(F) Application Equipment and Techniques – Part I

Application Equipment

There are many different types of equipment available for applying pesticides. It is important that one chooses the appropriate equipment for the task to be performed. Discussed below are some of the kinds of equipment used to apply pesticides. Specifically, equipment used to apply dry pesticide formulations, liquid pesticide formulations, kinds of pumps and sprayer nozzles are discussed.

Dry Pesticide Applications

Dusters

Dusters are used to apply fine pesticide particles (dusts) onto a surface. There are different types of dusters available in the market place. Four commonly used types are:

(1) Bulb Duster – used to force pesticide into cracks and crevices.
(2) Mechanical Dusters – used for landscape and garden pests.
(3) Compressed Air Dusters – used to apply pesticides into confined spaces (e.g. wall voids).
(4) Power Dusters – used in buildings and for landscape pests.

Advantages:
Dusters are lightweight, relatively cheap, simple to operate and do not require water.

Disadvantages:
Dusts are very visible, drift easily and are difficult to control.

Granular Spreaders

Granular spreaders are used to apply course dry particles to soil, water and sometimes foliage. Three types of granular spreaders are summarized below. These are:

(1) hand operated - rotary
(2) mechanically driven – drop, rotary or fan type
(3) powered – air blast

Advantages:
Granular spreaders are lightweight, easy to use and calibrate.

Disadvantages:
Granular formulations have limited uses. Other kinds of pesticide formulations and application machinery are generally required for the control of foliage diseases and leaf-feeding insects.

Liquid Pesticide Applications

Hand Operated Sprayers

Hand sprayers are commonly used for small jobs and in indoor situations. The capacity of hand sprayers ranges from ½ gallon to 5 gallons. Homeowners typically use hand sprayers when making pesticide applications.

Advantages:
Hand sprayers are simple to use, lightweight and very affordable.

Disadvantages:
Hand sprayers are generally practical for small jobs only**.**

Low-Pressure Boom Sprayers

Sprayers that operate at between 30 and 60 PSI and apply from 10 and 40 gallons solution per acre are considered to be low pressure sprayers. Low pressure boom sprayers are commonly mounted on a trailer, small truck or utility vehicle. They are used to apply liquid pesticide formulations to large areas of turf or crops.

Advantages:
Low-pressure boom sprayers apply relatively low volumes of pesticide solution to the area being treated, and thus, the spray tank does not have to be refilled as frequently as a high-pressure sprayer of equal holding capacity.

Disadvantages:
Low-pressure boom sprayers do not always penetrate and sufficiently cover dense plant foliage. Most use hydraulic agitators which are not very effective at suspending wettable powders. Mechanical or jet flow agitators solve this problem.

High Pressure Sprayers

High pressure sprayers are commonly referred to as hydraulic sprayers. They are similar to low pressure sprayers except that they have been built to handle high pressures.

High pressure sprayers generally operate at 100 psi or higher.

Advantages:
High pressure sprayers can penetrate dense foliage and reach the top of trees. They are strongly built and thus, long lasting. The pumps used with high pressure sprayers resist wear from gritty or abrasive materials and the pumps are effective at suspending wettable powders within the spray solution.

Disadvantages:
High pressure sprayers use high amounts of water. They can weigh and cost a lot. The force at which they apply a pesticide may contribute to pesticide drift and off-site contamination.

Air-blast Sprayer

With this type of sprayer, the pesticide solution is pumped through a nozzle of series of nozzles and then projected by a blast of air. The force of the air shatters the spray solution into tiny droplets which are then projected at the intended target. This type of sprayer is commonly used when applying pesticide to trees and for penetrating the foliage of some row crops.

Low and Ultra-low Volume Sprayers

These sprayers use a fan or whirling disk to break-up the pesticide solution into very tiny droplets. Low volume pesticide sprayers use a diluted pesticide mixture while ultra-low volume (ULV) sprayers used undiluted pesticide concentrate. These units are used indoors and outdoors and are generally from 1 quart to several gallons in size. However, some larger units are mounted on trucks.

Advantages:
Low and Ultra-low volume sprayers save time and money by eliminating the frequent refilling of the pesticide container/tank. They also reduce operator fatigue since the operator is able to carry a smaller volume of pesticide to accomplish the same task.

Disadvantages:
There is a greater chance of over applying the pesticide because the spray solution is more concentrated. The pesticide solution is more toxic to the user because it is being applied in a more concentrated form.

Types of Pumps

Centrifugal Pump

The centrifugal pump is the most common type of pump used with low pressure sprayers. With this type of pump, fluid is moved by the rotational action of an impeller.

Advantages:
Centrifugal pumps are good at handling abrasive material and have a long life.. They have a high pumping capacity (120 gpm or greater), allowing them to provide plenty of solution agitation.

Disadvantages:
When attached to a tractor PTO, centrifugal pumps require a speedup mechanism. They are not self priming and are not the best choice for generating high pressures (up to 200 psi).

Roller Pumps

Roller pumps move fluid by the movement of rollers that fit into slots on a moving hub. The rotating hub moves the rollers which push fluid from the inlet port towards the outlet port.

Advantages:
This kind of pump has a low cost, is easy to prime and operates at PTO speeds. This type of pump is cheap and easy to rebuild.

Disadvantages:
This type of pump has a short life when used with abrasive materials.

Piston Pump

Piston pumps are a type of positive displacement pump; whenever the piston is moving, the fluid is moving (i.e. being displaced). With positive displacement pumps, output flow is proportional to rotational speed and independent of pressure.

Advantages:
This type of pump is capable of generating high pressures (up to 1000 psi). Piston pumps are resistant to wear and work well with wettable powders and other abrasive materials.

Disadvantages:
Piston pumps require a surge tank and are is the most expensive kind of pump.

Diaphragm Pump

Diaphragm pumps are another kind of positive displacement pump. The up and down movement of a flexible diaphragm generates the movement (displacement) of fluid.

Advantages:
Diaphragm pumps are wear resistant and capable of generating moderately high pressures (up to 850 psi).

Disadvantages:
This kind of pump is only able to pump low volumes (up to 60 gpm) and requires a surge tank.

Sprayer Nozzles

The sprayer nozzle is a fundamental element critical to proper operation of a piece of spray equipment. It is the most important part of any sprayer. The nozzle material, type, size, condition, height, orientation and spacing affect the rate and uniformity of a pesticide application.

Nozzle Materials

Spray nozzles are made of a variety of materials. The five most common materials used are brass, plastic/nylon, stainless, hardened stainless steel and ceramic. Each of these is discussed below.

Brass – inexpensive, not very resistant to wear and is the material most commonly used.

Plastic and Nylon – inexpensive, do not last very long, are used with nonabrasive materials, subject to swelling when exposed to some solvents and not recommended for use at higher pressures.

Stainless Steel – moderately expensive, noncorrosive and is very wear resistant.

Hardened stainless steel – expensive, very resistant to wear and used with very abrasive materials.

Ceramic – expensive, most durable and is excellent for corrosive and abrasive spray solutions.

Nozzle Types

There are a good variety of nozzle types available in the market today. The hollow cone, solid cone, flat-spray, even-spray, flooding and multi-pattern types are discussed in greater detail below.

Hollow Cone Nozzle
This type of nozzle produces a circular pattern and generally emits smaller droplets than a solid cone nozzle.

Flat-spray nozzles
Also known as a flat fan nozzle, this type of nozzle produces a fan-shaped spray pattern with tapered edges. Even spray coverage is achieved by overlapping the tapered edges. This type of nozzle is frequently used to apply structural pesticides to floors and walls.

Even-spray nozzles
This nozzle type produces a narrow rectangular pattern and is used for band applications of chemicals. It is commonly used with planting equipment.

Flooding nozzles
Flooding nozzles are used to apply fertilizer, herbicide and defoliants. They apply large droplets in a wide flat spray pattern. This type of nozzle can be used alone or mounted on a boom in a variety of positions.

Multi-pattern spray nozzles
Multi-pattern spray nozzles are used on professional hand-held sprayers. The individual can select from a variety patterns. The choices usually include two flat fan patterns, a pin stream and a crack and crevice accessory tool.

References

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