

CHAPTER-1

INTRODUCTION

1.1 BRIEF INTRODUCTION ABOUT THE PROJECT

A sprayer is a mechanical device used to spray the liquid like herbicides, pesticides, fungicides and fertilizers to the crops in order to avoid any pest. Sprayer provides optimum utilization of pesticides or any liquid with minimum efforts.

Dusters and sprayers are generally used for applying chemicals. Dusting is the simpler method of applying chemicals and dusters are best suited for portable machineries and this usually requires simple equipment. But these devices are less efficient than sprayers, because of the low retention of the dust.

The invention of a sprayer brings revolution in the agriculture or horticulture sector, this enables farmers to obtain the maximum agricultural output. They are used for agriculture spraying, garden spraying, weed and pest control, liquid fertilizing and plant leaf polishing. There are many advantages of using sprayers such as easy to operate, maintain and handle, it facilitates uniform spread of the chemicals, capable of throwing chemicals at the desired level, precision made nozzle tip for adjustable stream and capable of throwing foggy spray, light or heavy spray, depending on requirement.

Sprayers are available in different varieties. In Indian farms generally two types of spray pumps are used for spraying; hand operated spray pump and fuel operated spray pump. out of which hand operated spray pumps are most popular. The main drawback of hand operated spray pump is that the user can't use it continuously for more than 5-6 hours since he gets tired after such a long duration. Also the fuel operated spray pump requires fuel which is expensive and availability of fuel at rural areas is difficult. At the same time it exhausts carbon dioxide as pollutant which is harmful to our environment. In such situation we should think to move towards some non-conventional energy. Considering it, solar energy would be one of the solutions.

By considering all these issues many innovative spraying systems are developed. In that Shivarajkumar.A and Parameswaramurthy.D have developed wheel driven sprayer. This wheel operated pesticide spray equipment consists of reciprocating pump to pressurize the liquid. Here the to and fro reciprocating action of the pump takes place by moving the equipment. It is a portable device and no need of any fuel to operate, the main drawback of

this equipment is it cannot move in the land where the crops are already grown to the certain height. And also difficult to carry into the clay land. [1]

Varikuti Vasantha Rao, Sharanakumar Mathapati, Dr. Basavaraj Amarapur have developed multiple power supplied fertilizer sprayer this system is the modified model of the two stroke petrol engine powered sprayer. The two stroke petrol engine has been replaced by a direct current motor and operated by the electrical energy stored in the battery attached to the unit. The battery can be charged by alternate current through the charger. [2]

Abhishek Jivrag, Vinayak Chawre, Aditya Bhagwat have developed Solar Operated Multiple Granulated Pesticide Duster this system accomplished by the use of solar panel, impeller type centrifugal blower, gear reduction mechanism, dispensers, D.C motors and batteries. This device essentially works for disbursing solid granulated (powder) form of pesticide. The main drawback of this device is not portable. [3]

1.2 Types of Sprayers.

Based on the mechanism of operation and usage of fossil fuel the conventional sprayers are classified into following few types. The features and drawbacks compare to the newly developed sprayer system are highlighted.



Fig 1.1 Hand driven Sprayer



Fig 1.2 fuel operated Sprayer

(a) Hand Driven Sprayer

Hand driven sprayer as shown in Fig 1.1 it consist of a flexible diaphragm made of synthetic rubber connected to the pump handle by a crankshaft mechanism, a rigid diaphragm chamber and either flat or ball-type inlet and outlet valves. The outlet valve is connected to a pressure chamber, which in many hand driven pump sprayers has a variable pressure setting

valve. These pumps typically operate between pressures of 1 to 2.5 bar (15-44 psi) and it is suitable for herbicide application where large droplets are required to minimize spray-drift.

(b) Fuel Operated Sprayer

The fuel operated sprayer as shown in Fig 1.2 it consists of an integrated or external spray tank; a high pressure piston pump usually powered by a petrol engine a pressure regulating valve and a hose of up to 50 m of length. Spray tanks are too big to be carried as a knapsack. The fuel operated sprayer is produced in a number of versions. Most simple and common is an engine driven pump mounted on a frame without wheels, a 200 liter drum and hose and lance. Flow regulation is to be done via a pressure regulating valve and/or by restrictors (basic power sprayer) and the size of the nozzle. At the other end of sprayers mounted on wheels, equipped with pressure regulators. Technically, the power sprayer has a lot in common with the motorized knapsack-sprayer. The unit is generally set for high volume spraying, transporting the droplets with high pressure. Hollow cone nozzles are the preferred type of nozzles.

(c) Foot Operated Sprayer

The pump of the sprayer is worked by operating a pedal lever by the foot of the operator. It requires two persons to work. The spray liquid is kept in bucket or container and it is sucked by a suction hose through a filter (strainer) due to piston movement. A suitable ball valve is provided in the piston assembly to serve as suction valve. The liquid from the pump cylinder is then delivered into a pressure chamber where from the pressurized liquid reaches hydraulic nozzle. Minimum two person team is required to work on this machine. Hydraulic pressure of 10 kg/cm² can be achieved which is necessary to project the jet of spray to tall trees simultaneously from two spray nozzles.



Fig 1.3 Foot operated Sprayer



Fig 1.4 Rocker sprayer

The foot operated sprayer as shown in fig 1.3. It is basically for orchard and tree spraying. The design is strong. An adjustable type hydraulic nozzle (Triple Action Nozzle) is generally used which can generate different types of spray patterns viz., fine spray (hollow cone), medium spray and coarse spray (jet). The fine and medium spray are suited for low height orchards, jet spray are necessary for tree spraying. The spray jet can reach height of 15 - 20 feet. For spraying taller trees an extra extension like bamboo lance may be used to gain additional height by 8 - 10 feet.

(d) Rocker Sprayer

It is very much similar to the foot sprayer. The main difference is the operation of pump. The pump actuation is done by hand of the operator. The sprayer pump mounted on wooden platform is kept on ground and the spray solution is kept in a separate tank or container. It can develop high pressure 10 kg/cm². For spraying tall trees, an extension bamboo lance can be fitted. The adjustable type hydraulic nozzle (Triple Action Nozzle) is normally used. The rocker sprayer is shown in fig 1.4

(e) High pressure power sprayer



Fig 1.5 High pressure power sprayer

These are high capacity power operated hydraulic sprayers. They are the high volume spraying machines good for large scale application in orchards and tree crops. The source of power is engine or electrical motor. A pressure regulator is used to control the pressure in the discharge lines and by-pass from the pressure regulator is used for hydraulic agitation in spray tank. High pressure like 400 psi can be built up and large spray discharge rate like 30 L/min. can be obtained. The engine or electrical motors 3 - 5 H.P capacity power the sprayer.

1.3 Types and uses of Pesticides

These are substances or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. A pesticide may be a chemical substance, biological agent (such as a virus or bacterium), ant microbial, disinfectant or device used against any pest. Pests include insects, plant pathogens, weeds, mollusks, birds, mammals, fish, nematodes (roundworms), and microbes that destroy property, spread disease or are a vector for disease or cause a nuisance. Although there are benefits to the use of pesticides, there are also drawbacks, such as potential toxicity to humans and other animals.

A pesticide consists of an active ingredient coupled with inert ingredients. The active ingredient kills the pests, while the inert ingredients facilitate spraying and coating the target plant; they can also contribute other advantages that are not conferred by the active ingredient alone. Pesticides are used to control organisms considered harmful. For example, they are used to kill mosquitoes that can transmit potentially deadly diseases like west Nile virus, yellow fever, and malaria. They can also kill bees, wasps or ants that can cause allergic reactions. Pesticides can prevent sickness in humans that could be caused by mouldy food or diseased produce. Subclasses of pesticides include: herbicides, insecticides, fungicides, rodenticides, pediculicides, and biocides.

An **insecticide** is a pesticide used against insects. They include ovicides and larvicide's used against the eggs and larvae of insects respectively. Insecticides are used in agriculture, medicine, industry and the household. The use of insecticides is believed to be one of the major factors behind the increase in agricultural productivity in the 20th century.

An **herbicide**, commonly known, as a weed killer is a type of pesticide used to kill unwanted plants. Selective herbicides kill specific targets while leaving the desired crop relatively unharmed. Some of these act by interfering with the growth of the weed and are often synthetic "imitations" of plant hormones. Herbicides used to clear waste ground, industrial sites, railways and railway embankments are non-selective and kill all plant material with which they come into contact. Smaller quantities are used in forestry, pasture systems, and management of areas set aside as wildlife habitat.

Fungicides are chemical compounds or biological organisms used to kill or inhibit fungi or fungal spores. Fungi can cause serious damage in agriculture, resulting in critical losses of yield, quality and profit. Fungicides are used both in agriculture and to fight fungal infections in animals.

Herbicides can be used to clear roadside weeds, trees and brush. They can also kill invasive weeds that may cause environmental damage. Herbicides are commonly applied in

ponds and lakes to control algae and plants such as water grasses that can interfere with activities like swimming and fishing and cause the water to look or smell unpleasant. Uncontrolled pests such as termites and mould can damage structures such as houses. Pesticides are used in grocery stores and food storage facilities to manage rodents and insects that infest food such as grain. Each use of a pesticide carries some associated risk.

Pesticides can save farmers' money by preventing crop losses to insects and other pests; in the U.S., farmers get an estimated fourfold return on money they spend on pesticides. One study found that not using pesticides reduced crop yields by about 10%. Another study, conducted in 1999, found that a ban on pesticides in the United States may result in a rise of food prices, loss of jobs, and an increase in world hunger.

Based on the feedback obtained from the farmers who are utilizing the present conventional sprayer system and from the literatures, it is observed that the conventional sprayers and developed spraying systems have many difficulties, such as they need lot of effort to push the liver up and down in order to create the pressure to spray, these are highly expensive, they need fossil fuel to run, also availability of the fuel in rural areas is difficult. In order to overcome these difficulties, "A portable solar operated chemical sprayer" has been designed and developed. This system can be operated using solar energy. The solar energy converted into electrical energy is stored into the storage battery. The stored electrical energy in turn can be utilized to run the system. The main advantages of the present system are the running cost reduces to a minimum and it consumes less time for spraying operation. Most often it can be used at various locations such as farms; gardens etc. and also they are more popular in rural areas as well. The additional advantage of this project is, it can be used as a home lighting system as its charged battery can be used as lighting source at night.

1.4 Objectives of the project

- ❖ To utilize renewable energy sources for the purpose of pesticides sprayer.
- ❖ To reduce the discomfort occurs to the farmers during spraying.
- ❖ To create the awareness to the farmers about the renewable energy sources.
- ❖ To eliminate environmental pollution by using natural energy source.
- ❖ To Work efficiently under different working conditions.
- ❖ To Decrease the cost of machine
- ❖ To reduce labour cost and maintenance cost.