

Understanding pesticide application equipment

By Laurie Ann Hurner

Editor's note: This article grants one continuing education unit (CEU) in the Private Applicator category when submitted and approved toward the renewal of a Florida Department of Agriculture and Consumer Services restricted-use pesticide license.

One area of pesticide application that is very important is equipment. If you are not using the appropriate equipment and using it correctly, you are not operating efficiently or effectively. This article will go into detail on the following topics associated with application equipment:

- Main advantages and disadvantages associated with various types of pesticide application equipment
- Four types of sprayer pumps, their main features and suitable uses
- The purpose of strainers in a spraying system
- Principal parts of a spray nozzle
- Basic nozzle patterns, including examples
- Procedural steps to prepare a sprayer for storage

PROS AND CONS OF PESTICIDE APPLICATION EQUIPMENT

The equipment that you choose to use for your pesticide application will help or hinder your application process. There are advantages and disadvantages to each type of sprayer. For citrus operations, there are three broad classes of sprayers:

boom sprayers, airblast sprayers and handheld spray guns.

Boom sprayers are designed to apply sprays to a relatively large area. These sprayers are generally mounted on trailers or fitted to tractors or trucks. They deliver a low to moderate volume of spray and work at pressures ranging from 1 to 80 pounds per square inch (psi). Although these sprayers are able to work at 80 psi, it is not recommended due to the large

drift potential at this high pressure. Roller pumps or centrifugal pumps are most often used with boom sprayers, and they are generally fitted either with a hydraulic or mechanical agitator.

Advantages of boom sprayers are their versatility and the ability to use large tank sizes, which allows a large area to be treated with each fill of the tank.

A disadvantage of boom sprayers is low pressure, which may limit spray penetration and reach into the citrus canopy. These sprayers are usually used to treat areas close to the boom.

Airblast sprayers use a combination of air and liquid to deliver the pesticide. Nozzles deliver coarse droplets under pressure into an airstream that delivers these droplets to the target location.

Advantages of airblast sprayers are good coverage and penetration, high capacity, and options to spray at high or low volumes.

Disadvantages of airblast sprayers are drift hazards, unsuitable for windy conditions or for use in small areas, and high cost.

Handheld spray guns have the capacity to deliver large volumes of liquid sprays at very high pressures for overhead delivery to large trees. They can also deliver spray at relatively low pressure and at low volumes



Pest control operators need to use the correct cleaning process before storing sprayers after use.

when making applications to small or low areas.

Advantages include delivering spray to hard-to-reach places, such as trees, as well as application at high pressure and high capacity or low pressure and low volume.

A disadvantage is that spray guns are not suited for treating large areas.

TYPES OF SPRAYER PUMPS

The type and size of pump required for a specific application is determined by the pesticide formulation to be used, the spray pressure needed and the nozzle delivery rate desired. A significant decision that must be made when choosing a pump is capacity. It must have enough capacity to both operate the agitation system and supply the needed output volume to the nozzles. Some systems will have mechanical agitation within the tank, so extra pump pressure is not needed for agitation.

Pump capacity needed for a specific application is very easily determined. If the pump's capacity is at least 20 percent greater than the largest volume required by the nozzles, the pump capacity is generally considered adequate. Please remember: Never operate a pump at speeds or pressures above those recommended by the manufacturer.

Roller pumps are the most widely used of all sprayer pumps in most areas of the country. In Florida citrus, however, it is the centrifugal pump that is most often used. Roller pumps provide moderate volumes at low to moderate pressure. They are self-priming, and the pump housing or frame is usually cast iron or nickel-iron alloy.

The rollers need to be examined often for wear, as some pesticide products may damage the pump over time with continued use. For this reason, roller pumps are not an ideal choice for sprays of wettable powders. Roller pumps work well with emulsifiable concentrates, soluble powders and other pesticide formulations that are not abrasive.

Centrifugal pumps are adaptable

to a wide variety of spray applications. They can deliver high volume, up to 200 gallons per minute, at low pressures. These pumps are not self-priming and *must be* either mounted below the tank outlet or provided with a built-in priming system. Centrifugal pumps are well suited for spraying abrasive materials like wettable powder.

Diaphragm pumps can deliver low volumes at low to moderate pressures. Some models may provide high-volume, high-pressure output. These pumps are self-priming and withstand abrasion from chemicals much better than gear, roller or piston pumps. Users need to be careful with solvents when using diaphragm pumps because the diaphragm is made of rubber and can be degraded following exposure to chemicals.

Piston pumps deliver low to medium volumes at low to high pressures. These pumps are used often in high-pressure sprayers, but are also suitable for low-pressure systems. Piston pumps have replaceable piston

cups and are abrasion-resistant. They can handle wettable powders for repetitive use.

SPRAYER STRAINERS

Strainers (filters) are something that most sprayer operators are very familiar with but seldom think about until there becomes a problem. There are three types of strainers that are commonly used on agricultural sprayers: tank-filler strainers, line strainers and nozzle strainers. Strainers play a very important role in the operation of spray equipment because they keep foreign material from plugging up the sprayer nozzles and, in turn, minimize pump wear.

The number on the strainer represents the openings per inch of screen surface area. A higher number of threads per inch will only permit finer particles to pass through the strainer. One safety reminder for cleaning strainers: Do not clean out or try to unclog a strainer by blowing through it. Because screens are exposed

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to pesticide material, they can cause great harm to operators who blow chemical debris back into their eyes, face or mouth.

PRINCIPAL PARTS OF A NOZZLE

Most nozzles have four major parts: body, strainer (screen), tip and cap. The nozzle body holds the strainer and tip in proper position. Different tips provide different spray patterns and can be interchanged on a spray nozzle body. Basically, there are three types of nozzles that spray different patterns:

- Jet-pattern nozzle tips make solid spray patterns. They are used in small handheld sprayers and may be used in some high-pressure handguns.
- Fan-pattern nozzle tips produce a fine spray pattern that provides uniform coverage of a regular surface and are used on soils, band applications in rows and on coats of animals. These tips come in several different patterns and



Proper nozzle placement and performance are important in pesticide application.

are usually used with adequate overlap or adjacent nozzles along the spray boom.

- Cone-pattern nozzle tips produce cone-shaped patterns that provide good penetration of plant foliage and are most often used for the application of fungicides and insecticides.

crop. Likewise, similar concerns of crop phytotoxicity can occur when preparing a sprayer for storage that has held an organo-auxin herbicide such as 2,4-D, dicamba or triclopyr.

If there are no storage-specific instructions in the equipment service manual or the pesticide product label, then spray operators should do the following:

1. Add one-half tank of fresh water and flush tanks, lines, booms and nozzles for at least five minutes using a combination of agitation and spraying. Rinsate sprayed through the booms is best sprayed on a labeled site to avoid accumulation of pesticide-contaminated rinsate. Pressure sprayers are useful for removing caked-on internal and external residues.
2. Fill the tank with fresh water, add a cleaning solution or a commercially available tank cleaner and agitate the solution for 15 minutes. Add one of the following cleaning solutions to each 50 gallons of water to make a cleaning solution:
 - a. 2 quarts of household ammonia (let stand in sprayer overnight for organo-auxin herbicides)
 - b. 4 pounds of trisodium phosphate cleaner detergent

PROPER SPRAYER STORAGE

Now that we have discussed the essential parts and uses of these parts for application equipment, we need to look at a topic that many pesticide applicators ignore: sprayer storage. Applicators are pretty good at caring for and cleaning equipment during a spray season. They make sure that equipment is running properly and is safe (no leaks, no inoperable components, no concerns of spillage, etc.). In fact, in the state of Florida, it is against the law for a pesticide applicator to operate faulty or unsafe equipment.

Applicators do not always use the correct process when they are storing application equipment between crops. Without proper cleaning, nonselective herbicide products such as glyphosate are capable of causing crop injury due to sprayer contamination when subsequently used for applying other agricultural chemical products such as fungicides or insecticides into the foliar canopy of the



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3. Operate the spray booms long enough to ensure that all nozzles and boom lines are filled with the cleaning solution. Let the solution stand in the system for several hours, preferably overnight. Agitate and spray the solution onto an area suitable for the rinsate solution, such as a site approved for application according to the product's label.
4. Add more water and rinse the system again by using a combination of agitation and spraying. Remove nozzles, screens and strainers, and clean them separately in a bucket of cleaning agent and water.
5. Rinse and flush the system once again with clean water.

When cleaning any spray equipment, be sure to always wear the proper personal protective equipment to ensure your safety.

Remember, operating equipment effectively and efficiently does not only refer to driving safely and finishing on time. The equipment operator should be knowledgeable about the parts of the equipment, what each part is used for and which type of equipment is used for each type of application. The operator should also be able to operate and store equipment properly.

Source: Information for this article has been taken from Private Applicator Agricultural Pest Control – 3rd Edition (SM53), by Fred Fishel, University of Florida, Department of Agronomy.

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'Understanding pesticide application equipment' test

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1. Centrifugal pumps are the most widely used of all sprayer pumps in Florida. T F
2. Storing a pesticide sprayer is no big deal; you just park it. T F
3. Handheld spray guns have the capacity to deliver large volumes of liquid sprays at very high pressures and low volumes at low pressures. T F
4. Strainers are never a problem in a pump's system. T F
5. The best way to clear a clog in a strainer is to blow through it with your breath. T F
6. Cone nozzle tips produce a cone-shaped pattern that provides good penetration of plant foliage. T F
7. Glyphosate is a nonselective herbicide that may cause injury due to sprayer contamination from previous tank mixes. T F
8. One disadvantage of an airblast sprayer is that drift is highly likely on a windy day. T F
9. Tank size allows a large area to be treated per fill and versatility with a boom sprayer. T F
10. Diaphragm pumps are great because they are self-priming. T F
11. Diaphragm pumps receive a lot more damage from abrasion than gear or roller pumps. T F
12. Centrifugal pumps deliver high volume at low pressure, which makes them great for spraying wettable powders. T F
13. It is against Florida law for a pesticide applicator to operate faulty or unsafe equipment. T F
14. Roller pumps are an ideal choice for sprays of wettable powder. T F
15. Fan-pattern nozzle tips produce a fine spray pattern that provides uniform coverage. T F
16. Most nozzles have two general parts, the body and the nozzle tip. T F
17. You do not have to worry about rinsing and cleaning your spray tank before storing it when you have applied 2,4-D. T F
18. Two quarts of ammonia or 4 pounds of trisodium phosphate cleaner detergent are two formulations that can be used to clean a spray tank before storing it. T F
19. The best pump type for long use of wettable powder products is a piston pump. T F
20. Handheld spray guns are a great type of equipment for applying pesticides in tiny cracks and crevices. T F

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