>Tool</b>
1	Tank	Coating ,drilling	Metal coating machine, Drilling machine	Coating blade, Drill bit
2	Delivery Pipe	Machining , Coating	Lathe Metal Coating	Single point cutting , Tool twist



**Fig 15(Painting operation)**

### **CONCLUSION:**

By making a talk about the topic of agricultural technology, we can learn more and in-depth about it. This is our little effort to make comfort to our farmers, this machine is developed to reduce the time and effort required for production up to the great extent Not only that, but the making cost of our equipment is also economic affordable and cost-efficient. All the manufacturing processes are carried out with a great concentration; any wrong calculation may have resulted in the failure of the project model.

Hence by comparing Pneumatic sprayer and Battery sprayer, it has been observed that battery sprayer is more than 4. 5 times faster than any other sprayer.

### **REFERENCES**

- [1]. "Design And Fabrication of Battery spraying machine" By S. T. Nonrare In November 2014
- [2]. "Development Of Double nozzle Multipurpose sprayer" By Gururaj P. Bhilainagar in February 2015.
- [3]. "Design, Development And Analysis of pesticide sprayer" By Dr. H. ErdalOzkan in May 2015.
- [4]. "Development And Evaluation Of Automatic sprayer" By Silas0. N, kainic, And Abu Hussein in January 2015
- [5]. "Development Of Double Wheel Multi Use Manually Operated sprayer" By Sridhar. H. S, November 2013.
- [6]. "Design And Fabrication Of Manually Operated Sprayer With pesticides Sprayer" By M. G. Jadhav , Prof.. J. K. Swale , December 2016.



- [7] Andrew Miller and Robin Bellinger (2015): Herbicides application using knapsack sprayer, National Agriculture Science Center(NASC).
- [8] Laukik P. Raut, Smit B. Jaiswal, Nitin Y. Mohite (2013): Design, development and fabrication of agricultural pesticides, International Journal of Applied Research and Studies (IJARS)
- [9] Monte P. Johnson, Entomology, and Larry D. Swetnam, (2012): Sprayer nozzles selection & calibration, (University of Kentucky college of agriculture).
- [10] A research paper on "Fabrication of Portable Foot Operated Agricultural Fertilizers and Pesticides Spraying Pump" by S R Kulkarni, R V Nyamagoud, Hareesh Naik, Mohan Futane
- [11] A research paper on "Design, development and fabrication of agricultural pesticides sprayer with weeder" by Laukik P. Raut, Smit B. Jaiswal, Nitin Y. Mohite
- [12] R. Joshua, V. Vasu and P. Vincent "Solar Sprayer – An Agriculture Implement", "International Journal of Sustainable Agriculture 2 (1): 16-19, 2010 ISSN 2079-2107"
- [13] R. D. Fox, R. C. Derksen, "Visual and image system measurement of spray deposits using water-sensitive paper" Applied Engineering in Agriculture Vol. 19(5): 549–552 2003 American Society of Agricultural Engineers ISSN 0883–8542
- [14] A research paper on "Review of Solar Powered Pesticide Sprayer" by Sarvesh Kulkarni, Karan Hasurkar, Ramdas Kumbhar, Amol Gonde, Raut A.S.
- [15] M. A. Miller, B. L. Steward, M. L. Westphalen "Effects of multi-mode four-wheel steering on sprayer machine performance", American Society of Agricultural Engineers ISSN 0001–2351 A. Taiwo K. Oje, "Development and testing of a swirl chamber nozzle", Journal of Agricultural Engineering and Technology (JAET), Volume 16 (NO. 1) June, 2008
- [16] Prof. Swapnil, L. Kolhe, Nilesh B. Gajbhiye, Vivek B. Deshmukh, "Eco-friendly Mechanically Operated Multipurpose Spray Pump", "International Journal of Research in Advent Technology", E-ISSN: 2321-9637, Volume 02, Issue 02, Feb-2014.
- [17] Dhiraj N. Kumbhare, Vishal Singh, Waghmare, Altaf Ansari, Vikas Tiwari, Prof. R.D. Gorle, "Fabrication of Automatic Pesticides Spraying Machine", "International Research Journal of Engineering and Technology", ISSN: 2395-0056, Volume 03, Issue-04, Apr-2016 [18] Shailesh Malonde, Shubham Kathwate, Pratik Kolhe, Rodney Jacob, Nishant Ingole, "Design and Development of Multipurpose Pesticides Spraying Machine", "Journal of Advanced Engineering and Global Technology", ISSN: 2309-4893, Volume 02, Issue-03, May 2016