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Solar Operated Boom Sprayer

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ABSTRACT

As we know that INDIA have 70% people who do farming and farming related work. Agriculture is to be enhance for increasing "Gross Domestic Product" of the country. The productivity can be increased by the use of the pesticides. Spraying the pesticides is very important process in cultivation of the crops. There are various non-conventional energy source available by which we can generate power. Solar energy is one of them. We are trying to use this solar energy for spraying the pesticides in farms. A solar operated boom sprayer which consist pump which is running on electricity generated by the photovoltaic panel by collecting the sunlight. It has no effect on environment with respect to internal combustion engine based pump. The solar panel has the most up to 70% of the system cost.

KEYWORDS: Solar; Boom; Sprayer.

I. INTRODUCTION

Solar operated boom sprayer consists of components like solar panel, pump, AC motor, storage tank, nozzles, booms, etc. Solar energy is converted into the electrical energy by the help the solar panel. By this electric energy AC motor is running. AC motor is connected with solar panel through inverter and battery. With this AC motor pump is connected. With this pump connecting pipes are connected. At the end of the connecting pipes nozzles are mounted. Through which the boom is sprayed.

Spraying pesticides is very important process of the cultivation of the crops. By spraying pesticides productivity of the crop can be increased. A sprayer is a basically mechanical device which is used to spray liquid like herbicides, pesticides, fungicides fertilizers to avoid any pest. This sprayer provides the optimum usage of pesticides or any liquid with minimum efforts.

In Indian farms there is mainly two types of sprayers is used. One is hand operated pesticides sprayer and another one is fuel operated pesticides sprayer. Among this two pesticides sprayer hand operated pesticides sprayer is most popular. The main drawback of hand operated pesticides sprayers is that user cannot use it continuously. It can be only use it for 5 to 6 hours because of he gets tired after such a long time duration. Also fuel operated pumps are not widely used in rural areas because of unavailability of fuel.

Also in fuel operated pesticides sprayers the running cost high due to fuel. It generates flue gases which creates pollution of environment.

Now, there are various types of non-conventional energy source available. Solar energy is one of them which is widely available in our country. Also which is freely available without any cost. In India solar energy is available for around 8 months. So we are trying to use this solar energy for running of pesticides sprayer.

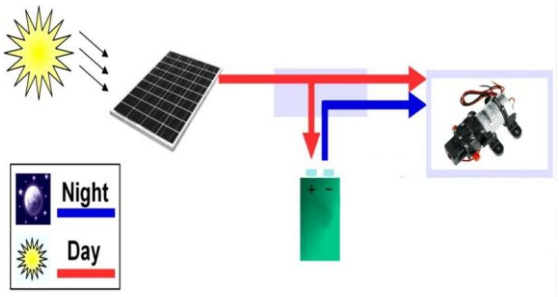

Figure 1 Circuit Diagram

During days sunlight is used to generate power. Solar panel is used to convert that sunlight into electric energy. But the current which is produced by this solar panel is DC. So we have to use inverter. If we want to use AC equipment for that we have to use inverter for it. It converts Direct current into alternative current. The power which is developed by the solar panel by that power AC motor runs with help of inverter. With this motor AC pump is connected. With this AC pump connecting pipe is connected. Through this connecting pipe these connecting pipes are connected with the flat face nozzle.

During nights, battery stores the energy generated by the solar panel during days. It is used for running the system in night as we can see in the circuit diagram.

II. LITERATURE REVIEW

Mandar S. Sawant, et al,[1] Presented in multiple power supplied fertilizer sprayer. The paper includes hand operated and power sprayer and the component of each sprayer. The paper also includes the specification of pump, battery and DC pump. They mentioned that this sprayer is more efficient and environmental pollution free. They also mentioned that this system is used in all type of power sprayer and that is useful in future to all of us and the pesticides sprayer. The solar operated sprayer has capacity of 7.5 litre + water and cost of 4500 Rs. And nil operational cost. The speed of the system is controlled by the single potentiometer. There are two compartment is there for assembly. First is contain storage or water tank and other is battery and circuits.

M. Venkateswarlu, et al, [2]Presented in Agriculture solar sprayer with multi-application. The paper consist of types of the sprayer and types of nozzle and brief about the solar operated sprayer. In this paper it is also indicated that how the battery of the solar sprayer is charged and it gives the some information regarding the different pesticides sprayer. The photovoltaic system is directly based on the pump capacity which has used to decide the size of the solar panel or the photovoltaic cell. There are different type of sprayer like aerial sprayer, fuel operated, tractor mounted, and hand driven and solar operated. There are different types of nozzle are also contained like fan nozzle, flood nozzle and turf jet nozzle. The solar sprayer consist of the storage tank, DC motor, DC battery, connecting pipe and fitting elements. In agriculture sprayer is mounted on tractor with the help of the boom is used for spraying pesticides and the herbicides but the range of this sprayer is 6 to 15 feet. It is larger than the other pesticide sprayer. Normally the range of normal hand driven sprayer is 4 to 7 feet it is so less than the boom mounted sprayer.

Dr. S. K. Chaudhary, et al, [3] Presented in the agriculture and the fertilizer sprayer – A review. The paper consist the information about the backpack sprayer, bullet santi, lite track, and the aerial sprayer. The paper gives information that the sprayer is used to spray the pesticides, herbicides, fungicides and the defoliants. This particular sprayer gives more output with respect to the less input. In India it is useful because of the normal sprayer consist of the small range and the work on the labour is more. If this sprayer is used the area covered by the sprayer is more than the backpack sprayer so it is useful to the farmer. The use of the harvester, sprayer and the other machines are grown up. Holmes farm supply limited is supplied track machine. The word comes from the lite tractor. It is contain tool carrier, self-propelled lime and the fertilizer tank and the whole machine assembly. It has capacity of the 8000 lit and the 48 meter range. BulletSanti is a multi-spray nozzle and motor bike mounted sprayer which is also effective sprayer but not as much the lie track. It plough the half acre of farm in just half an hour in just two liter of diesel. Because of this the cost of the sprayer is increased. Aerial spraying technique is not used for the small or medium farm. It is used only for a large farm because it has more cost and it is used for the big area, so everyone cannot afford it easily.

Dr. Basavaraj Amarapur, et al, [4] Presented in multiple power supply fertilizer sprayer. The paper contains the existing sprayer, design and the software based analysis of the sprayer. It also includes the whole data of the design with help of the software. It consist the block diagram of the sprayer. When the on button starts the sprayer takes the energy from battery by the chemical reaction and it gives the power of the 12 V and the work is start. The photovoltaic cell or the solar panel give the power of the 5 W and 17.40 V. Maximum system voltage is 800 V. DC pump is also contained 12 V and capacity of 560 ml/10sec.

Iranna Ijeri, et al,[5] Presented in solar based pesticides sprayer which contains the solar sprayer and its result, conclusion and advantages of the solar sprayer. The solar sprayer is multipurpose and portable machine with less cost and maintenance. It has less pollution and the easy too assemble machine. This machine is does not compromise the petrol or diesel based pesticides sprayer. It is as work full as the petrol sprayer. The performance is getting that by fully charged the 8 Ah battery the pump runs about the 3 hours and the spraying area covered is 2 acre and it is free from the cost because of the solar panel is attached the battery is charged by the solar panel directly. The petrol based sprayer can spray this area in

1 litre of the petrol which cost is 80 Rs. Which is very costly. The models consist of 21 kg weigh but it can reduced by using PVC tank it reduced by 3-4 kg To spray the pesticides with this spraying pump 12v, 2.1amp DC motor is required and the DC motor is driven by the 12v 8AH battery. The motor has consist of the one inlet port and one outlet port. The whole assembly connected with nozzle, which is used to spray the pesticides. The tank capacity is 12 lit. Different type of nozzle is used to spray the pesticides which is F-type, tapper nozzle and the sector nozzle. Sprayer device is used to spray the liquid. Most of the sprayer are used in market is hand driven or fuel based instead of that sprayer solar sprayer is very useful. It has less cost a high efficiency and it has less maintenance also.

III. Working

The working of the proposed system is as follows: when the control button is made ON and OFF while the sprayer motor is switched ON and OFF using the push button. The sprayer takes the energy from the energy conversion unit and this energy is stored in form of chemical energy in the battery which is then converted to electrical energy required to run the AC pump through protection and control unit.

Fig 2 Solar Operated Boom Sprayer

Specifications Of Different Components Required For Purposed system

1. Specification of Battery

Weight of the battery : 2.5kg
Cost of the battery : 1050 Rs.
Operating voltage : 12v
Rated current : 8 Ah

2. Specification of solar panel

Panel Size : 355×295×20mm
Cost of panel : 2100 Rs.
Weight of the panel : 2.306 kg
Maximum Power : 100 W
Voltage @max. Power : 12.5 V
Current @max. Power : 0.61 A
Open circuit Voltage : 20 V
Short circuit current : 0.7 A

3. Specification of Pump

Weight of the motor : 500 gm.
Liquid Discharge : 6 ltr/Min
Operating power required : 70 W
Operating voltage : 12 V
Operating current : 0.8 A
Motor speed : 1500 RPM
Motor cost : 1200 RS.

IV. Design

A. Analytical calculation of current and charging time of the battery.

The current produced by the solar panel was calculated by knowing the maximum power (P) of the solar panel and the voltage rating (V) of the battery that is given by

$$I=P/V \quad (1)$$

Therefore, I=7.32/12 = 0.61 Ampere

Charging time (T) was computed by taking the ratio rating of battery in ampere hour (Ah) to the total current consumed by the solar panel.

T= (battery rating in ampere hour)/(total current consumed by the solar panel)

Therefore, T=7/0.42=16.67 hours

B. Practical measurement of current and charging time of the battery.

Experimentally the current produced by the solar panel can be measured by connecting an ammeter in series with supply. The charging time of the battery using solar panel has been measured by continuously charging battery and it is found that 17.5 hours for three day of every day 8 hours

Table 1 Comparison

Charging time		**Current**		**Voltage**		**Discharge time**
Theoretical	practical	Theoretical	practical	Theoretical	practical	Practical
16 hour	17 hour	0.61 amp	0.48 amp	12v	12v	3.45 hours

V. CONCLUSION

We concluded that the solar operated boom sprayer is pollution free, cost free and more effective spraying system then other system which are available at present. We also conclude that there is different types of alternative solutions but it has more installation and running cost. It reduces the discomfort to the operator while spraying and it creates the awareness about renewable energy to the farmers.

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