



Unit 4

Weeding and plant protection equipment



SPRAYER

Sprayer is a machine used to apply liquid chemicals on plants to control pest and diseases. It can also be used to apply herbicides to control weeds and to spray micronutrients to enhance plant growth. The main functions of a sprayer are

- Breaking the chemical solution into fine droplets of effective size.
- Distributing the droplets uniformly over the plants.
- Applying the chemicals with sufficient pressure for positive reaching the plants
- Regulating the amount of liquid applied on plants to avoid excessive application. Desirable quality of a sprayer. A good sprayer should possess the following qualities
- It should produce a steady stream of spray material in desired droplet size so that the plants to be treated may be covered uniformly.
- It should deliver the liquid at sufficient pressure so that the spray solution reaches all the foliage and spreads uniformly over the plant body.
- It should be light in weight yet sufficiently strong, easily workable and repairable

BASIC COMPONENTS OF A SPRAYER

Components of a sprayer are as follows

a) Pump b) Chemical tank c) agitator d) Air chamber e) pressure gauge f) Pressure regulator g) valves h) Strainer i) suction line j) delivery line k) nozzles

Pump: A pump is a device used to move fluids, such as liquids or slurries, or gases from one place to another. A pump displaces a volume by physical or mechanical action. Most hydraulic sprayers are equipped with positive displacement pumps capable of developing pressure, required for many spraying jobs. The discharge capacity of these pumps is approximately proportional to the speed. A pressure relief valve or by-pass valve is required to protect these positive acting pumps from damage when the discharge line is closed and for the convenience of the operator.

Tank: It is the container to hold the chemical solution. It is made up of PVC, Brass, etc. It is usually made of metal sheet or synthetic rubber or plastic having good resistant quality against corrosion, erosion, and similar actions. The size of the tank varies according to the pump capacity and the requirements.

Agitator: It is the device which stirs the solution and keeps the contents in homogeneous condition. Positive agitation of spray material in the tank is essential to permit using the full range of spray materials including powdery emulsions, fungicides, cold water paints or other spray material. The propeller or paddle type mechanical agitators or hydraulic agitators are very common.



Air chamber: In a reciprocating type pump, an air chamber is provided on the discharge line of the pump to level out the pulsations of the pump and thus providing a constant nozzle pressure

Pressure gauge: It is a dial gauge which indicates the pressure at which the liquid is delivered from the pump. A pressure gauge properly calibrated, within the pressure range of the pump is provided on the discharge line to guide the operator for making proper adjustment of the pressure at site.

Pressure regulator: The pressure regulator serves several important functions. It is the means of adjusting the pressure as required for any spray job within the pressure range of the pump. With the positive displacement type of pump, it also serves as a safety device in automatically unloading the excess pressure by directing the unused discharge flow from pump back to the tank.

Valves: A valve is a device that regulates the flow of a fluid (gases, liquids, fluidized solids, or slurries) by opening, closing, or partially obstructing various passageways.

Cut-off valve is provided in the delivery line to control the flow from the pump

By-pass valve is provided in the delivery line to by-pass the flow from pump to tank when flow in delivery line is reduced than the pump capacity

Relief valve - It is an automatic device to control the pressure of fluid or gas within a range a predetermined pressure.

Strainer: It is a small circular plastic ring with nylon wire mesh to filter any dust particle coming with the chemical solution. It is included in the suction line between the chemical tank and the check valves. In some sprayers strainers are provided at the mouth of the chemical tank.

Eg. Knapsack sprayers

Nozzles: It is the component which breaks the fluid in to fine droplet. Atomization of spray fluid is usually achieved by discharging the liquid through an orifice called nozzle under pressure. Atomization is also achieved by breaking up the jet of liquid with a blast of air.

Spray gun - It is a hand held metallic or PVC pipe to one end of which the nozzle is fitted and a flow cut off valve and a handle are fitted at the other end. The delivery hose is connected to the spray gun. It conducts the fluid from the delivery hose to the nozzle. The operator holds the gun and does the spraying job. Area of coverage by a spray gun is less compared to the coverage of a spray boom. Spray guns are used with low power sprayers. Eg. Knapsack sprayers, rocker sprayer

Spray boom - It is a long metallic or PVC pipe to which several nozzles are fitted with. The delivery hose is connected to the spray gun. High power and high capacity sprayers



use spray booms. The coverage is larger compared to spray guns. Booms are usually mounted on suitable structures and used. Eg. Tractor operated sprayers, power tiller operated sprayers

Spray lance: A hand-held pipe through which liquid reaches the nozzle mounted at free end

Over flow pipe - It is a conduit pipe through which excess fluid from a pump is by passed in to chemical tank by the action of a relief valve or pressure

COMPONENTS A OF NOZZLE

Nozzle body

It is the main component which encloses all other components of a nozzle

Swirl plate

It is metal disc with two tangential holes which imparts a swirl or rotation to the liquid passing through it

Nozzle disc

It is the component which breaks the fluid in to fine droplet. It is a flat disc with an orifice at the centre. When the spray solution reaches the disc from the swirl plate the disc builds up further pressure on the fluid and when the fluid passes out of the orifice, it breaks in to fine droplets. The disc has a specific design to impart a hollow cone or solid cone or a flat fan type of discharge to the outgoing fluid.

The popular nozzles are a) hollow cone b) solid cone c) fan or flat type

Nozzle Cap: Component which retains the assembled parts in or on a nozzle body. The nozzle disc or tip may be integral with the cap.

Strainer

It is a small circular plastic ring with nylon wire mesh to filter any dust particle coming with the chemical solution

Space

There are two number of runner/ plastic rings placed in between nozzle plate and swirl plate and between swirl plate and strainer for effective travel of the solution

Based up on the volume of liquid handled ,sprayers may be classified in to

- (1) High volume sprayer (more than 400 litres /ha)
- (2) Low volume sprayer (5 to 400 litres/ hectare)



(3) Ultra low volume sprayer (ULV) spray (less than 5 litres /ha). The selection technique depends up on type of vegetation, kind of pests and approach to the field.

ULTRA LOW VOLUME SPRAYER ULV

Sprayer is used to spray chemicals on row crops like cotton, cowpea, groundnuts, tobacco and vegetables. It is ideally suited for home gardens. It is a hand held sprayer with a spinning / rotating disc designed for ultra-low volume (ULV) and controlled droplet application of insecticides, fungicides, pesticides, herbicides and all liquids. Rotating disc technology ensures efficient liquid atomization to give appropriate droplet size. ULV formulations are applied at only 2.5-7.5 litres / ha. One hectare of crop can be treated in around 2.5 hour

HAND COMPRESSION SPRAYER

It is suitable for applying chemicals for field crops and lawns. Similar to hand atomizer this sprayer also consists of a tank of 10-12 lit capacity for holding spray material, a vertical air pump, pressure gauge, filling port, spray lance, nozzle and a flow control lever. The chemical tank is filled 75-80 % volume. The pump is operated to pump air in to the tank to build pressure up to 2.0 – 3.5 kg/cm². When the flow cut off lever is pressed, the fluid passes through the nozzle and spraying is done. The sprayer is carried on the shoulder of the operator. The application rate ranges from 45 to 100 litres /ha.

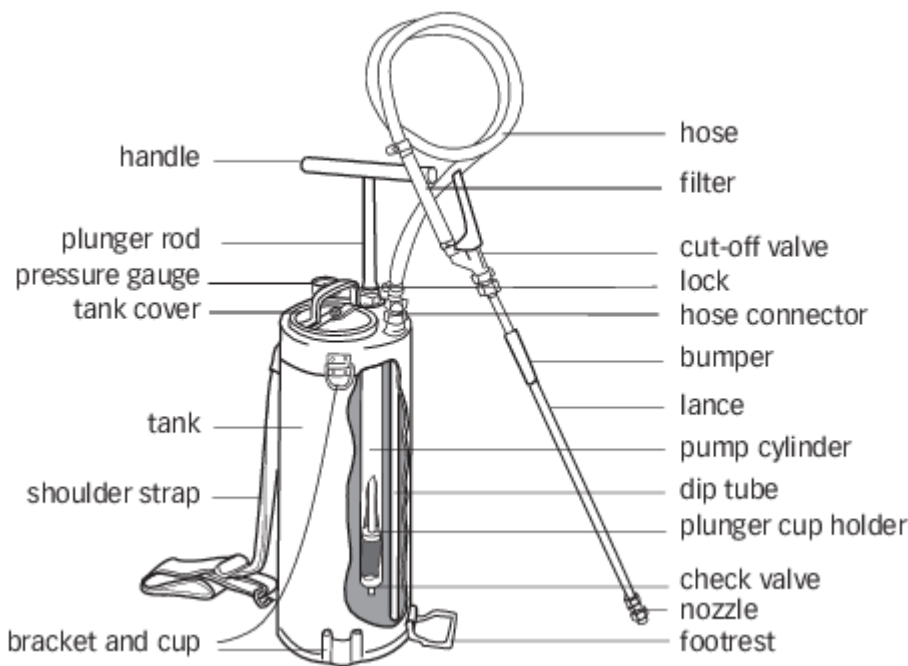
Eg: Knapsack sprayer

TYPES OF SPRAYERS

HAND ATOMIZER

This sprayer is also ideally suited for home gardens and small fields. It consists of a container of 0.5 to 3.5lit capacity a built in air pump, pressure gauge, nozzle and flow cut off lever. The tank is to be filled with $\frac{3}{4}$ the volume. The pump is operated to build pressure in the tank of 0.15-0.3 kg/cm². When the flow cut off lever is pressed, the fluid passes through the nozzle and spraying is done. The application rate ranges from 45 to 100 litres /ha





KNAPSACK SPRAYER (HAND OPERATED)

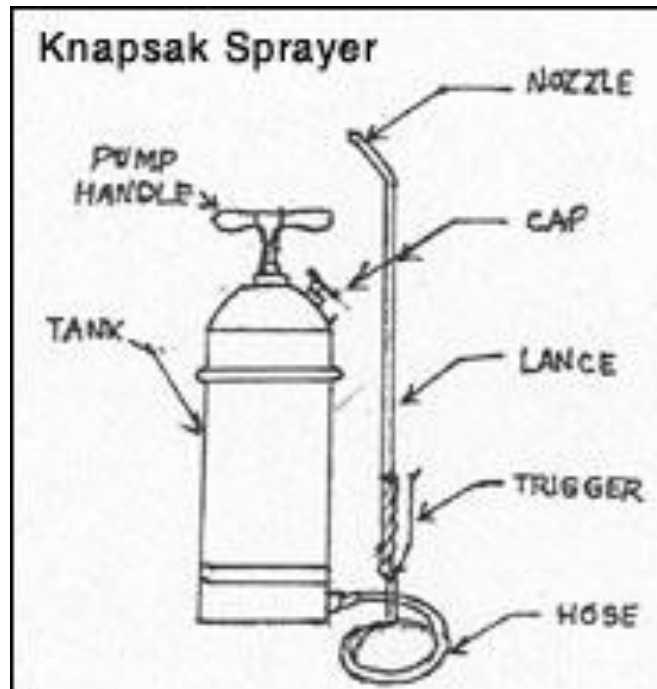
This sprayer is suitable for applying chemicals to several field crops. The operator carries the sprayer on his back and hence the name knapsack sprayer. It has a flat or bean-shaped tank of 10-15 litres capacity, a hydraulic pump fitted inside the tank, a handle to operate the pump, agitator, filter, delivery hose, and spray gun with nozzle and flow control lever. The tank is made of either brass or PVC material. The tank is filled with chemical solution. When the pump is operated, it draws the fluid through the suction hole and delivers it to the spray gun. When the cut off lever is pressed spraying is done through the nozzle as fine droplets. The pressure developed in these sprayers depends on the pump and varies from 3 to 12 kg/cm². The application rate is 500 lit/ha. The coverage is 0.5-1.0 ha/day.

Salient features of knapsack sprayers.

1. Useful to develop high pressure with less effort.
2. Light in weight and easy to carry on the back of the operator.
3. High work rate and economical.
4. Robust and simple to maintain.
5. Both left and right hand operation
6. 10-15 lit. capacity



7. Easy to spray chemicals.



ROCKER SPRAYER

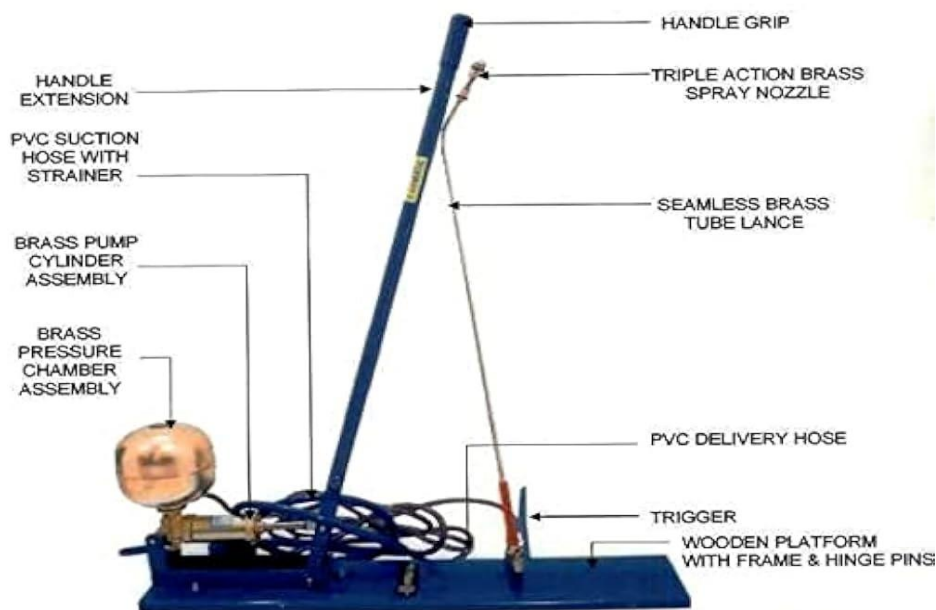
Rocker sprayer is mainly used for spraying fruit trees in orchards, coconut and areca nut trees, flower gardens, and cotton and tapioca fields. It consists of a piston type pump, a

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platform with fork, a lever to operate the pump, pressure chamber, suction hose with strainer, delivery hose, and a spray gun with flow control knob and nozzle. The pump builds up a pressure up to 14-18 kg/cm² which facilitates the use of the sprayer for tree spraying. The Pressure chamber helps for continuous spraying. The chemical is taken in a separate container and the suction hose is kept in the chemical container. When the pump is operated, it draws the fluid through the suction hose and delivers it to the delivery hose through the pressure chamber. When the flow control knob is turned, the fluid is sprayed through the nozzle. The output of the sprayer is 70-90 lit/hr with one nozzle. Coverage is about 1.5 ha/day

ROCKER SPRAYER **ILLUSTRATION OF PARTS**

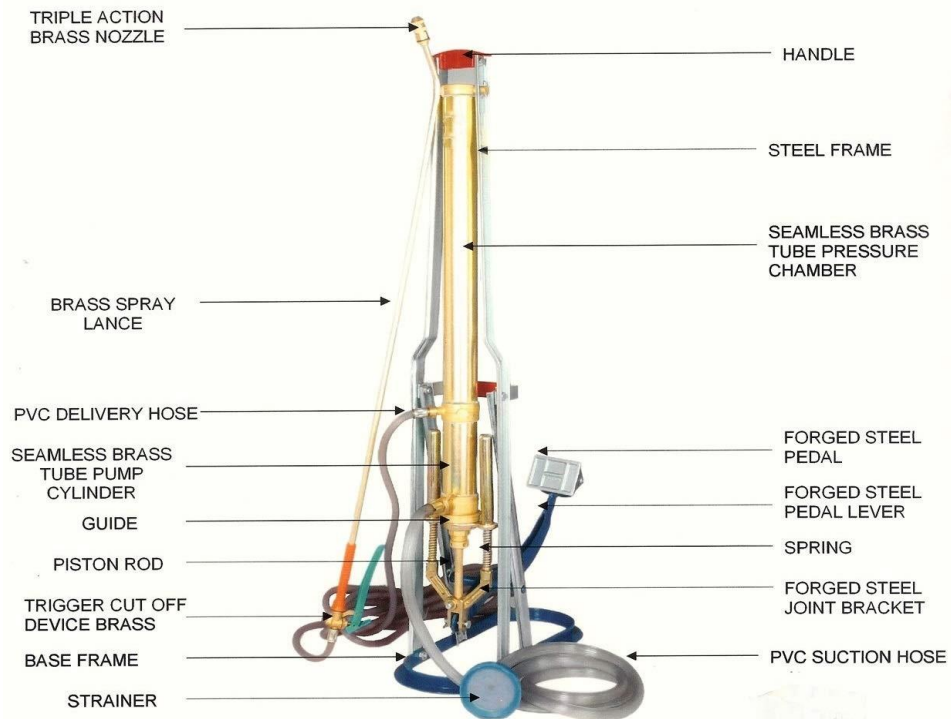


FOOT OR PEDAL OPERATED SPRAYER

The foot or pedal sprayers, as they are commonly called, consist of a plunger assembly, stand, suction hose, delivery hose, spray gun with a nozzle etc. One end of the suction hose is fitted with a strainer and the other end is connected to the pump inlet opening. Similarly, the delivery hose is fitted at one end to the delivery opening of the pump and the other end to the spray gun. Constant pedaling is required for continuous spray. It develops a pressure of 17-21 kg/cm². The chemical is taken in a separate container and the suction hose is kept in the chemical container. When the pump is operated by the foot, it draws the fluid through the suction hose and delivers it to the delivery hose. When the flow control lever is pressed, the fluid is sprayed through the nozzle. Agitation of chemical solution is done by supplying a portion of air from the blower, The discharge rate with one nozzle is 110-135 l/hr and coverage is 1.0 ha/day



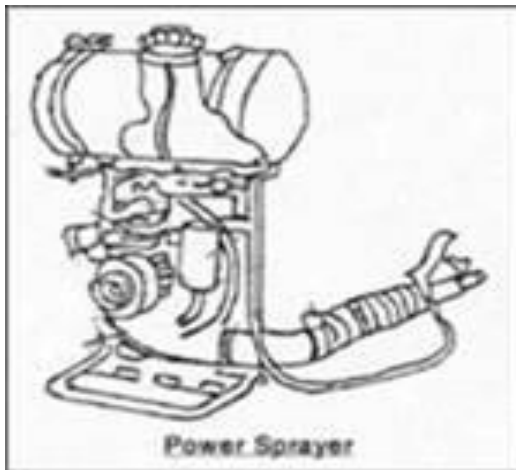
FOOT SPRAYER **ILLUSTRATION OF PARTS**





POWER SPRAYER

It is a heavy duty and efficient sprayer. It consists of a triplex pump with stainless steel piston with oil bath lubrication. It can Develops 250 to 350 pounds pressure and can deliver the solution up to 15m. It can be powered by a 3 HP engine or electric motor. It is convenient to spray with 4 to 6 spray lances at a time using the sprayer. There are sprayers can be operated by tractor PTO as well as by a power tiller.



Bucket sprayer

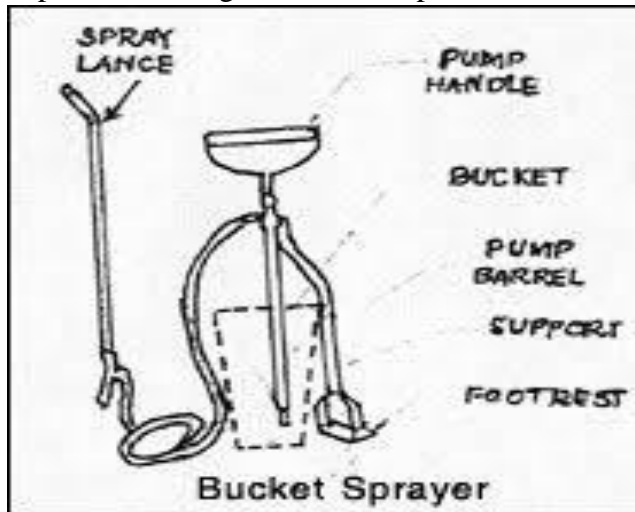
The bucket sprayer is designed to pump the spray fluid directly from the open container usually a bucket.

The hydraulic pump will be put inside the bucket and held properly with the help of foot rest.

As the plunger is pulled up the fluid enters through the suction ball valve assembly and when the plunger is pressed down the suction valve closes and the fluid enters the pressure chamber through a ball valve assembly



As the plunger is continuously worked, pressure is built in the pressure chamber and the delivery hose. As soon as the required pressure is built up the spraying will be done. A pressure of 4kg/cm^2 is developed in most of the models



Stirrup pump





STIRRUP PUMP

