International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 04 | April - 2023 Impact Factor: 8.176 ISSN: 2582-3930

Design and Development of Grape Yard Pesticide Sprayer

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Abstract- India is an agricultural nation. India's population is growing, as we all know, and agricultural sector modernization is crucial to meet the country's growing demand for food. Farmers in our nation use fertilizers, pesticides, and insecticides on their crops to get rid of weeds and other undesirable plants. They also employ substances to get rid of mice and rats and manage a range of insects and bacteria. Fertilizers are manually applied in the traditional manner by farmers using backpack sprayers. It can be perilous and is quite damaging to their health. The required work is rather more difficult. There are pesticide spraying machines on the market, therefore there is no problem. However, farmers cannot afford the exorbitant expense of purchasing two different pieces of equipment for spraying pesticides and fertilizer. Therefore, cost optimization that can improve the Farmer's financial situation with developing multipurpose pesticide sprayer is the main emphasis of our work.

Keywords- Multipurpose pesticide sprayer, Modernization, Health, Expense.

1. INTRODUCTION

About 73% of the population in India is dependent on agriculture, either directly or indirectly. India is an agriculturally based nation as a result. But as of now, our farmers continue to practice farming in the same manner. They plant seeds and apply fertilizers and pesticides, while producing using traditional techniques. This industry must develop, most notably the spraying method for pesticides and fertilizers, as it takes more time and effort to spray in the conventional manner. Since most Asian countries are still in the developing stage and have a big population, their agricultural production is significantly lower than that of developed countries. India is one of the countries that is dealing with this issue. Low level farms, limited farm power availability, and inadequate farm mechanization are the causes of this.

Modernizing the agriculture industry is necessary to meet the demand for food created by the expanding population and brisk industrialization. On many farms, production declines because of delayed sowing, poor distribution of herbicides and fertilizers, and improper distribution during harvest. All the issues that lead to low production are resolved through mechanization. It gets better and more evenly distributed while conserving input and accuracy in the work. It lessens the quantity required for a better response, prevents losses, and wastes the applied input. It has excellent productivity, which lowers production costs.

The government's Agriculture Implement and Machinery Program is taking initiatives to increase the availability of pumps, tractors, power tillers, harvesters, and other power operated devices to meet production requirements. The latter was given particular attention because more than 65% of farmers fall into the small and marginal category. Small form mechanization is typically highly difficult and unaffordable, but the Japanese manage to make it happen. They are more productive than Indian farmers thanks to proper mechanization. To increase production, they are utilizing contemporary time-saving machinery of the necessary proportions. Japanese agriculture set new standards.

2. LITERATURE REVIEW

Agricultural Fertilizers and Pesticides Sprayers (2015): Day by day the population of India is increasing and to fulfil the need of food modernization of agricultural sectors are important. Due to chemical fertilizers the fertility of soil is decreasing. Hence farmers are attracted towards organic farming. By mechanization in spraying devices fertilizers and pesticides are distributed equally on the farm and reduce the quantity of waste, which results in prevention of losses and wastage of input applied to farm. It will reduce the cost of production. It will reduce the cost of production. Mechanization gives higher productivity in minimum input. Farmers are using the 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 laborers carrying backpack sprayer and fertilizers are sprayed manually. The efforts required are more beneficial for farmers having small farming land.

Development of Multipurpose Sprayer (2016): The scenario in the country like India is different. The agriculture field being small, automation is such places are a difficult task also the economic condition of majority of Indian farmers is not well to do. Therefore, the manually operated sprayer finds wide application in such conditions. In Indian farms two types of sprays are used: Hand operated and Fuel operated pump. The main drawn back of hand operated spray pump is that the user cannot use it for more than 5-6 hours continuously as he gets tired whereas fuel operated spray pump requires fuel which is expensive, and availability of fuel is not easy at rural places. In such a situation we should think about moving towards nonconventional energy. This review paper tries to develop a new mechanical system which will overcome all the above problems and will help farmers too.

Manually Operated Multi-Nozzle Pesticide Sprayer Pump (2018): Purpose of this paper is to generate a low-cost sprayer pump for India's poor range farmers and reduce the required efforts. An accurate working model has been fabricated. It gives similar nozzle pressure and covers maximum area. In agriculture there are different field works like weeding, reaping, sowing etc. Along with these operations spraying pesticide is a preliminary operation performed by farmers. To protect them from insects, dieses, fungi, and pests. Now a days number of technologies are used to spray pesticide by using solar energy, electric energy, and chemical energy.

Review on conventional and mechanized agricultural methods (2017): Some traditional methods are used by the farmers for spraying fertilizers and pesticides; equipment's are also same for ages. Using backpack sprayer for spraying fertilizer leads to back pain and is beneficial for small farms. Making modifications in conventional spraying methods will lead to equal distribution of pesticides and fertilizers on the farm and eventually reduce the waste, hence, reduce the cost of production.

3. PROBLEM STATEMENT

Chemicals and pesticides that are harmful are getting into close touch with farmers' bodies. Heavy rains during the rainy season make it difficult (mud) for tractors to spray pesticides. Spraying pesticides requires more laborer's, and the expense of fuel is also significant from an economic standpoint. The cost of labor is expensive.

4. OBJECTIVE OF PROPOSED WORK

To avoid direct contact of chemicals with farmer. Utilizing electrical energy, which is more cost-effective than a tractor, can reduce pollution. to automate the spraying process. to speed up the process of spraying insecticide while minimizing human work.

5. METHODOLOGY

- Objective
- Problem Statement
- Market Survey
- Selection of Material
- Calculations
- Fabrication
- Assembly of Components
- Testing Actual Model
- Modification If Necessary
- Final Model

6. DESIGN CALCULATIONS

Vehicle Dimensions:

Length = 1200 mm
Width = 700 mm
Height =762 mm
Weight = 200 kg
Area = width × height = 0.5334 mm2
Wheel radius = 0.2032 m
Speed = 3 km/hr (Assumed)

- **To find RPM:**

Linear wheel travel = $2\pi r2$
= 2×3.14×0.2032
= 1.5 m

Speed v = 3 km/hr = 20 × 1000 / 3600 = 0.8 m/s
RPM required = speed/wheel travel =0.8 × 60 / 1.5
RPM required= 33.33 rpm.

- **To find Power:**

Power = (m × g × v × rolling resistance) + (air density × coefficient of drag × area × v3) +(m × g × sin10)
= (200 × 9.81 × 0.8 × 0.075) + (1.23 × 0.82 × 0.5334 × 0.83)
+ (200 × 9.81 × sin10)
= 432.13 Watt

- **To find Torque:**

P = $2\pi NT$ / 60
463 = 2 π × 222 × T60
T = 132 Nm.

- **Torque on each wheel:**
  T = 1324=33 N
- **Form selection of gear:**
  RPM at Output,
  $P = 2\pi N2T / 60$
  $N2 = 250 \times 60 / 2\pi \times 33.37$
  N2 = 73 RPM

  No. of Teeth on Output Gear,
  $N1 / N2 = T2 / T1$
  $120 / 73 = T2 / 11$
  T2 = 18 Teeth

  Diameter of Output Gear,
  $M = D2 / T2$
  D2 = 2.58 × 18
  D2 = 47mm.

- **Battery Calculation:**
  Wattage = 250 W
  Voltage = 24 V
  Current =?

- **To find current:**
  Wattage = Voltage × Current
  250 W = 24 V × Current
  Current = 10.416 Amp

- **Range:**
  250 W × 1 Hr = 250 Wh
  Considering that the battery has 80% efficiency
  250Wh × 1.20 = 300 Wh
  = 300Wh / 24V
  = 12.5 Ah (Per motor)

7. ASSEMBLY OF COMPONENTS

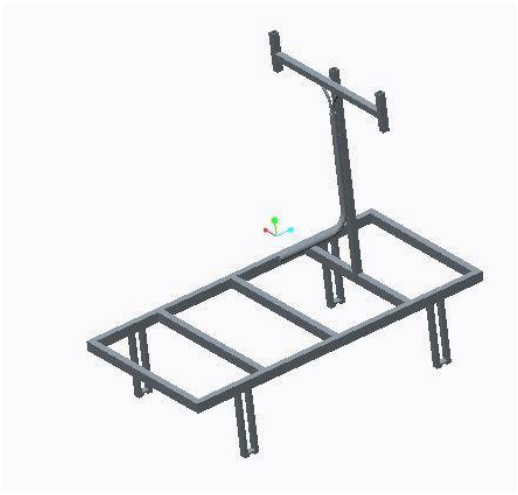

Fig 1. Base Frame

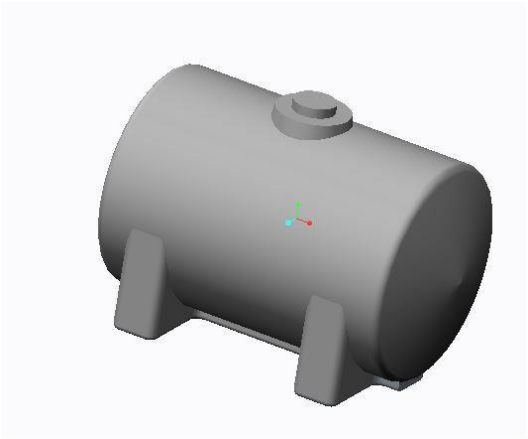

Fig 2. Tank

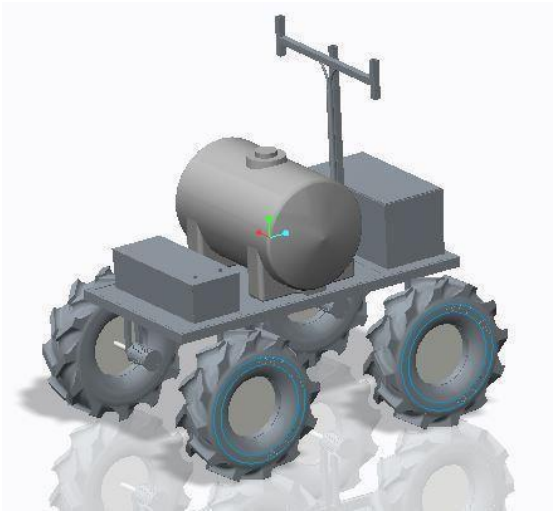

Fig 3. Main Design

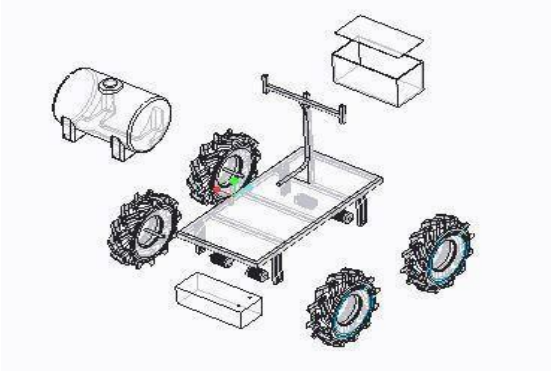

Fig 4. Exploded View

8. CONCLUSION

When compared to other forms of spraying techniques, the

application of such a project makes it possible to spray pesticides more effectively. It is possible to avoid exposing people to highly harmful pesticides. Spraying pesticides requires less labor than other methods. With little effort, it increases productivity. This pesticide spraying apparatus also contributes less to environmental degradation. By employing our technique, we can spray the fertilizers equally while reducing labor requirements.

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