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Solar Sprayer - An Agriculture Implement

R. Joshua, V. Vasu and P. Vincent

[1]Madurai Kamarajar University, Mohamed Sathak Polytechnic College, Kilakarai, India
[2]School of Physics, Madurai Kamarajar University, Madurai, India
[3]Department of Rural Development and Science,
Arulanandar College, Karumathoor, India

Abstract: "Energy - demand" is one the major thread for our country. Finding solutions, to meet the "Energy - demand" is the great challenge for Social Scientist, Engineers, Entrepreneurs and Industrialist of our Country. According to them, Applications of Non conventional energy is the only alternate solution for conventional energy demand. Now-a-days 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. This paper deals how a 'Power Sprayer' which is already in use and works with fossil fuel can be converted into solar sprayers works without any fossil fuel.

Key words: Energy alternate device % Solar Sprayer % Agriculture Implements % Performance analysis

INTRODUCTION

Objectives: To extend the concept of Solar PV-Technology on "Solar Sprayers" as "Energy Alternate Devices".

To Convert the "Fuel Operating System" as "Free Energy Operating System" for agriculture implementation.

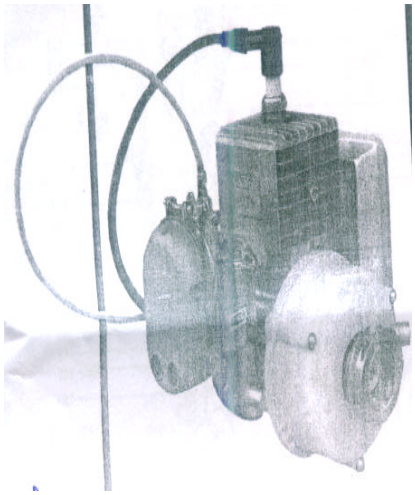

Fig. 1:

Power Sprayer and its Performance: Power Sprayers are used to discharge pesticides and fertilizers in the liquid form. It is Two Stroke Petrol Engine. It need fuel and Oil for its operation. The Mechanical parts of the engine operates with this Fuel Energy. The Two Stroke Petrol Engine mounted on a power sprayer is as shown in Figure (1).

The overall view of the power sprayer existing in the market with its components and parts are shown in Figure (2).

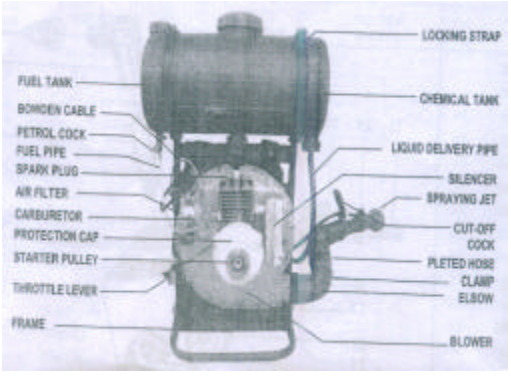

Fig. 2:

Corresponding Author: R. Joshua, Selection Grade Lecturer - Physics, (Part Time Research Scholar, Madurai Kamarajar University), Mohamed Sathak Polytechnic College, Kilakarai.
Tel: 9842624002, E-mail: cp_mspc@yahoo.com.

Technical Specifications of Power Sprayers: The capacity, running cost and economic analysis of the existing model in the market are as below,

Capacity of Fuel Tank	:	1.25 ltr.
Fuel Consumption for one hour continuous operation	:	1.25 ltr.
Running Cost per Hour	:	Rs.70 to 75
Operating Cost	:	Rs.1.50 per minutes (approx)
Durability of the Engine	:	4 to 5 years
Annual Maintenance Cost of the Engine	:	Rs.500/- (approx)
Weight of the Engine	:	3.6 kg.
Speed Range	:	3000 - 6000 rpm
Power output	:	0.82 kw

Maintenance and Care: To keep the efficiency of the machine, care must be taken in the following areas.

- Maintenance of air filter must be strictly observed.
- Through cleaning is necessary after three hour operation of the engine.
- Carburetor has been adjusted correctly, service and maintenance of the carburetor should be adopted strictly as per the Instruction of the company.
- The spark plug has to remain clean and always free from oil and deposits.
- Pipes and Carburetor should always be kept clean.
- Servicing and repair of the ignition system shall be done by an expert only.
- If the engine is to be put out of service for a longer time, then the corrosion preventive oil should be added.

Alternate Device: To overcome the above difficulties in the Existing models and to reduce the operating cost of the Power Sprayer, a modified model has been designed and introduced for effective operation without fossil fuel.

In this modified model the two stroke petrol engine is replaced by a single motor. This can be operated by the electrical energy stored in the 12V battery attached in the Unit. The 12V battery can be charged by the Solar Panels.

The overall view of the modified model with motor and charging battery is as shown in Figure [3, 4].

Fig. 3:

Specifications of Motor

Weight of the motor	:	1kg (approx)
Operating power required	:	82 watt
Operating Voltage	:	12V
Operating current	:	7 Amp.
Motor Speed	:	1,600 rpm.
Motor Cost	:	Rs.350 - 400

Technical Specifications of the Battery

Weight of the battery	:	2 kg.
Cost of the battery	:	Rs.500 - 600
Output power	:	84 watt.
Operating voltage	:	12v
Current	:	7 Amp.

Figure (4)

Fig. 4:

Battery Charging Technique: The 12V dischargeable battery can be charged by Solar Panel available on the top of the Sprayers. A separate charging system using Solar Panels can also be used for charging the battery, which is as shown in Figure (5).

Fig. 5:

Specifications of Solar Panels:

Panel Size : 1 ¼ " x 1"
Cost of the Panel : Rs.700 - Rs.1,000/-
Weight of the Panel : 1kg.

Power Rating:

Voltage : 15 volt
Current : 5 Amp.
Power : 15 x 5 = 75 watt.

Testing of Charging Time:

Instrument used to measure Sun Radiation : Sun Meter
The Sun Radiation are measured in : mW/CM^2
Required voltage for charging the Battery : 12 volt.

Time Measurement:

When the Solar radiation is between
200 to 300 mW/CM^2 : 3 to 4 hrs.
When the Solar radiation is between
300 to 400 mW/CM^2 : 2 to 3 hrs.
When the Solar radiation is between
400 to 600 mW/CM^2 : 1 hour.
Running period : 3 to 4 hours.
Operating cost : Nil

Working Principle and Operation: Solar radiation can be converted directly into electricity using semiconductor devices, which are known as Photovoltaic (PV) cells.

When Sunlight falls upon the Solar cell a part of the light is absorbed and it is converted into Electrical Energy by means of Electron Movements. This Solar Panel is connected to 12V lead acid battery for storing the electrical energy. A 12V DC motor is connected to these lead acid battery to convert the electrical energy into mechanical energy.

Power Conversion Efficiency: The Solar cell Power Conversion Efficiency can be calculated by using the relation,

$$?=\frac{P_{max}}{P_{in}} = \frac{\text{Output Power}}{\text{Input Power}}$$

Where,

P_{in} = Incident Solar radiation x Area of the Solar Cell
= I_T x A

The output power (P_{out}) = V x I
It is the power delivered from the Generator.

Operating System of Solar Panel: Charging can be done using a solar banal.

Battery can be charged continuously during discharge itself, by attaching the banal on the sprayers.

Without Banal on the sprayers, discharge can be done for a minimum period of 4 to 5 hours.

By changing the battery, discharge can be continued for further more hours.

Charging can be done by separate Solar Banal attachment.

Note: During Rainy Season charging can be done by electrical devices.

Economic Analysis: The cost of the fuel increases day by day. It should be reduced by the modified model which works on the principle of solar energy. The operating cost of power sprayer for one hour operation is calculated and its value is compared with the operating cost of solar sprayer. Its seems that there is no need of operating cost but, the initial investment towards the charging unit is a one time investment with a life period of Twenty years which is almost equal to the unit cost of the power sprayer with twist of petrol engine.

Operating system with fuel	Operating system without fuel (Solar energy)
Working Model	Working Model
Two Stroke Petrol Engine with fuel	Rotating motor by the mechanical energy derived from the Solar Cell without fuel.
Unit cost of power sprayer with engine Rs. 4,000 - 5,000/-	Unit cost of power sprayer without engine 1,500 Cost for Motor 400 Cost of Battery 700 Solar Panel 1,000 Switches & other Service charges 300 4,000 (approx)
Operating Cost per hour: Rs.70/- to Rs.75/-	Nil Operating cost.
Effective Maintenance should be adopted	Maintenance Free.

CONCLUSION

- This Technology is most suitable for Energy Alternate Device for power sprayers.
- The farming community is more dynamic and they can accept the proved technology for implementation.
- Moreover the same technique and technology can also be extended for all types of power sprayers.

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