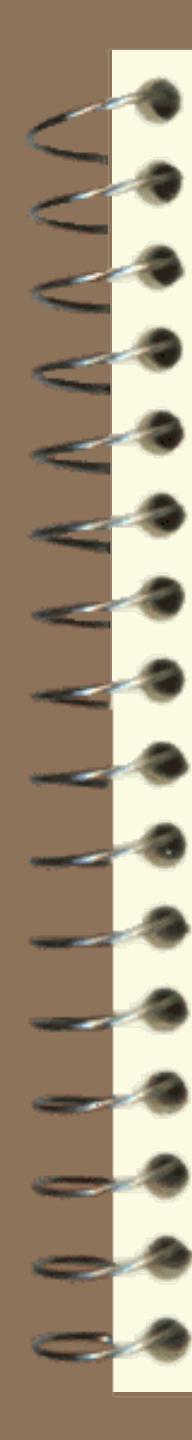


Unit D: Agricultural Equipment Systems

Lesson 5: Operating, Calibrating, and Maintaining Spraying Systems



Terms

-  Air sparging
-  Atomization
-  Control valves
-  Nozzles
-  Pressure gauge
-  Pump
-  Relief valve
-  Screens
-  Strainers

Objective #1

What are the types of sprayers?



Types of sprayers

Hand operated sprayers

- Operate in 35 to 275 kPa range
- Commonly used by home gardeners
- 4 to 20 liters in size and simple in design
- Pressure provided by hand operated air pump
- Air is compressed in tank forces liquid out

Knapsack or back-pack sprayers

- Small piston or diaphragm pump that is powered by hand or small gasoline engine

Types of Sprayers

Low-pressure sprayers

- Most widely used type of field applicators
- Operated in 140 to 350 kPa range
- Applies 20 to 230 liters per hectare
- Relatively inexpensive

Controlled droplet applicators

- Apply low volumes of pesticide mixtures
- 3.5 to 11 liters of spray mix per hectare

Types of sprayers

High pressure sprayers

- Similar to low pressure except capable of working with pressures of up to 6900 kPa
- Force spray through dense foliage or tops of trees
- Single nozzle on a hand gun to large units with multiple nozzles

Air carrier

- High speed air stream carries pesticide to the surface being treated
- Capacities range 1,500 to 18,000 cubic meters per minute

Types of sprayers

Air-boom sprayers

- Uses a blower to carry small spray droplets into the target
- Lowers volume of carrier used to better coverage and reduce drift

Foggers

- Apply pesticides in very fine droplets
- Commonly used in confined spaces for insecticides

Types of Sprayers

Rope wick applicators

- Apply liquid herbicides by wiping it onto the weeds
- Pesticide is in a pipe and a rope acts as the wick bringing out chemical to plant

Direct injection systems

- Holds undiluted pesticide and carrier in separate tanks
- Undiluted pesticide is metered into nozzle line by pumps for blending with carrier
- Eliminates need to mix chemical in spray tank



Hand Operated
Sprayer

Back-pack
Sprayer



Air-boom Sprayer



Low-pressure Sprayer



Direct Injection System



R040200

Rope wick Applicator



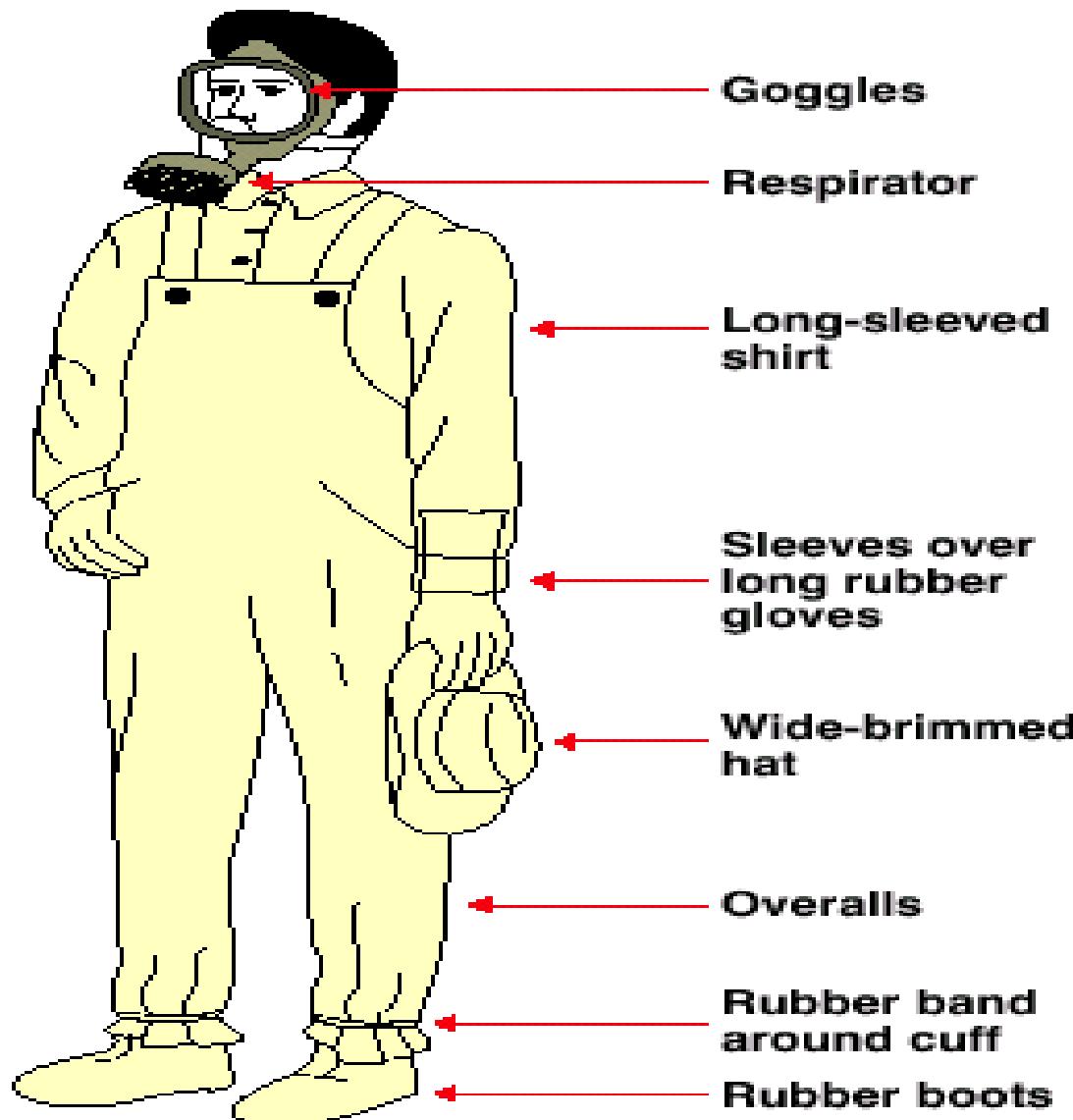
Insect Fogger



with air-assist

Air Carrier Sprayer

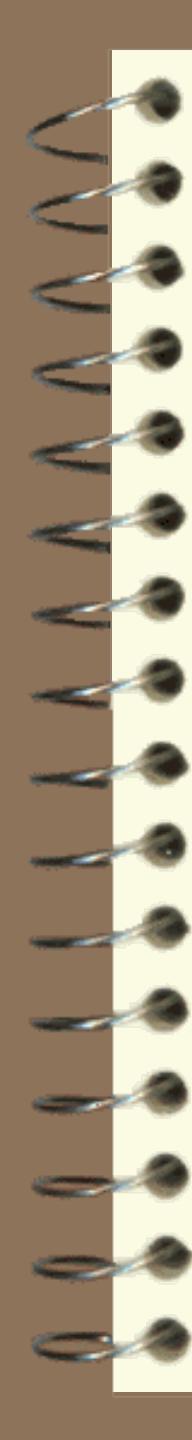
PESTICIDE SAFETY





Objective #2

How are sprayers selected and what are their components?

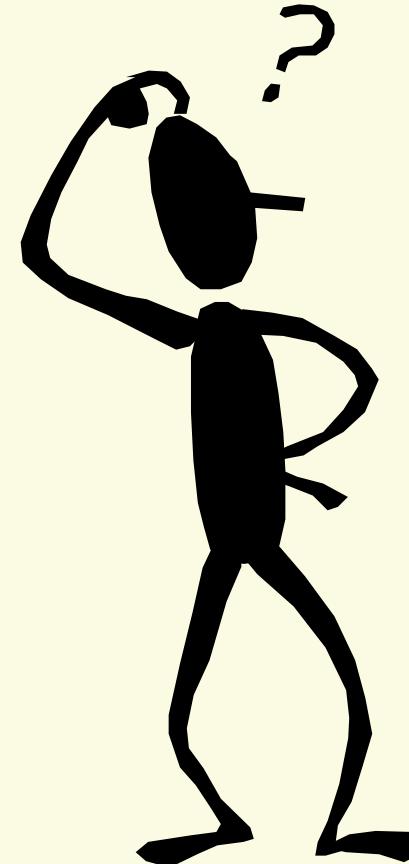


3 basic functions of sprayers

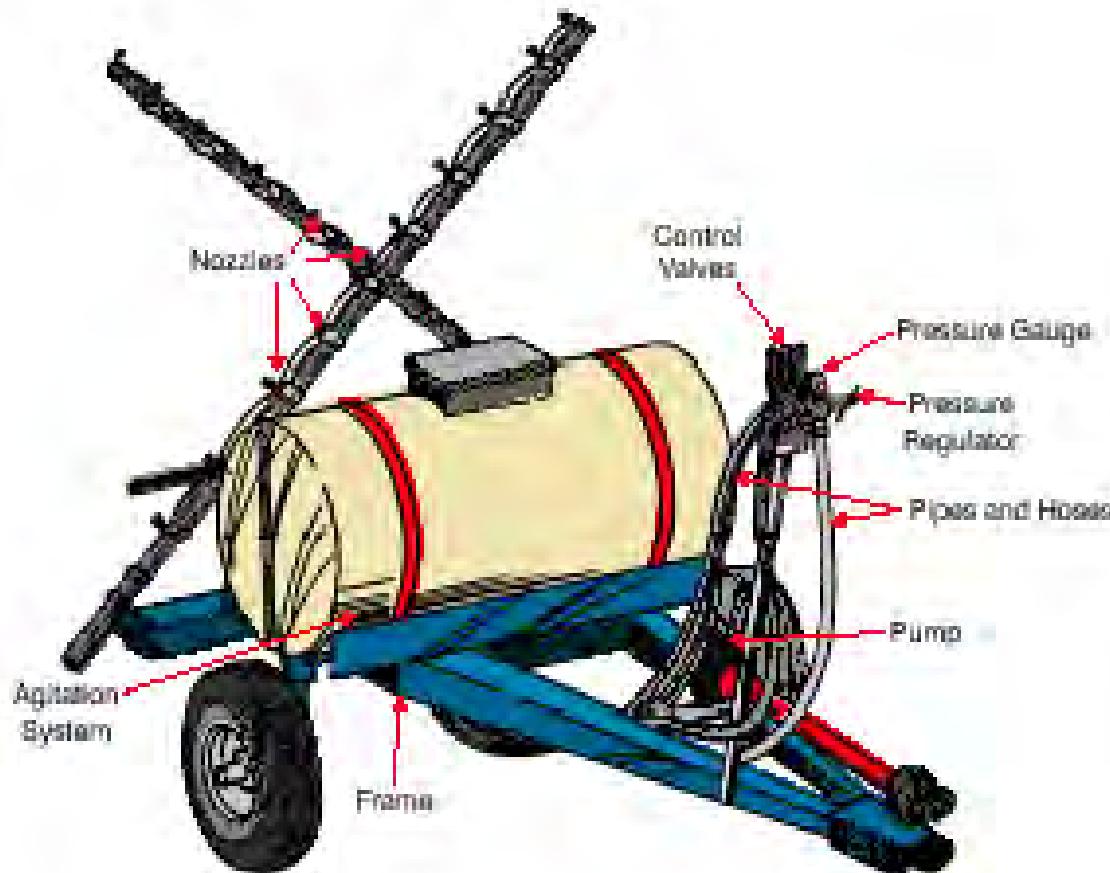
- Storage of chemicals prior to application in the field
- Meter the quantity of material being applied
- Distribution of material into desired pattern

Sprayer selection factors

- ☰ Chemical being applied
- ☰ Application rate
- ☰ Crop being treated
- ☰ Required accuracy



MAJOR COMPONENTS OF A SPRAYER



Sprayer components

Sprayer tanks

- Sufficient capacity
- Easy to fill and clean
- Be corrosive resistant
- Shape suitable for mounting and agitation

Agitator

- Maintain a uniform mixture

Agitation systems

Mechanical

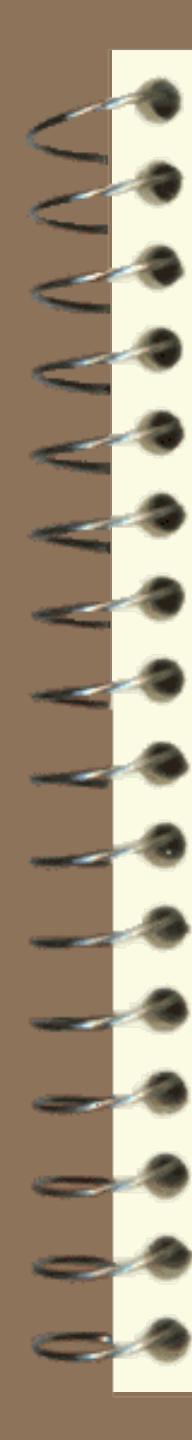
- Propellers mounted on a shaft near bottom of tank

Hydraulic

- Returns a portion of the pump output to tank

Air sparging

- Agitation by bubbling air through the liquid



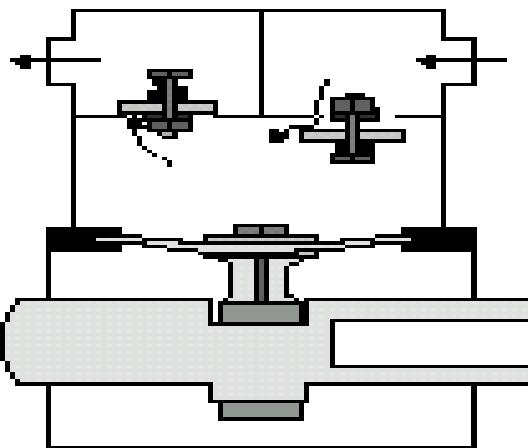
Sprayer components



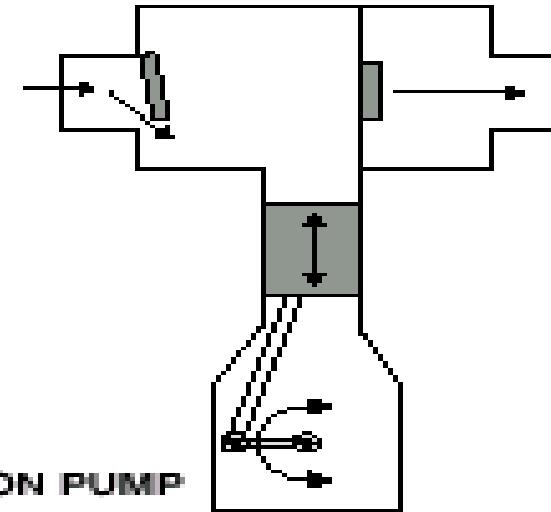
Pump

- Moves liquid from the tank to the nozzles and creates pressure to produce droplets

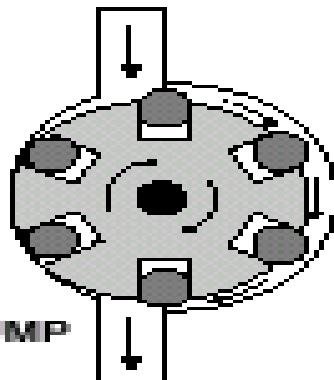
SOME PUMPS USED IN SPRAYERS



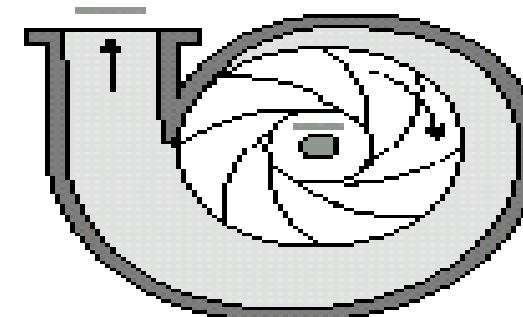
DIAPHRAGM PUMP



PISTON PUMP



ROLLER PUMP



CENTRIFUGAL PUMP

(Courtesy, Interstate Publishers, Inc.)

Types of pumps

Diaphragm pump

- Flexible diaphragm that produces the pumping action

Centrifugal pump

- Creates a high speed impeller that forces liquid out of pump
- Not self priming

Types of pumps

Piston pump

- Self-priming
- Pistons travel inside cylinders and force liquid through one way valves

Metering pump

- Driven by ground wheel
- Ground speed changes so does the pumping rate proportionately

Types of Pumps



Roller pump

- Cylindrical rollers that move in and out of slots in a spinning rotor
- As rotor spins creates space for liquid during half its rotation
- Liquid is discharged from pumping chamber during remainder rotation
- Self-priming
- Easy to repair
- Operate efficiently on PTOs

Sprayer components

Relief valve

- Safety device that releases liquid when pressure exceeds a safe level

Pressure gauge

- Used to measure the pressure in the system and valuable diagnosing tool

Strainers and screens

- Used to remove particles from the system

Screen & strainer locations

Tank screens

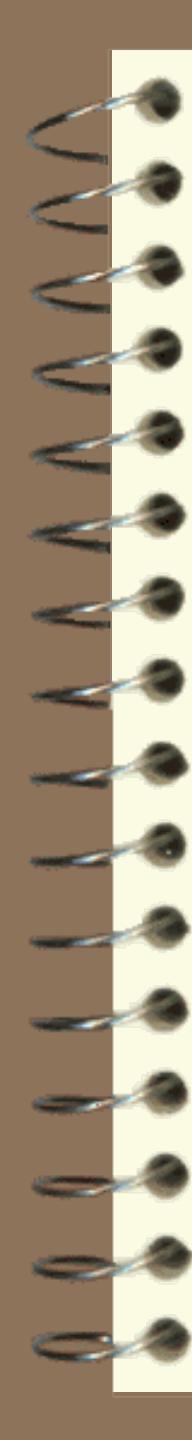
- Removes foreign materials when filling tank

Line strainers

- Removes foreign materials from reaching the pump

Nozzle strainers

- Removes foreign material from clogging nozzles



Sprayer components



Pipes and hoses

- Convey the liquid through the sprayer system



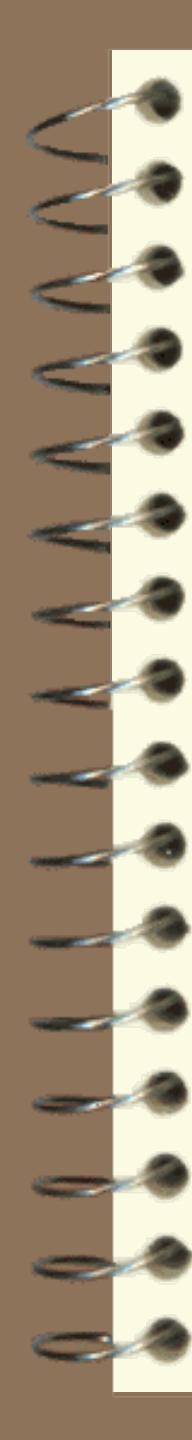
Sprayer frames

- Must be strong and durable
- Be able to attach the nozzles



Control valves

- Used to start and stop the flow of liquid to the nozzle



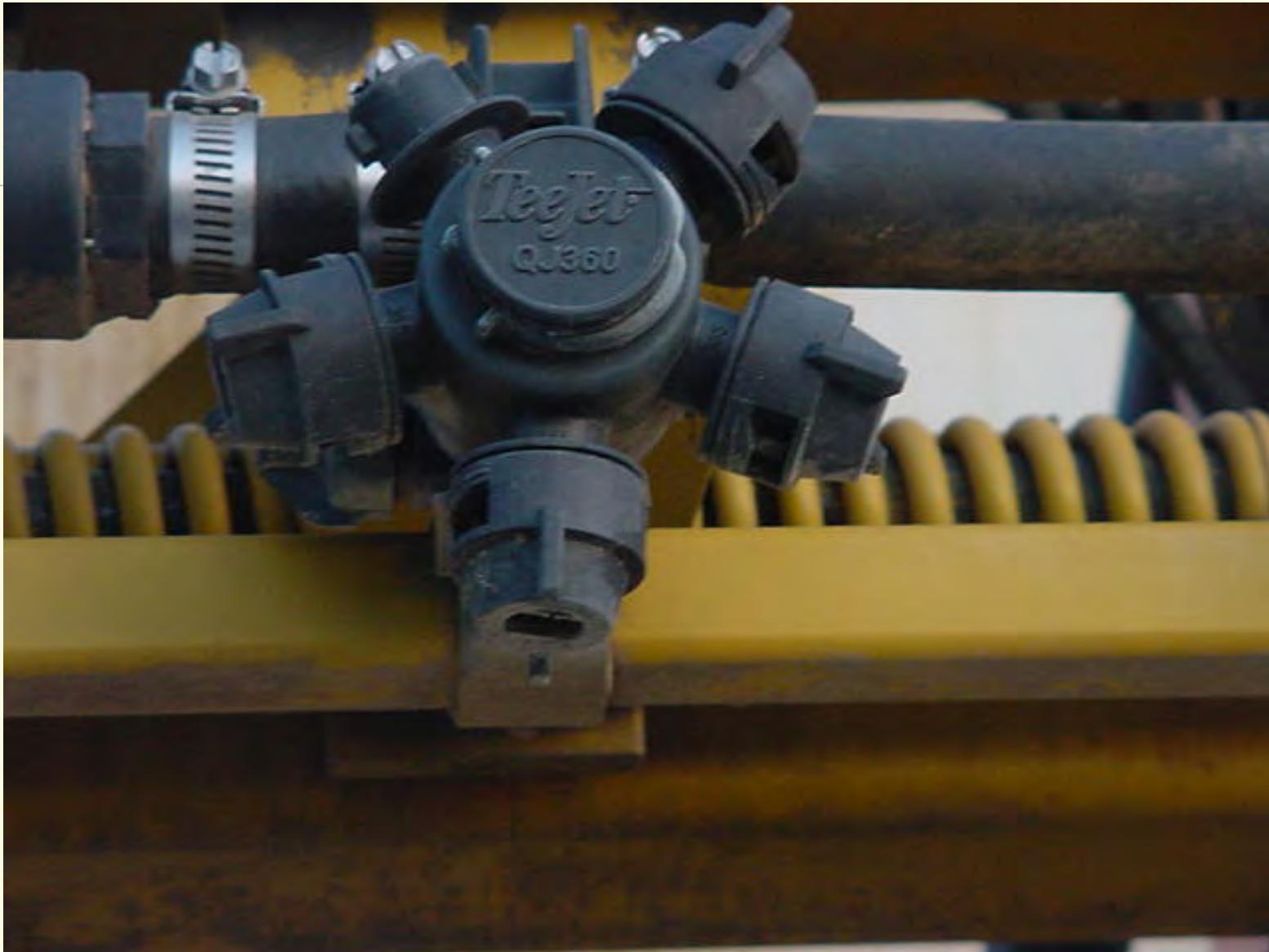
Sprayer components

Nozzles

- Meter the liquid, atomize the liquid stream into droplets, and disperse the droplets in a specified pattern

Atomization

- Liquid breakup caused by the tearing action of the air



Selection of nozzle type and size

Nozzle determines

- Amount of spray applied to the area
- Uniformity of the application
- The coverage of the sprayed surface
- Amount of drift

Flow rate depends on the effective size of the orifice and pressure

Described according to the shape of the application pattern

Nozzle types

Flat-fan nozzles

- apply uniform coverage across the entire width of the spray pattern, and should only be used for banding pesticides over the row.

Extended-range flat-fan nozzles

- frequently used for soil and foliar applications when better coverage is required.

Nozzle types

Wide angle flat fan nozzles

- allow for application over a wider area.

Even spray nozzles

- provide consistent, uniform coverage over the area.

Nozzle types



Hollow cone nozzles

- produce coverage around a plant without actually covering the plant



Full cone nozzles

- produce large droplets over a wide range of pressures



FIGURE 1:
Flat fan spray pattern



FIGURE 2:
Extended range flat fan
spray pattern



FIGURE 3:
Wide angle flat fan
spray pattern



FIGURE 4:
Even spray pattern



Overlap broadacre pattern



Band spray application

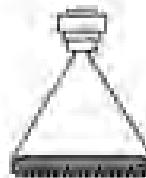


FIGURE 5:
Hollow cone spray pattern

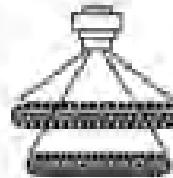


FIGURE 6:
Full cone spray pattern

Nozzle guide for band and directed spraying.



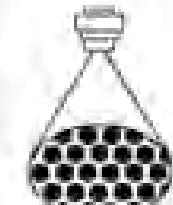
Even
Flat Fan



Twin Even
Flat Fan



Hollow
Cone



Full
Cone



Disc and
Core Cone

Herbicides

Pre-emerge

Very Good

Good

Good

Post-emerge Contact

Good

Very Good

Very Good

Post-emerge Systemic

Very Good

Good

Fungicides

Contact

Good

Good

Very Good

Systemic

Very Good

Good

Insecticides

Contact

Very Good

Very Good

Very Good

Systemic

Very Good

Good

Growth Regulators

Good

Very Good

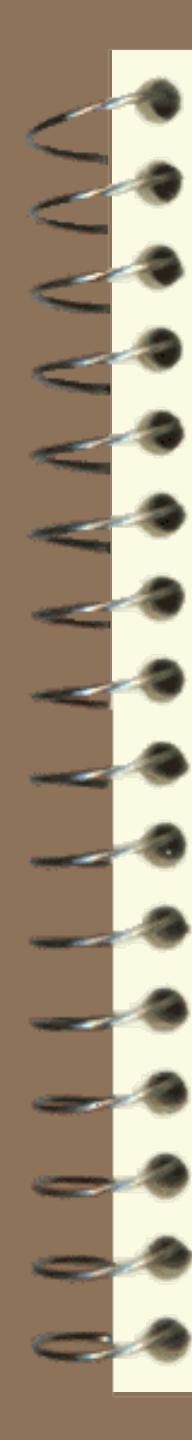
Objective #3

How are sprayers operated?



Guidelines to use when spraying

-  Decide to use a pesticide and which one
-  Adjust and set sprayer based on label
-  Calibrate sprayer
-  Load the sprayer
 - Quantity of pesticide & procedure to follow while mixing pesticide
-  Transport loaded sprayers as little as possible
-  Maintain constant ground speed & pressure
-  Monitor for plugged nozzles and leaks



Guidelines to use when spraying

- ☰ Clean the sprayer after each different pesticide
- ☰ Store the sprayer in a dry, clean building



A. Wash sprayer with brush and soapy water. Wear protective clothing, boots, gloves, hat, and goggles.



B. Hose off the machine.
C. Wash the tires with a brush.

D. Pump soapy water through the nozzles.



Objective #4

What are the procedures to follow
when calibrating sprayers?



Calibrating a sprayer

- Proper calibration helps insure area being sprayed receives right amount of chemical
- Variables
- Nozzle flow rate
- Ground speed
- Width sprayed/nozzle

Calibrating a sprayer

-  Determine amount of pesticide, add the pesticide to partially filled tank of carrier, then add the carrier to desired level with continuous agitation
-  Operate the sprayer at proper ground speed and pressure in tank
-  Check nozzle flow rate frequently

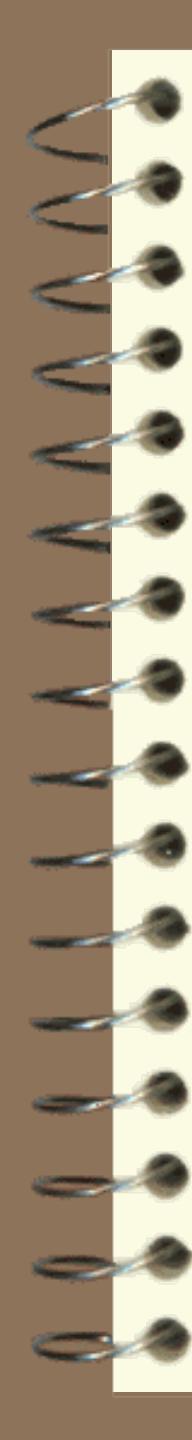
Objective #5

How are sprayers maintained?



Maintaining a sprayer

- Preventative maintenance will reduce chances of breakage, repair bills, & loss of time
- Adequate and timely adjustment, repair, lubrication, and protection from weather adds life to the sprayer
- Clean thoroughly inside and outside after each use and always wear protective clothing when cleaning



Review

- What are the types of sprayers?
- How are sprayers selected and what are their components?
- How are sprayers operated?
- What are the procedures to follow when calibrating sprayers?
- How are sprayers maintained?