EXERCISE – 7

STUDY OF STRUCTURAL DETAILS OF SPRAYERS, DUSTERS AND SEED DRESSERS

Sprayers

- The Sprayer is one which atomises the spray fluid (which may be a suspension, an emulsion or a solution) into a small droplets and eject it with little force for distributing it properly.
- It also regulates the amount of pesticide to avoid excessive application that might prove wasteful or harmful.
- The mechanical appliances that are used for distributing the dust formulations of pesticides are called as dusters.

Types of sprayers

- Sprayers are classified into four categories on the basis of energy employed to atomise and eject the spray fluid as
- hydraulic energy sprayer
- gaseous energy sprayer
- centrifugal energy sprayer and,
- kinetic energy sprayer

Hydraulic energy sprayer

- Hydraulic Energy Sprayer is one which the spray fluid is pressurised either directly by using a positive displacement pump or by using an air pump to build the air pressure above the spray fluid in the air tight container.
- The pressurized fluid is then forced through the spray lance, which controls the spray quantity and pattern.

Gaseous energy sprayer

- In Gaseous Energy Sprayer high velocity air stream is generated by a blower and directed through a pipe at the end of which the spray fluid will be allowed to trickle by the action of gravity through a diffuser plate.

Centreifugal energy sprayer

- In the Centrifugal Energy Sprayer the spray fluid fed under low pressure at the centre of a high speed rotating device (Such as flat, concave or convex disc a wiremesh cage or bucket, a perforate sieve or cylinder or a brush) is atomised by centrifugal force as it leaves the periphery of the atomiser.
- The droplets are carried by the air stream generated by the blower of the sprayer or by the prevailing wind, if the sprayer is not provided with a fan.

Kinetic energy sprayer

- In Kinetic Energy Sprayer the spray fluid flows by gravity to a vibrating or oscillating nozzle which produces a coarse fan shaped spray pattern.
- This is used for application of herbicides.

Types of sprayers

- Depending on the source of power it can be classified as manually operated and power operated dusters.
- The manually operated dusters are (i) package duster (ii) plunger duster (iii) bellow duster and (iv) rotary duster.

(i) Package dusters

- In some pesticide dusts are packed in containers that serve as a hand applicators and may be discard after use.
- They are mostly provided with rubber, leather or plastic section which, on getting squeezed, provides a puff of air that emits the dust in a small cloud.
- The simplest type of package duster is worked by pressing it between the fingers.

(ii) Plunger dusters

- The consists of an air pump of the simple plunger type, a dust chamber, and a discharge assembly consisting of a straight tube or a small exit pipe whose discharge outlet can be increased or decreased by moving a lid provided at the end of the dust chamber.
- The air from the pump is directed through a tube into the container where it agitates the dust and eject it from a discharge orifice or tube.
- The amount of dust can be controlled by the speed of the operation of the pump.
- These are useful for spot application in restricted areas and for controlling ants, poultry pest and pest of farm animals.

(iii) Bellow duster

- In the below may be made from rubber, leather or plastic.
- On squeezing, it puffs the air that expels the dust in a small cloud.
- Hand held bellow duster has containers of capacity from 30 g to 500 g.
- The bellows can be operated either directly by hand or by handle provided for that purpose.
- The knapsack duster has the container capacity of 2.5 to 5.0 kg.
- The air blast developed by the bellow draws the dust from the hopper and discharges through the delivery spout intermittently.
- These dusters are suitable for spot treatments.

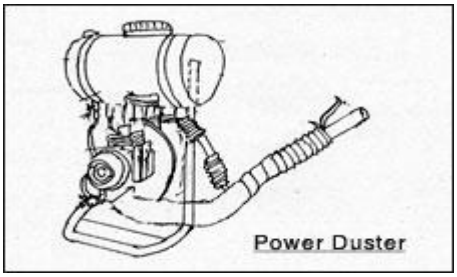
(iv) Rotary duster

- A consists basically of a blower complete with a gear box and a hopper. It is operated by rotating the crank.
- The cranking motion is transmitted through the gear box to the blower.
- A drive is taken for the dust agitator located in the hopper.
- The rotary duster may be hand carried type or shoulder mounted or belly carried type.
- The feed is controlled by a feed control lever, which operates a slide to control the aperture at the bottom of the hopper.

Some of the recommendation of WHO (1974) for this duster are

- The sheet hopper should not be less than 0.63 mm thick.
- The concave bottom of the hopper permits all the dust to move towards the feeding aperture.
- The fan should be capable of displacing 0.84 m3 of air per minute at a speed of 35 rpm.

(v) Power dusters



- The resemble the rotary duster is construction, except that th power to drive the blower through the gear box is tapped from a external power source which may be an engine or P.T.O. shaft o the tractor or flywheel of the power tiller.
- The power operated centrifugal energy knapsack sprayer als can be converted into a power duster, by allowing the dust flui into the air stream, near the point of attaching the pleated hos in the blower elbow.

Uses of spraying and dusting equipments

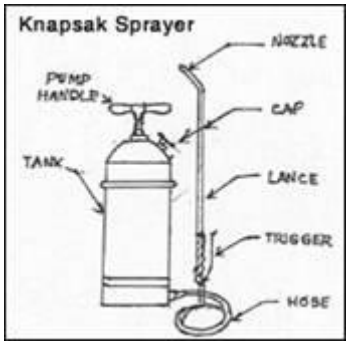
- The spraying and dusting equipments are used for the following purposes
- For the insecticides application to control insect pests on crops and in stores, houses, kitchen, poultry farms, barns, etc.
- For the insecticides application to control insect pests on crops and in stores, houses, kitchens, poultry farms, barns, etc.
- For the acarices application to control phytophagous mites.
- For the fungicides and bactericides application to control the plant diseases.
- For the herbicides application, to kill the weeds.
- For the harmone sprays application to increase the fruit set or to prevent the premature dropping of fruits.
- For the application of plant nutrients as foliar spray.
- For applying the powdery formulation of poisonous chemicals on the crops and for any other purposes.

Hand sprayer

- The hand sprayer is a small, light and compact unit.
- The capacity of the container varies from 500 to 1000 ml.
- This is generally used for spraying small areas like kitchen garden and experimental laboratory plots.
- It is a hydraulic energy sprayer.
- It has a hydraulic pump inside the container, with cylinder, plunger and a plunger rod.
- By operating the plunger up, the spray fluid in the container is sucked into the cylinder through a ball valve assembly and then pressurised during the downward stroke.
- The pressurised fluid is then let out through a nozzle, and sprayed into fine droplets.
- If the pressure to be built inside the container an air pump with cylinder, plunge and plunger rod is required.
- When the plunger is pulled up, the air is sucked into the cylinder and when pushed down the air bubble is releases into the container with 80% of its volume filled with the fluid.

- The air reaches the space above the free fluid surface and presses the fluid.
- The pressurised fluid is drawn up through a trigger cut of valve to the nozzle, where is atomized and sprayed.
- In some other type, air pump and the container are separate pieces and the pump is attached to the container is such a way to release the pressurised air through an orifice at the top of the container.
- The fluid is lifted through an office at the top of the container.
- The fluid is lifted through a capillary tube due to surface tension developed by the high velocity air at the outlet and sheared away by the air and sprayed as droplets.

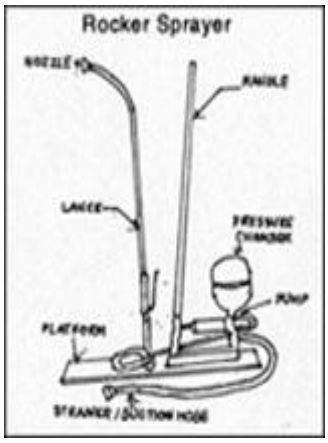
Knapsack sprayer



- Any sprayer which is carried on the back of the operator is called a knapsack sprayer.
- The commonly used manually operated knapsack sprayer will have one hydraulic pump working inside the container.
- The plunger works inside the replacement well attached at the bottom of the container, for easier maintenance.
- The pump can be operated through the appropriate linkages by oscillating the handle, with the sprayer carried on the back.

- An agitator is also provided with the pressure chamber to agitate the fluid so that the particles in suspension will not be allowed to settle down.
- A delivery tube is attached on the other end of the pump which carries the pressurises fluid to the spray lance.
- The flow to the nozzle is controlled by a trigger cut-off valve.
- In the case of compression knapsack sprayer, an air pump is used to build air pressure above the free surface of the spray fluid in the container and normally the pumping of the air will be done by keeping the unit on ground and then sprayed til the air pressure comes down.
- The unit is again brought back to the ground for pumping air and then the spraying is contained as before.
- The spray fluid, which does not enquire any agitation only can be sprayed by using this type of sprayers.

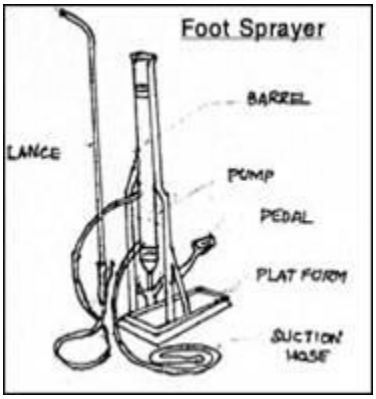
Rocker sprayer



- The rocking sprayer has a pump assembly, fixed on a wooden platform with an operating lever, a valve assembly with two ball valves, a pressure chamber, suction hose with strainer, and delivery hose with spray lance.
- When the plunger is pulled behind by pulling the lever way from the pump, the spray fluid from the container is sucked through the strainer and pushes the bottom ball valve above and enters the pump.
- The movement of the lower ball valve is arrested by the upper valve seat.
- When the lever is pushed towards the pump, the sucked fluid is forced to enter the pressure chamber by opening the upper ball valve.

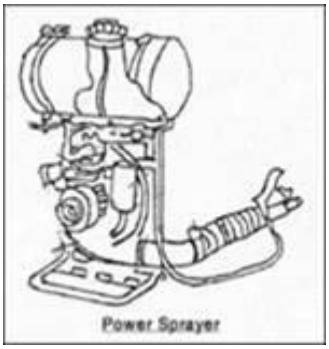
- The operation is continued till the entire suction pipe, ball valve assembly, delivery hose and a portion of pressure vessel is fitted with spray fluid and the pump operator finds it difficult to push the piston forward, due to the downward pressure developed by the entrapped compressed air in the pressure vessel.
- Thereafter, the trigger cut off valve will be opened to allow the spray fluid to rush through the nozzle and get atomized.
- Usually 14 to 18 kg/cm2 pressure can be built in the pressure chamber and hence can be conveniently used for free spraying.

Foot sprayer



- This is a modified version of rocker sprayer.
- The pump is fixed in a vertical position with necessary braces.
- The plunger moves up and down when operated by the pedal.
- A ball valve is provided in the plunger assembly itself to allow the fluid to cross the plunger and getting pressurized in the pressure vessel.
- During the upward motion of the piston fluid is sucked in and pressurized into the pressure vessel and during downward movement, the sucked fluid crosses the plungers and enter the pump.
- The pressure developed is about 17-21 kg/cm2.

Power sprayer



- All the sprayers which impart the mechanical energy developed by an I.C. Engine, on the spray fluid before spraying is called as a power sprayer.
- The most commonly used type of power sprayer in India is a gaseous energy type knapsack sprayer.
- In construction, it has a back pack stand on which a blower with a S.I.
- Engine of 1.2 to 3 hp capacity, the spray fluid tank and the petrol tank are fixed rigidly.
- A pleated hose is attached to the blower elbow to carry the high velocity air and at the end of that a shear nozzle is fixed to allow the spray fluid to trickle in from the spray fluid storage tank, with a valve control.

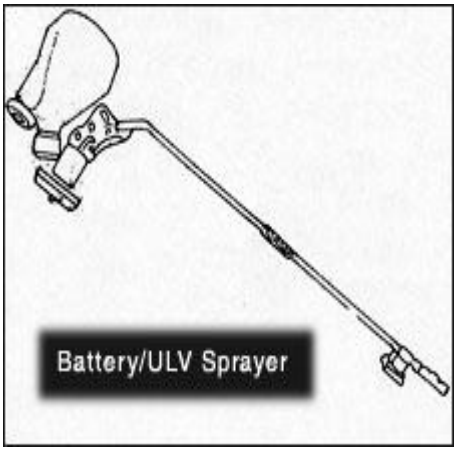
- From the top of the blower casing, an air hose is taken into the spray fluid tank, which carries little quantum of air to press the spray fluid during operation.
- In operation, the engine is started by keeping the unit on the ground and then carried by the operator.
- The blower sucks the air behind the backrest and forces it into the pleated hose.
- The valve of the shear nozzle is opened or the shear nozzle with selective opening and discharged through the nozzle.
- The high velocity air shears off the droplets and atomizes by the impact of diffuse and delivers it on the plant the surface.
- An air current of 2.7 to 9.1 m2 / minute is delivered at a velocity of 175 to 320 kmph.
- The spray fluid tank capacity varies from 7 to 12 litres.
- The fuel tank capacity varies from 0.75 to 2.25 litres.

- The spray fluid discharge can be varied from 0.5 to 5 lit / minute.

A power sprayer can be used as a power duster by making the following changes.

- Chemical filler cap is removed to dismantle that strainer with the air pipe.
- The liquid delivery pipe below the chemical tank is dismantled and removed with the shear nozzle.
- The tank is thoroughly cleaned to remove possible traces of moisture left inside.
- The dust agitator tube is fixed at the bottom of the chemical tank.
- This tube has holes at the bottom to prevent the entry of dust into the agitator and clogging it.
- Dust intake tube is inserted into the chemical tank at the discharge and this tube has no. of large size holes on its periphery.
- Dust intake tube and the blower elbow are connected by using the dust outlet pipe, which is a pleated hose.

Battery or ULV sprayer



- ULV sprayer was invented as a result of the desire to reduce the quantum of chemical carried by the man for application and to eliminate the water as a medium to carry the chemicals.

The basic requirements of ULV spraying are

- The narrow and controllable droplet spectrum (100-250 µm for fine sprayers, 50-100 µm for mist sprayers and 0.1 to 50 µm for aerosols)
- The accurately controllable emission rate and
- The non-volatile pesticide formulation of suitable viscosity and density.

- The reduction in volume of the spray fluid decreases the time spent in travelling to recharge sprayer, in fetching water, in mixing the pesticide and filling the tank. In a day of 8 hour about 8 ha can be covered in ULV spraying against 3 ha with power sprayer.
- A battery operated ULV sprayer has a long handle at the horse power D.C. motor is fitted with a spinning disc and a cover.
- A HDPE bottle is fixed close to the motor, in such a way that spray fluid is allowed to trickle at the centre of the spinning disc in operation.
- Centrifugal energy imparted fluid comes out of the nozzle and atomizes.
- The hand held ULV applicators are so designed to release the spray droplets at 1 m away from the body of the operator.
- Further, it is recommended that they should be operated only when the spray cloud would be blown away from him by the breeze so as to minimize the risk of contamination.
- After spraying, the atomizer must be flushed with paraffin to remove the residual pesticide.
- Inefficient cleaning would leave the pesticide deposit in the feeder stem to completely of partially block the flow of the pesticide.

Power sprayer operated suction trap

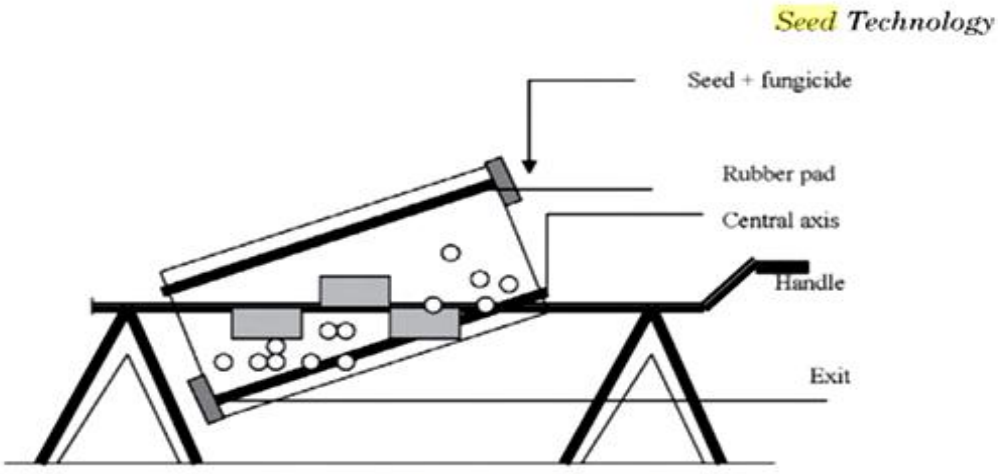
- This consists of a metal elbow matching the suction opening and the blower and the outer diameter of the pleated hose.

- This unit is closely fitted with the blower suction opening with the help of an extension frame work identical to the back pack stand.
- To the pleated hose attachment opening of the elbow a pleated hose is attached rigidly.
- In between the two pleated hoses a screen, an insect collector and valve to control the size of the opening are provided in a Tee section.
- In operation the low pressure created at the blower inside is transmitted through the below and pleated hose which helps in sucking the lighter objects like insects and dust from a distance of 0.5 to 1.0 m away from it.
- The sucked insect of dust will be filtered by the screen and dropped into the collection bowl.

1. Drain off any liquid still in the tank.
2. Add 1 kg of washing soda per 45 litres of water, which will serve as a cleaning detergent. Spray this liquid through the nozzle on waste land.
3. Add fresh water in the tank and spray with and then without nozzle on the waste land.
4. Wash the outside of the sprayer.Remove the nozzle and filters and store safety after cleaning.
5. Ensure the absence of water in the pump and lubricate the parts.

SEED DRESSING MACHINES

The fungal seed treatment with fungicides is highly essential because a large number of fungal pathogens are carried on or in the seed. In addition, when the seed is sown, it is also vulnerable to attack by many common soil borne pathogens, leading to their seed rot, seedling mortality or produce diseases at a later stage. Seed treatment is probably the effective and economic method of disease control and is being advocated as a regular practice in crop protection against soil and seed borne pathogens that infect embryos, cotyledons or endosperms under the seed coat.



Schematic diagram of a typical rotary seed dresser

a) Rotatory seed dresser

Seed dressers are small hand driven machines, having drum fitted on a stand and which can be rotated with the help of a handl provided at one end of the drum. The drums should be rotated slowly 30-40 times during which process the seeds are coated with chemicals. The drums should be filled only two- third of its capacity to have effective seed dressing. In large seed farms power operated machines are used.

b) Gravity seed dresser

This type of machine is used for seed treating chemicals which are comparatively volatile in nature. Seed treatment takes more time, but does not involve any manual labour. The machine has a suitable steel drum fitted with cones and baffles which are perforated. The seeds and chemicals are introduced through the lid provided at the top. The delivery of the treated seeds is taken from a small opening provided at the bottom. The seeds while coming downwards slowly due to gravity get mixed with the chemical.

c) Slurry seed treaters : In this machine the slurry, a thick suspension of seed treating chemical in small volume of water or other solvent is used in place of dry chemicals. These machines are driven by 3 -4 hp. electric motor or oil engine. The machine is provided with an arrangement in which measured quantities of seed and the slurry chemical are automatically fed into the treatment chamber in a synchronous manner. The smaller machines may be fixed on a platform while the larger one may be fitted on a stand. The output of the machine is 30 quintals of seed per hour. The slurry treatment has been advocated to eliminate hazard of objectionable dust of seed treating chemicals.

d) Grain treating machines: These are used for treating cereal grains or pulses with the chemicals. These may be manually operated or power operated.

EXERCISE – 8

AWARENESS CAMPAIGN AT FARMER'S FIELDS

Pesticides can be considered as an economic, labor-saving, and efficient tool of pest management with great popularity in most sectors of the agricultural production.

Despite their popularity and extensive use, pesticides has serious concerns about health risks arising from the exposure of farmers when mixing and applying pesticides or working in treated fields and from residues on food and in drinking water for the general population have been raised.

These activities have caused a number of accidental poisonings, and even the routine use of pesticides can pose major health risks to farmers both in the short and the long run and can degrade the environment. In developing countries, farmers face great risks of exposure due to the use of toxic chemicals that are banned or restricted in other countries, incorrect application techniques, poorly maintained or totally inappropriate spraying equipment, inadequate storage practices, and often the reuse of old pesticide containers for food and water storage

Types of pesticides

Depending on the target organisms, these substances can be classified as fungicides, bactericides (often called antibiotics) or nematicides.

- **Fungicide (Mycocide)-** Fungicide is a latin word (Fungus + Caedo: to kill). A chemical that is capable to kill the fungus is known as fungicide. eg; Mancozeb, Carbendazim etc.
- **Fungistatic (mycostatic)** –A compound that prevents fungus growth without killing the fungus. eg; Auerofungin (antifungal antibiotic).
- **Antisporulants-** A chemical which inhibit the spore production without affecting vegetative growth. Antisporulants also known as **"Gene static compounds"** because they prevent spore production that is necessary for inhibition of secondary infection. Eg; Bordeaux mixture.
- **Antibiotics-**Antibiotics are those substances which are produced by one organism and become toxic to another one. eg; Streptomycin (produced by *Streptomyces griseus*), griseofulvin (produced by *Penicillium griseofulvum*) and blasticidin etc.
- **Soil fumigants-** These are volatile organic compounds that are generally used as soil fumigation as they give off gases after being applied to the soil. These are effective against nematodes, many fungi insect and weeds. Example- Chloropicrin, Methyl Bromide, Formalin, DD mixture etc.
- **Bactericide-** A chemical that kills bacteria.Example- Streptocycline.
- **Bacteristatic-** A chemical which prevents growth and multiplication of bacteria without killing.

- **Wound dressers-** Chemicals that apply on the wounds and cuts, to prevent the fungal and bacterial infection. Example- Bordeaux paste and Chaubattia paste.
- **Insecticide** – Chemicals which are used to control insects.
- **Herbicides –** Chemicals which are used to control unwanted plants or weeds.
- **Rodenticides –** Chemicals are used to control mice, ground squirrels and pocket gophers.
- **Acaricides -** Chemicals are used to control mites.

BASIC PRECAUTIONS IN PESTICIDES USES

A. Purchase:

- Purchase only just required quantity e.g. 100, 250, 500, 1000 g/ml for single application in specified area.
- Do not purchase leaking containers, loose, unsealed or torn bags.
- Do not purchase pesticides without proper/approved labels. It identifies the hazardous substances, properties and toxicity. It provides a guide to safe handling, storage and use. It will help you to choose which chemical is least toxic to humans, but will still do the job. It provides first aid treatment advice. Make sure you have an antidote on hand. Additional information should be available in the form of a Material Data Safety Sheet4. While purchasing insist for invoice/bill/cash memo.

B. Transporting pesticides:

Pesticides can present a particularly severe hazard if they are involved in accidents during transportation. When pesticides are spilled on the roadway, they may catch fire, be scattered by passing cars and trucks, be blown by wind onto nearby crops or people, or be washed into ditches or streams by rain. If they catch fire, the fumes and smoke may injure fire fighters, police, and people far removed from the scene of the accident. Even under relatively uneventful circumstances, pesticides may simply contaminate the vehicle, cargo, or people transporting the chemicals. When you transport pesticides, you are legally responsible for them. To reduce the likelihood of pesticide spills or exposure of workers riding in vehicles transporting pesticides, the following guidelines should be followed:

- ✓ Pesticides should be most safely transported in the beds of trucks.
- ✓ Pesticides should never be transported in the passenger compartment of any vehicle.

- ✓ People should never be allowed to ride in the beds of pick-up trucks carrying pesticides. This applies especially to children as passengers.
- ✓ Pesticides should never be transported in the same compartment with food, feed, or clothing.
- ✓ All pesticide containers in shipment should be secured tightly. This is especially critical for glass containers.
- ✓ Pesticide containers made of paper, cardboard, or similar materials should be protected from moisture during transport.
- ✓ Pesticides in parked service vehicles must be made secure from theft, tampering, and contamination.

C. Storage:

It is necessary and legally required that pesticides be stored in a safe, secure and well identified place. Here are some rules which pertain to pesticide storage:

- Avoid storage of pesticides in house premises.Store in a well ventilated and well lit shed that is lockable and has an impervious floor and impervious shelving.
- Make sure a tap is located close to clean up any spills.
- Store the hazardous substance in their original containers, with labels intact. Re-label containers if labels come off.
- Always store pesticides in tightly sealed containers and check containers periodically for leakage, corrosion breaks, tears, etc.
- Do not transfer pesticides to other containers. Separate hazardous substances that may react with one another.
- Never keep them together with food or feed/fodder. Keep away from animal feeds, fertilizers and seeds.
- Never store pesticides in old bottles or food containers where they could be mistaken for food or drink for humans or animals.
- Keep away from reach of children and livestock.
- Store away from protective clothing and equipment.
- Do not expose to sun-light or rain water. Always store pesticides where they are protected from freezing or excessive heat.

- Always store different types of pesticides in different areas, to prevent cross contamination and the possibility of applying a product inadvertently. Do not store weedicides along with other pesticides.
- Never carry/ transport pesticides along with food materials.
- Avoid carrying bulk pesticides (dust/granules) on head shoulders or on the back.

D. Precautions for preparing spray solution:

All pesticides are potentially harmful, particularly for those who work with them on a daily basis because of the potential for being exposed to large doses and the likelihood of chronic exposure. Many pesticide accidents occur when the chemicals are being mixed for use.

A few common sense rules can make mixing and loading safer, thereby helping you to avoid the leading cause of pesticide-related illnesses:

- ✓ Before begin to mix, load and apply pesticides, and after you've read and understood the label directions.
- ✓ Based on label recommendations, put on protective clothing and use other necessary protective equipment. Also from reading the label, follow instructions on what special equipment is necessary. If you have questions concerning protective equipment, contact your expert before you open the container.
- ✓ Always protect your nose, eyes, mouth, ears and hands. Use hand gloves, face mask and cover your head with cap. Read the label and Material Safety Data Sheet for instructions on appropriate protective clothing to use during mixing and application.
- ✓ Use polythene bags as hand gloves, piece of clean cloth as mask and a cap or towel to cover the head (Do not use polythene bag contaminated with pesticides).
- ✓ Use a sharp knife to open paper bags; do not tear them or the label.
- ✓ Measure accurately; use only the amount you need to apply at the rate specified on the label. Prepare the spray solution as per requirement.When removing the concentrated material from the container, keep the container below your waist if possible to prevent the possibility of splashing or spilling any pesticide into your face and eyes. Use clean water for preparing spray solution.
- ✓ Do not mix granules with water.
- ✓ Concentrated pesticides must not fall on hands etc. while opening sealed container. Do not smell pesticides.

- ✓ Avoid spilling of pesticides while filling the sprayer tank.
- ✓ The operator should protect his bare feet and hands with polythene bags.
- ✓ Do not eat, drink, smoke or chew while preparing solution.
- ✓ Do not work alone. Be sure that help is available nearby in case you get into trouble.

E. Equipment-

- Select right kind of equipment.
- Do not use leaky and defective equipment.
- Select right kind of nozzles.
- Do not blow/clean clogged nozzle with mouth. Use old tooth brush tied with the sprayer and clean with water.
- Do not use same sprayer for weedicide, fungicide and insecticide.
- Never re-use empty pesticide container for any purpose

F. Precautions for applying pesticides:

Careful attention to a few simple guidelines during pesticide application will greatly increase your chances of effectively controlling the pest. At the same time, attention to these details will make the job much safer for you, other people, pets, livestock, and the surrounding environment.

- Apply only at recommended dose and dilution.
- Do not apply on hot sunny day or strong windy condition.
- Do not spray just before the rains and after the rains.
- Do not spray against the windy direction.
- Emulsifiable concentrate formulations should not be used for spraying with battery operated ULV sprayer.
- Wash the sprayer and buckets etc. with soap water after spraying.
- Containers, buckets etc. used for mixing pesticides should not be used for domestic purpose.
- Avoid entry of animals and workers in the field immediately after sprayer.
- Avoid tank mixing of different pesticides.
- Spraying and dusting fails normally during rainy season because the chemicals do not stick well on plant surface therefore certain other compounds are added to them such as stickers, surfactants etc.

G. Disposal

- Left over spray solution should not be drained in ponds or water lines etc. throw it in barren isolated area if possible.
- The used/empty containers should be crushed with a stone/stick and buried deep into soil away from water source.
- Never reuse empty pesticides container for any other purpose.
- Wash the sprayer and bucket etc with soap water after spraying.

H. Clean up

- Thoroughly clean all spraying and protective equipment where run-off will not contaminate the environment or create a hazard.
- Wash work clothing separately or dispose of as appropriate.
- Wash exposed skin areas with soap and water, and rinse with clean water.

I. First Aid procedures

- Learn the early symptoms of poisoning for the pesticide you're using.
- For skin contact, wash with soap and water, and rinse with clean water.
- For eye contact, hold eye open under running water for 15 minutes.