

SELECTION AND CALIBRATING LOW-VOLUME SPRAYERS

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Low-volume sprayers are an alternative to hydraulic sprayers for greenhouse and nursery pesticide application. Although more expensive, they provide better coverage with less chemical material. Some low-volume sprayers also reduce application time and, therefore, labor cost. Proper selection and operation is important for the type of application and crop.

Introduction

The most important goal in the application of agricultural pesticides is to get uniform distribution of the chemicals throughout the crop foliage. Underdosing may not give the desired coverage and control needed. Overdosing is expensive, as it wastes pesticide and increases the potential for contamination of the groundwater.

In the hydraulic sprayer, the spray material is carried to the target (plant foliage) by the energy supplied by the pump. Water is the carrier and the pump creates the pressure (40 to 1,000 psi). Spray material is usually applied to runoff. Nozzles on a boom or hand held gun direct the spray and break it into small droplets.

In a low-volume sprayer, spray material is injected into a high speed air stream from a blower or compressor. A small pump is used to inject a concentrated pesticide into the air stream. The air stream speed may be up to 200 mph. To get good coverage, the air within the foliage canopy must be replaced with air that contains the pesticide. Because droplet size is much smaller, less chemical is needed.

One way to distinguish between a hydraulic sprayer and low-volume sprayer is by droplet size. Hydraulic sprayers produce droplets with a 200 to 400 micron diameter (thickness of the human hair = 0.004 in. = 100 microns). Low-volume sprayers develop a mist (50 to 100 microns) or fog (0.05 to 50 microns). Small droplets from a mist or fog applicator increase the likelihood of insects contacting the spray material.

One disadvantage to smaller droplets is the greater possibility of drift, especially in outdoor applications. In a 3 mph wind, a 200 micron droplet will be carried about 18 feet, a 50 micron droplet, 178 feet and a 1 micron droplet, 84 miles! For this reason, fog applicators are normally used in greenhouses where the pesticide is contained by the building.

One gallon of spray material will yield 318 million droplets, 300 microns in diameter or 68 billion droplets that are 50 microns in size. Coverage can be more uniform with the smaller droplets.

Water usage with low volume sprayers is reduced from 10% to 60%. This means a smaller tank size can be used and more area can be covered before reloading.

The following is a review of the different types of low-volume applicators.

Mist Blower

A small engine and fan creates an air stream with a velocity of 100 to 200 mph. Concentrated spray injected into the air stream by a special nozzle is carried to the foliage by the air.

This spraying technique is more complicated than with a hydraulic sprayer. The nozzle should be directed into the plant canopy to get food penetration and coverage, but it should be kept at least six feet away from the plants to avoid blast damage. The operator should visualize that the air within the canopy must be replaced by the air from the mist blower.

Electrostatic Sprayers

Compressed air forms spray droplets and carries them to the plants. In addition, the spray materials as it travels through the nozzle is given a static electric charge. This helps to create particles of more uniform size that disperse well because they repel each other.

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Charged particles are attracted to leaves, metal and some plastics. Uniform coverage occurs because a charged particle, when it strikes a surface, creates a momentary overcharge that repels other particles. These land elsewhere on the leaf, so there is more uniform coverage.

Several styles of electrostatic sprayers are available. The simplest are backpack mounted and contain a tank and spray gun. They require an independent air supply to charge the tank. Other units are cart mounted with an integral compressor powered by a gas engine or electric motor. Electrostatic sprayers work best if the spray distance is less than 15 feet.

Field crop sprayers with boom mounted nozzles are available. These reduce chemical usage by 30% to 60%. Water usage is also reduced. After spraying, plants are dry with no visible residue on the plant leaves, and there is no runoff.

Thermal Foggers

Designed for greenhouse use, these foggers require a specially formulated carrier that is mixed with the pesticide to improve uniformity of droplet size and distribution of the spray material. The carrier also decreases molecular weight, allowing the particles to float in the air for up to six hours, a disadvantage if you have to get into the greenhouse to care for the plants.

In the operation of a thermal fogger, the pesticide is injected into an extremely hot, fast moving air stream that vaporizes it into fog particles. Moving from one end to the other in the greenhouse, an acre can be covered in as little as 15 minutes. Using air circulation, such as the horizontal air flow (HAF) system, will give greater uniformity of coverage and better foliage penetration.

Temperature and humidity in the greenhouse also affect the spray droplets. Under high temperatures and low humidity, the spray droplets will tend to fall out of the air quicker and increase the deposits on the upper leaf surface.

Because of the noise associated with the jet engine, hearing protection is recommended with this type of applicator.

Mechanical Foggers

Also called cold foggers, these devices use high-pressure pumps and atomizing nozzles to produce fog-sized particles. Distribution of the spray material is through a hand-held gun or external fan unit.

With the fan unit, the distance and amount of area that can be covered depends on the capacity of the fan. Multiple units or multiple settings may be needed to cover large areas.

As with other foggers, penetration and coverage may not be as good as with mist or hydraulic sprayers. Small particles don't have the mass or velocity to move into heavy foliage. Still, in most studies, good insect control has been achieved.

Safety is important when using a mechanical fogger employing a high pressure pump. Keep hands and arms away from the outlet because at 2,000 to 3,000 psi, the spray particle can penetrate the skin very easily.

Calibration

Low-volume sprayers provide better coverage with less spray material by developing smaller size droplets that are carried to the leaf surface by air movement. The greater uniformity of coverage allows less pesticide to be applied. This may require an adjustment in the rate that is recommended on the label.

When making a tank mix, both the dosage and water requirement need to be considered. The dosage, the amount of chemical that should be applied to a given area, is listed on the label. With most pesticides, a range is given; for example, 4 to 12 oz/100 gal. Selection of the rate should be made based on the level of infestation,



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type and maturity of the crop, past experience and other variables. If this is the first time that the pesticide is being used, a dosage in the middle of the range is a good starting point.

The amount of water that is needed to cover the growing area depends on the type of equipment used. With hydraulic sprayers, a rate of 25 to 50 gal/10,000 sq. ft. is common. Low-volume sprayers use only 1/4 to 2 gal/10,000 sq. ft.

Most chemical labels state the amount of pesticide to be diluted into 100 gallons of water and not the amount of spray concentrate that is to be applied to a given area. Some labels now list the amount of chemical that should be applied per acre. The instruction manual that comes with each sprayer contains charts or tables that help to guide in determining how much spray material to mix with the water. This is usually based on a 10,000 sq. ft. area, so must be adjusted to fit the growing area to be sprayed. Also with low-volume sprayers, the rate can frequently be reduced at least 5% because of not spraying to runoff as with a hydraulic sprayer.

Spraying Technique

The technique by which crops are sprayed is very important. It should be developed to fit the type of equipment that is being used. The compressed air from fans propels the mist or fog into the foliage. With hand-held guns, a sweeping motion over the foliage will allow

the spray material to penetrate and get to the underside of the leaves.

With fixed fan type units, an air flow pattern needs to be established so that all of the plant canopy receives the pesticide. Location of the unit is important to get good air flow. With both systems, the use of an air circulation system, such as HAF will enhance the movement and distribution of the fog and mist particles. The fan should continue to operate from 30 to 60 minutes after the spraying operation is done.

Observations should be made to see that the sprayer is operating correctly and that good coverage is being obtained. A good way to monitor coverage with a mist sprayer is to use strips of water-sensitive paper (available from Spraying Systems Co., North Avenue at Schmale Rd., Wheaton, IL 60189-7900 or from a local spraying equipment supplier). The paper is attached to representative leaves in the plant canopy. When exposed to spray droplets, stains will appear indicating the size and number of particles that were received by the leaf. For fog applications, evaluation of coverage can be made using a fluorescent dye in water. Placing representative leaves under an ultraviolet light or black light will show droplet size and distribution.

Another tool that can help to promote better techniques and coverage is to keep a log of the spraying operations and the results that were obtained. This should include the date, time and location of application, crop and pest,

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pesticide used, tank mix and an evaluation of the results obtained. Adjustments should be made in subsequent applications to try to improve the application.

Maintenance

As with any type of spray equipment, maintenance is important to get consistent results. This is particularly true with low-volume sprayers, as the nozzle openings are smaller than with hydraulic units. Cleaning with soap and water will remove most of the pesticide residue. Filters and nozzles should be disassembled and scrubbed with a brush.

Thermal foggers require maintenance of the pulse-jet engine after each use. The batteries in the gun of the electrostatic sprayer need to be replaced after 10 to 15 hours of operation. Engine powered units require oil changes and lubrication on a regular basis. With regular maintenance, many years of service can be expected from the equipment that is available today.

Because low-volume sprayers are more complex to set up and operate, a checklist that guides you through the steps should be developed. It should be developed following the steps in the manual, but without all the explanation. Page references are helpful in locating information that is complex. Dilution amounts for the chemicals that are frequently applied could be included. Keep this list with the spray log.

Environmental and safety concerns affect the way spraying is done. A well-calibrated and maintained low-volume sprayer can achieve good results with less spray material.

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