RAMA UNIVERSITY

www.ramauniversity.ac.in

FACULTY OF AGRICULTURAL SCIENCES & ALLIED INDUSTRIES

ENT-121: Fundamentals of Entomology

Lecture 27: Insecticide Application Equipments:

Here are some common pesticide application methods:

- Band: applied in parallel strips, such as between or over rows of crops.
- Broadcast: uniformly applied to an entire area or field.
- Direct Spray: targeted applications to minimize contact with non-target plants and animals.
- Foliar: directed to the leafy portions of a plant.
- Rope wick of wiper: released onto a device that is wiped onto weeds taller than the crop, or wiped selectively onto individual weeds in an ornamental planting bed.
- Soil: placed directly on or in the soil instead of on a growing plant.
- Inside Soil: by tillage, rainfall, or irrigation equipment to mix pesticide into the soil.
- Space Treatment: applied in an enclosed area.
- Spotty: applied to small, distinct areas.

OBJECTIVE OF PESTICIDE APPLICATION: The objective of the application of pesticide is to keep the pest under check. The pest population has to be kept suppressed to minimum biological activities to avoid economic loss of crop yields. Thorough killing of pest or eradication of pest is neither practical nor necessary. The objective of pesticide application besides keeping the pest population under check should also be to avoid pollution and damage to the non-targets.

The success of pest control operations by pesticide application greatly depends on the following factors: -

1. Quality of pesticide
2. Timing of application
3. Quality of application and coverage

Even though good quality pesticide is used and optimum timing for the application of pesticide is also adopted; unless the pesticide is applied properly it will not yield good results. Therefore, the quality of application of pesticides is very important in pest control operations. Adherence to the following points can ensure it:

1. Proper dosage should be applied evenly
2. The toxicant should reach the target
3. Proper droplet size
4. Proper density of droplet on the target

On the basis of volume of spray-mix the technique of spraying is classified as:

1. High volume spraying
2. Low volume spraying
3. Ultra-low volume spraying

The range of volume of spray mix in each of the above case is arbitrary. Usually for field crop spraying the following spray volume ranges are taken as guide.

High Volume Spraying 300 - 500 L/ha
Low Volume Spraying 50 - 150 L/ha
Ultra-Low Volume Spraying < 5 L/ha

CLASSIFICATION OF PLANT PROTECTION EQUIPMENTS:

SPRAYERS (Hydraulic energy): These are two types

Manually operated:

1. Syringes, slide pump
2. Stirrup pumps
3. Knap sack or shoulder-slung
4. Compression sprayer
5. Stationary type

Powered operated:

1. High pressure sprayer (hand carried type)
2. High pressure trolley/ Barrow mounted
3. Tractor mounted/ trailed sprayer
4. High pressure knaps-sack sprayer
5. Air craft, aerial spraying (Fixed wing, helicopter)

SPRAYERS (Gaseous energy):

Powered operated

1. Knap sack, motorized type
2. Hand/ Stretcher carried type
3. Tractor mounted

SPRAYERS (Centrifugal energy)

1. Hand held battery operated ULV sprayer.
2. Knapsack motorized type
3. Tractor/ vehicle mounted ULV sprayer
4. Aircraft ULV sprayer

OTHER SPRAYERS

1. Aerosol sprayers
2. Liquefied-gas type dispensers
3. Fogging machines
4. Exhaust Nozzle Sprayer

DUSTING EQUIPMENT:

Manually operated:

1. Plunger duster
2. Bellow duster
3. Rotary duster

Powered operated:

1. Knapsack motorized duster
2. High pressure trolley/ Barrow mounted
3. Tractor mounted/trailed duster

GRANULE APPLICATOR

Manually operated:

1. Broad-casting tins
2. Knapsack Rotary granule

Powered operated:
1. Knapsack motorized type
2. Tractor mounted/ trailed duster
3. Aircraft

Hollow cone nozzles:

This is a very popular type of hydraulic snozzle for spraying insecticides and fungicide. It produces a hollow cone pattern of spray consisting of mixture of different sizes droplets. In its simplest design this type of nozzle is made of brass metal having orifice hole drilled in it and a rotral with tangential cut grooves provides swill motion to spray liquid which breaks down into droplet when emerging from the nozzle under pressure. This simple brass nozzle is screwed onto a hand lance/ boom. There are different designs of hollow cone nozzle. Other designs of nozzles consist of a stainless-steel disc with a central circular hole through which the spray emerges from a swirl chamber behind it. The disc and the swirl plate (core) are suitably fitted in the body of the nozzle which has threads for screwing (fitting) it to the lance/ boom. The normal working pressure of hollow cone nozzle is about 40 psi. Plant Health Engineering Division, NIPHM Page 8 Hollow cone nozzles are good for treating complex targets because spray particles move in infinite angles and various planes providing better penetration of spray. These nozzles are generally not recommended for herbicide application due to possible drift of fine spray particles and difficulty in obtaining an even distribution of spray across the swath. The variation of liquid pressure can vary discharge rate, spray angle and also droplet size. The nozzles are made from brass, stainless steel and plastic materials. The nozzles tips wear due to chemical corrosion and abrasive action. The stainless-steel tips or plastic tips are better wear resistant and help consistent spraying.

Fan nozzle:

They are also called flat fan nozzles. The spray liquid is thrown from an orifice which is elliptical to give a flat shaped sheet of spray. These are used for band spraying. These nozzles are generally used on booms with propor distance in between and overlapping to give even distribution. The normal working pressure is about 40 psi. However, these fan nozzles can also be used for herbicide application but the application is done at low pressure like 15 -20 psi to avoid drift of fine droplets.

Impact nozzle:

These nozzles are also known as deflector nozzles or flood jet nozzles. In these nozzles, the spray liquid emerging from a circular hole strikes an inclined smooth face and is deflected at an angle. The liquid thus spreads as a sheet in a wide angled fan pattern. These nozzles are used for herbicide spraying and are low pressure (15 - 25 psi). The spray pattern essentially consists of coarse droplets.

Adjustable nozzle:

These are also called as tripple action nozzle. They are so called because of varying patterns of sprays that can be obtained by manipulating the swirl velocity of spray liquid in the

eddy chamber. The hollow cone spray pattern consisting of fine spray particles, or a jet spray for orchard/ tree spraying and a medium coarse spray petterns can be obtained by simple adjustments. These nozzles are generally used with foot operated sprayers, rocking sprayers or high-pressure hydraulic sprayers for spraying trees.

GASEOUS ENERGY NOZZLES

In this type of nozzle spray liquid is injected into a stream of high velocity air. The force of the air stretches the liquid to form ligaments which ultimately break into fine spray droplets. The airstream further transports the droplets to the target. The liquid flow into the airstream is metered. Motorized knapsack sprayer or mist blower is fitted with this type of air blast nozzle. The spray droplet size depends upon the nozzle design. The positioning of liquid flow and air velocity is very important. By increasing the liquid flow rate the droplet size also Plant Health Engineering Division, NIPHM Page 9 increases. In larger models of sprayer's hydraulic nozzle atomize the liquid first and then the droplets are further sheared by the air blast. Vertical nozzles also work on gaseous energy for
ULV spraying.

CENTRIFUGAL ENERGY NOZZLES

If liquid is fed on fast rotating disc, then it is carried by centrifugal force to the outermost edges of the disc and spray droplets are issued. Rotating cylindering cage of fine mesh also produce fine spray if liquid is fed into it. The revolving speed of the disc or cage is very important for size of droplets. The disc has serrated teeth on the periphery which make droplet spectrum narrow. The physical properties of the spray liquid are important for droplet size besides the speed of rotation. These types of nozzles are generally used for ULV spraying and for L.V spraying methods.

THERMAL ENERGY NOZZLES

Fogging machines work with thermal energy nozzles, also called hot tube nozzles. Spray liquid is injected into stream of hot gases (exhaust of engine) where it vaporizes due to high temperature but then it condenses when issued out of the nozzle due to outside temperature and forms fog of fine droplets. Exhaust nozzle sprayers (vehicle mounted) are used for ULV application in locust control operation. Pulse jet engine models are used for pesticide fogging for public health purposes.