

Pesticide application equipment

By Stephen H. Futch

This CEU article grants one General Standards (CORE) CEU when submitted and approved toward the renewal of a Florida Department of Agriculture and Consumer Services Restricted Use pesticide license.

The equipment chosen for the application of pesticides must be properly selected to allow the chemical to reach the target at the proper rate and with sufficient coverage. The chemical or pesticide label will specify the application rate, spray volume, crop and application methods or restrictions as to where the product can be used. The application equipment may be as simple as an aerosol can, pump-up sprayer, electrical driven pump, power driven sprayer or various types of aircraft. This equipment may be carried by hand (aerosol, pump-up sprayer), on an all-terrain vehicle or tractor, be towed, or even be a self-propelled spray unit. The application volume may be as low as a few gallons to hundreds of gallons per treated acre.

SPRAYERS

In commercial situations, the most commonly used equipment is a sprayer that uses a combination of air

and liquid to deliver the pesticide to the target. Nearly 90 percent of these spray applications involve mixing the pesticide into a liquid carrier (usually water) to aid in delivering the pesticide to the target. Sprayers that utilize a liquid are classified as hydraulic sprayers. In a few cases, the pesticide may be applied as an ultra-low-volume spray where the pesticide is applied as formulated and not mixed with water. Sprayer capacity can range in size from a few gallons (pump-up sprayers) to up to 1,000-gallon sprayers pulled behind tractors. Large sprayers have multiple nozzles on one or more booms and use a pump to create pressure to deliver the spray mixture into a stream of air flow or toward the intended target. Smaller handheld or backpack sprayers usually have a single nozzle and use compressed air to deliver the spray mixture. In all cases, some form of pressure must be created to aid in delivery of the spray mixture through the nozzle.

Small handheld or backpack sprayers are designed for spot treatments and would be unsuitable to treat a large area or large trees. These small sprayers are usually inexpensive, easy to operate and maintain, but their usability is limited to small areas. Most

of these units have a tip on the nozzle that can be adjusted to modify the spray pattern and droplet size.

Many larger sprayers utilize a fan to create air flow in which the spray solution is released into, and thus called air-blast sprayers. For these air-blast sprayers, the pesticide is usually diluted with water to form a spray solution. Various size nozzles are used to create spray droplets of a desired size which are released into the air stream that is being created by the fan and carried toward the target site.

Applicators need to be aware that the droplet size being created by the sprayer nozzle greatly impacts the potential for off-target movement of a pesticide during the application process. Smaller droplet sizes are more likely to drift than larger droplets. To minimize drift, select a nozzle that will produce larger droplet sizes where possible. By selecting larger nozzle orifices and reducing pump pressures, the sprayer produces larger droplets and thereby reduces the likelihood of spray drift. To aid in selecting the proper nozzle size, see the owner manual for the sprayer you will be using. Equipment manufacturers should provide charts on droplet ranges in their catalogs or web sites. Applicators need to remember they are legally responsible for any damages that may result from off-target movement of pesticides.

DRIFT MITIGATION MEASURES

Drift can be controlled by maximizing droplet size and controlling the time the droplets are in the air. To mitigate drift, consider the following options:

- Make applications in accordance with label directions.
- Follow Florida pesticide label laws, especially when using organo-

auxin herbicides like 2,4-D. If these products are used, be aware of setback distances from nearby susceptible crops, wind speeds and direction, and location of sensitive crops in your area.

- Spray only when conditions are optimal for spray application. Do not spray when wind speeds are greater than 10 miles per hour. Also, be aware if relative humidity is below 50 percent and the temperature is high, which increases the likelihood of off-target movement.
- If spraying with a boom, keep the boom as close to the target as possible and use wide-angle nozzles.
- Select a reasonable application speed. The site where the sprays are being applied will ultimately determine ground speed. Rough ground conditions will require slower speeds. Higher application speeds will also create air movement and may result in off-target movement of the pesticide and poor spray coverage.
- Select the proper nozzle type and orifice (opening in nozzle) size for each application method.
- Calibrate the sprayer and replace any worn or damaged nozzles. Worn nozzles will impact spray patterns, droplet size and impact coverage. Worn nozzles should never be saved for later use and should be properly disposed of as they no longer provide the designed spray pattern or application rate.
- Use higher spray volumes when possible. Selecting larger nozzle orifices that produce higher spray volumes will increase droplet size, which is less drift-prone.
- Consider using a drift-reduction agent that impacts droplet size. Remember that drift-control agents will not totally eliminate drift.

SPRAYER COMPONENTS

Sprayer components include a tank, pump, agitation system, hoses, pressure gauges, strainers and nozzles. The tank contains the liquid in which the pesticide is diluted to create a spray solution. Larger tanks reduce the need to refill as often but require a larger tractor to properly pull the sprayer

through the field. The tank should be made of a material that resists corrosion and can easily be cleaned after application. Tanks require an opening in which filling, cleaning and inspection can be conducted. The tank opening must be watertight to prevent spillage while in transport.

A person should never enter a large tank without proper personal protection equipment (PPE) and only after the tank has been determined to be safe to enter. All safety regulations regarding entering confined spaces must be complied with including, but not limited to, appropriate training, PPE, safety devices and someone to remain outside the tank in the event an emergency were to occur while the person is in the tank. Entering these confined spaces can be hazardous to your health.

The pump supplies the needed pressure, volume to the nozzles and hydraulic agitation system. Pumps should be designed to resist corrosion and abrasion and be operated at a speed or pressure recommended by the manufacturer. Many different types of pumps are available, including — but not limited to — roller, gear, centrifugal, diaphragm or piston pumps. Each pump has advantages and disadvantages.

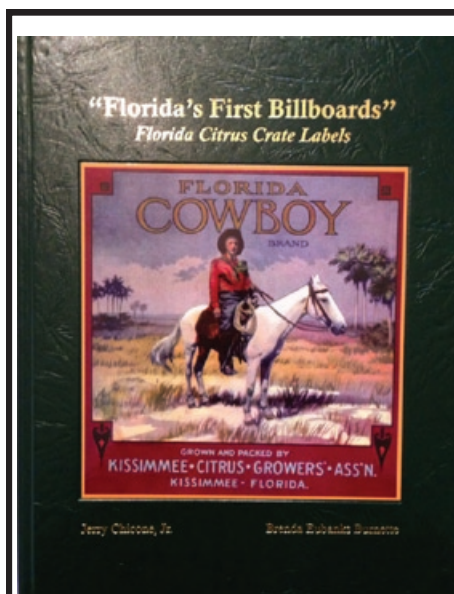
An agitation system (mechanical

or hydraulic) is useful in keeping the spray mixture thoroughly mixed during application and is essential when applying dry flowables, wettable powders and emulsifiable concentrate pesticides. The constant agitation of the spray mixture will ensure uniform spray mixture, which will result in an even application of the chemical mixture.

Strainers at various locations within the sprayer will help keep foreign matter from plugging the sprayer nozzles and minimize pump wear. Strainers are usually placed in the tank-fill opening, in the lines and before each nozzle. Common strainer types are slit or wire mesh. Wire mesh strainers will be manufactured and sold based upon the number of openings per linear inch of wire mesh. For example, lower mesh numbers (20-mesh) will filter out only large particles whereas a strainer with a high mesh number (50-mesh) will filter out smaller particles.

Hoses within the spray system should be made of a material that will resist wear and not be damaged by the spray solution. The hoses need to:

- be rated to have burst strength greater than the peak pump operating pressure
- have a working pressure at least equal to the sprayer's maximum operating pressure



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- resist oil and solvent that are in the pesticides

- resist sunlight

The hoses should be inspected on a regular basis to ensure they are in safe working condition. Hoses should be replaced when showing signs of wear or deterioration.

Pressure gauges should be placed in the line before the nozzles and in a location easily seen by the operator. The gauges should be easy to read and have a maximum range greater than the pump's peak pressure. If the pressure gauge sticks or will not zero, then it should be replaced promptly.

Nozzles control the amount of material applied, the formation of the droplets, their size, and the distribution and patterns of the droplet. The nozzle's spray pattern needs to be considered when selecting the proper nozzle for the intended application method. The nozzle orifice size affects the droplet size and flow rate. Larger orifices will produce larger droplet sizes.

Nozzles can be made of brass, aluminum, plastic, stainless steel or ceramic. Brass, aluminum and plastic will usually be the least expensive but will wear faster than those made of stainless steel or ceramic. Select the nozzle material based upon the type of pesticide products you will be applying. Remember, products like wettable powders and dry flowables are abrasive and will wear nozzle tips out faster than liquids or solution types of materials.

When applying a pesticide, the applicator is legally responsible for the proper application of the pesticide. Proper training and supervision is a key safety ingredient in any pesticide application. Be sure to read and follow label directions and follow the safety requirement as discussed in the equipment owner's manual.

Source of information: Applying Pesticides Correctly by Fred Fishel, SM 1, UF/IFAS; Pesticide Applicator Certification and Licensing in Florida, Florida Department of Agriculture & Consumer Service, 2010.

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'Pesticide application equipment' test

To receive one Core continuing education unit (CEU), read "Pesticide application equipment" in this issue of *Citrus Industry* magazine. Answer the 20 questions on the magazine's website (www.citrusindustry.net) or mail the answers and pesticide license holder application information to the address at the bottom of the form. The article and test set will be valid for up to one year from the publication date. After one year, this test will no longer grant a CEU. Please allow at least 10 business days after submission to receive your CEU approval form by mail or e-mail.

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| 1. Sprayers that utilize a liquid are classified as hydraulic sprayers. | T | F |
| 2. Ultra-low-volume sprays apply the pesticide as formulated and may not require mixing with water. | T | F |
| 3. Handheld or backpack sprayers are designed to treat large areas. | T | F |
| 4. Air-blast sprayers release the pesticide into a stream of air flow and will rely on the air to carry the pesticide to the target. | T | F |
| 5. Nozzles are used to create spray droplets of a desired size. | T | F |
| 6. Applicators are legally responsible for any damages that may result from off-target movement of the pesticides they apply. | T | F |
| 7. Florida has specific pesticide label laws that govern the use of organo-auxin herbicides. | T | F |
| 8. Low humidity and high temperatures will not impact the drift potential of a spray application. | T | F |
| 9. Keeping the spray boom elevated and using a narrow angle nozzle are good methods to reduce drift. | T | F |
| 10. Calibrating the sprayer and replacing worn nozzles can improve pesticide application. | T | F |
| 11. Drift-reduction agents will not impact droplet size. | T | F |
| 12. The material from which the spray tank is manufactured is an important consideration. | T | F |
| 13. You should not enter a spray tank unless you have been trained in entering confined spaces and have the proper PPE. | T | F |
| 14. Spray pumps should be designed to resist corrosion. | T | F |
| 15. Agitation systems aid in keeping the spray mixture thoroughly mixed during the spray application. | T | F |
| 16. Lower mesh size of strainers filter out small particles; whereas, large numbers on the strainer indicate it filters out large particles. | T | F |
| 17. You do not need to be concerned with the type of material that sprayer hoses are made of. | T | F |
| 18. Spray nozzles do not control the amount of spray material applied. | T | F |
| 19. Brass nozzles wear slower than stainless steel nozzles. | T | F |
| 20. Pressure gauges should be replaced if they stick or will not zero. | T | F |

Please circle the number below to rate this article and test:

Not very useful									Very useful
1	2	3	4	5	6	7	8	9	10

Pesticide Applicator CEU Form

First Name: _____ Last Name: _____

E-mail: _____

Pesticide License Number: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone Number: _____

Please mail the answer sheet or a copy of the form to: Steve Futch, Citrus Research & Education Center, 700 Experiment Station Road, Lake Alfred, FL 33850

If you have questions regarding this form, test or CEUs, e-mail Steve Futch at shf@ufl.edu or call (863) 956-8644. Please allow two weeks to process your CEU request.