

Design and Fabrication of Solar Electric Type Agricultural Sprayer

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Abstract- Now a day's energy demand is the great challenge for, Engineers, Entrepreneurs and Industrialist of our Country. According to them, Applications of Non conventional energy is the only alternate solution for conventional energy demand. The Concept and Technology employing this Non-conventional energy becomes very popular for all kinds of development activities. One of the major area, which finds number applications are in Agriculture Sectors. Solar energy plays an important role in drying agriculture products and for irrigation purpose for pumping the well water in remote villages without electricity. This Technology on solar energy can be extended for spraying pesticides, Fungicides and Fertilizers etc., using Solar Sprayers. By using trolley we can reduce the effort of spraying and by implementing multiple nozzles with variables heights we can spray multiple crops at a time. The sprayer is portable, low cost device and useful for small scale agriculture, nursery, horticulture, and community services including farms. An alternative to spray gun this trolley equipped with vertical spraying boom nozzles that move through the crop rows and enable better control of the variables such as spray pressure and work velocity. During rainy season and adverse weather conditions there is lack of solar radiations for that case we are implementing hybrid system which uses both solar and external electric supply also. Solar operated spray pump will help the farmers of those remote areas of country where fuel is not available easily. They can perform their regular work as well as saves fuel up to large extent and reduces environment pollution.

Keywords- Solar energy (Renewable energy), Agricultural sprayer, Multiple nozzles.

I. INTRODUCTION

Renewable Energy resources are the most preferable resources for generation of electrical energy because of environmentally friendly. All the renewable energy resources, solar power is the most resource mainly because it is free, unlimited and free from pollution. The solar energy is usually harvested through solar panels that are made up of photovoltaic cells. Approximately 80% of all photovoltaic systems are amended into a standalone system. The advent of photovoltaic modules and arrays or simply solar panel corroborates this progress. The photovoltaic (PV) or solar cells

crafted from silicon semiconductor are configured to trap and convert the sun's energy into the useful energy which is then used to perform work such as Dehydration of Agriculture products, irrigation pump, pesticide Duster etc.

Solar spray are the ultimate cost effective solution at the location where spraying is required. This solar powered spray pump system uses solar energy as a source. Solar energy is first used to charge a storage battery. Solar energy stored in a battery is utilized to operate motor which functions as a pump. It deals with the constant discharge of pesticide, compress air control system, solar power, battery charging, monitoring as well as timer and non-conventional power controlling techniques. As far as controlling is concerned, it include the parameters such as pressure, pesticide level, battery voltage, current, solar cell and discharge condition. In this paper we are trying to make unique equipment for cultivation users. Mostly in the forming process pesticide spray is taking a critical role due to poison properties of chemical. So, in this paper committed to do something unique and useful equipment with non-conventional source technique. Also reduce the weight of unique solar spray jet as compare to diesel spray jet.

Solar energy calculation as per sun about half the incoming energy from the sun is absorbed by water and land masses, while the rest is reradiated back into space.

II. PROBLEM DEFINATION

The main issue is to be tackled to design trolley driven solar and electrically operated agricultural sprayer which is compatible for easy spraying operation by eliminating problem of lifting a weight on the back and use of multiple nozzles.

III. LITERATURE REVIEW

Varikuti Vasantha Rao, Sharanakumar Mathapati, Dr. Basavaraj Amarapur[1] 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

Pandurang Lad, Virendra Patil^[2] They used solar energy in agricultural field, to extend solar P-V technology on solar sprayers.

Mr. Zoeb Khan.^[3] They gives specification of component over various spraying capacity of sprayer. R. Joshua, V. Vasu, R. Vincent^[4] They used solar energy in agricultural field, to extend solar P-V technology on solar sprayers.

Sagar P. Yadav, Pooja M. Kakad^[5] If we charge system a day, we can spray 200 litres of fertilizer, 2-3 acres of land.

Robson Susaki^[6] They coupled system with various solar panel angle. The angle of 20 degree & 40 degree produces greater amount of energy compared to 90 degree.

Varikuti Vasantha Rao, Sharankumar Mathapati^[7] They tested proposed system with AC charging & solar charging. The time for charging full capacity of 12V, 7Ah battery takes 17 hrs can spray 580 litres of fertilizer.

Abhishek Jurag, Vinayak Chawre.^[8] There is no running cost associated with sprayer. The maintainance cost only restricted to life of battery & PV module.

COMPONENTS

1. Solar Panel
2. D. C. Water Pump
3. Battery
4. Tank
5. Nozzles
6. Trolley

Detailed information about these components is given below:-

1. Solar Panel:

A solar panel (also solar module, photovoltaic module or photovoltaic panel) is a packaged, connected assembly of photovoltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. Each panel is rated by its DC output power under standard test conditions, and typically ranges from 100 to 320 watts. The efficiency of a panel determines the area of a panel given the same rated output - an 8% efficient 230 watt panel will have twice the area of a 16% efficient 230 watt panel. Because a single solar panel can produce only a limited amount of power, most installations contain multiple panels. A

photovoltaic system typically includes an array of solar panels, an inverter, and sometimes a battery and or solar tracker and interconnection wiring.

2. D. C. Water Pump:

For people living in remote areas, solar water pumps are usually the only solution as there is no access to diesel. If there is diesel, Solar Water Pumps are the only solution or an excellent alternative for diesel as the cost of running. A solar powered water pump differs from a regular water pump only in that it uses the sun's energy to supply electricity for the pump. The solar panels absorb the sun's energy and convert it to electrical energy for the pump to operate. All the pumped water is stored in a water tank so that there is constant supply even in bad weather conditions and during night time where there is insufficient power to generate the solar water pumps. Solar powered water pumps represent a higher initial investment, however, over a period of 5 years they represent a cost benefit due to minimal maintenance costs compared to AC pumps run with a generator.

3. Battery

The choice of batteries possibly the biggest decision to be made if planning a solar power system of any size. Unless you are looking at a very small system, possibly using a truck battery, upgrading your battery capacity is likely to be difficult and expensive. If you are using a 24 volt battery and decide you need more storage, you will either need to replace the battery for a larger one or connect a second battery of the same size in parallel with the first. When connecting batteries in parallel however, it is important that the batteries are similar. For this reason it may not be advisable to add to the battery after you have been using the system for a while, by which time there would have been some reduction in battery performance.

4. Tank

Tank is used to store pesticide solution while spraying.

The capacity of tank to be used is 20 liter.

5. Vertical Spray Boom Nozzle

An alternative to spray gun this trolley equipped with vertical spraying boom nozzles. That moves through the crop rows and enable better control of the variables such as spray pressure and work velocity.

Also in greenhouse crops the behavior of vertical spray booms determined that for same application volume, flat nozzle offers better coverage than cone nozzle.

IV. SPECIFICATIONS

1. According to spraying capacity & discharge capacity of spray motor is selected

- Weight of motor : 1 kg
- Current : 7 Amp
- Operating power req : 84 watt
- Operating voltage : 12 volt
- Motor speed : 1600 rpm
- Discharge capacity : 0-12 Lit/min
- Flow rate : >560 ml/10sec
- Fluid pressure : 1.6 kgf/cm²

2. According to motor operating power battery is selected

- Weight of battery : 2 kg
- Cost of battery : Rs. 1200
- Output power : 144 watt.
- Operating voltage : 12 volt

3. According to battery output power, solar panel is selected

- Power : 10 watt
- Dimension : 397*278*25 mm
- Weight : 1.6 kg
- Open ckt voltage : 21.5 volt
- Short ckt voltage : 0.65 amp
- Operating current : 12 amp,

V. EVALUATION

| Sr.No. | Type | Drawbacks |
|--------|---------------------------|--|
| 1 | Hand Driven sprayer | There are more efforts in this type of sprayer. Lifting and holding of almost 30kg weight on back is quite tedious job. Limitation on tank capacity |
| 2 | Fuel Operated sprayer | Operating cost of fuel sprayer is high. Maintenance cost of fuel operated sprayer is high. Limitation on tank capacity It badly affects on environment. |
| 3 | Electric Operated sprayer | Unavailability of electricity in Remote places. |

VI. ADVANTAGES

1. In our design we reduce the effort of spraying operation by using trolley.
2. Ease of spraying in multiple crops by the use of adjustable nozzles.

- 1.
2. We use renewable energy.
- 3.
4. Do not required fuel hence operating cost reduced for spraying.

It does not create air pollutants & noise.

VII. DISADVANTAGES

1. Initial Cost is high.

VIII. CONCLUSION

The Prominent aim of this project is to fulfill the tasks like hand spraying, IC engine spraying, etc using non-conventional energy sources. Thus solar operated spray pump will help the farmers of those remote areas of country where fuel is not available easily. They can perform their regular work as well as saves fuel up to large extent. At same time it reduces environment pollution. Thus saving revenue of government & also most demanded fuel.

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