Pesticide application procedures

By Stephen H. Futch and Tim Gaver

This is a CEU article that grants one General Standards (CORE) CEU when submitted and approved.

APPLICATION METHODS

Proper application procedures will require knowledge of the equipment used, target pest, crop being treated and the type of material being applied. The application equipment may be as simple as an inexpensive pump-up compression sprayer or a sophisticated computer-operated sprayer capable of spraying a large area in a single pass. Pesticides being applied could be in numerous formulations consisting of baits, dips, dusts, gases, granules, liquids, rubs or sprays. To properly apply any pesticide, the applicator must understand the application equipment and target site, and then combine these concepts to optimize pest control while minimizing potential environmental harm. To apply pesticides safely, the operator must make sure that the pesticide has been properly selected for the application site. The equipment must be calibrated and maintained to ensure proper application. In addition, the applicator should always read the pesticide label to ensure that effective, efficient and safe application practices are followed.

Selection of the application method will be influenced by the target pest, site characteristics, pesticide properties, application equipment, and pesticide and application cost. Common application methods to tree crop sites include band, broadcast, chemigation, cut stump, foliar, rope-wick or wiper, soil application or spot treatment.

Band application consists of parallel strips or bands being applied to the crop or to the soil to minimize weed growth. Where a band application is being utilized, other banded areas within the field will remain untreated, i.e, the entire area is not treated. In citrus groves, herbicides are commonly applied using a band application method to the soil surface utilizing a shielded boom to minimize herbicide contact to the tree.

Broadcast application is the uniform application being applied to the entire area. An example of a broadcast application is the application of dry fertilizers to the soil surface within a mature orange grove.

Chemigation is the term used when chemicals or other materials are directly injected into an irrigation system. The irrigation system, composed of a grid of delivery lines, then conveys the chemical to the target site within the irrigation water. When this method is used, the operator must ensure that required back-flow prevention devices are operational to ensure that none of the injected materials enter the water source in the event the system shuts off or malfunctions during the application process.

Cut stump application is utilized where a herbicide is applied to a freshly cut tree stump. The application is made to kill the remaining stump, thereby preventing regrowth from the stump. When applying cut stump treatments, the applicator should apply only enough material to cover the cut surface and minimize any herbicide material running onto the soil surface adjacent to the cut stump.

Foliar applications are directed to cover the leafy canopy of the citrus tree. These foliar applications may be applied in such a manner as to completely cover the leaf surface and/or fruit to provide protection from pests and/or diseases or to supply foliar nutrients to be absorbed by the leaf tissue. The application volume per acre will be governed by the material chosen, canopy size, the target pest and its location.

Rope-wick or wiper application methods are designed to apply herbicides only to the taller-growing weeds while minimizing application to the lower-growing species. This application method can successfully convert the row middles vegetation to lower-growing species that may be easier to mow or to species that are less invasive into the herbicide-treated band beneath the citrus tree.

Soil application places the pesticide directly onto the soil rather than applying the material to the tree. This application method is frequently used to control soil-borne pests like phytophthora.

Spot treatment is the application of the pesticide to a small or distinct area within the grove. These applications are intended to keep an isolated pest from becoming widespread. Examples of spot treatment could include treatments to a few trees where scale insects have become established or to minimize the spread of a new weed into the grove from an adjacent property.

SAFETY SYSTEMS

Chemical handling and transfer

Several systems have been developed to minimize contact by the applicator with the chemical. These closed mixing and handling systems

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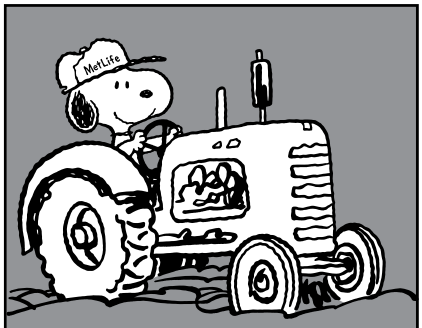
prevent pesticides from contacting the handlers or other persons involved in the mixing and/or loading process. For chemicals that may be highly toxic, these closed systems may be required by the pesticide label.

Closed systems can include the use of mechanical devices to transfer the pesticide from the original container directly into the spray tank or placing the pesticide into a water-soluble package that dissolves when placed in the spray tank. Both methods would minimize the mixer/loader coming in contact with the pesticide when it is in its most concentrated form.

Other mechanical devices are available which allow the mixer/loader to introduce the chemical into the tank from the ground, thereby minimizing possible slips, trips or falls while climbing up onto the spray tank to load chemicals. Any actions that can improve safety and minimize chemical spillage are a good investment and increase worker productivity.

Some of the newer mini-bulk containers that can hold 40 gallons to 600 gallons can be fitted with a mechanical loading system. These mechanical systems will enable the transfer and measurement of pesticide directly from the container into the spray tank without exposure to the chemical. If the mechanical loading system is fitted with a measuring system, these systems should be frequently calibrated to ensure accuracy. Once the mini-bulk tank is emptied, it can be returned to the pesticide dealer for refilling. The refilling process eliminates the need to triple-rinse the containers as well as numerous disposals of rinsates.



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Enclosed equipment cabs

An enclosed cab on a tractor, airplane cockpit or truck will surround the operator and serve to minimize exposure to chemicals as long as all doors, hatches or windows are kept closed at all times during the application process. Use of an enclosed cab does not negate the requirement for personal protective equipment (PPE) as stated on the pesticide label. Not all cabs are approved by the Occupational Safety and Health Administration as many lack proper air filtration.

When moving between outside and inside the cab, extra care is required to minimize any action that may bring pesticide contaminated PPE into the cab, thereby causing surface contamination. Once contamination is introduced into the cab, many of the advantages of using the cab system can be compromised.

Containment systems

When mixing and/or loading pesticides, the use of containment systems can minimize site contamination from spills or tank overflows. Containment systems are designed with a containment pad that would allow any spilled material to be captured and then reused in future sprays. A containment structure can be a moveable pad made of heavy plastic where the equipment is driven onto the pad, or could consist of a permanent site that has a sealed concrete floor. Any pad or permanent structure must be constructed in a manner to contain spills and keep them from running off onto adjacent locations.

APPLICATION EQUIPMENT

All application equipment must be designed and equipped to deliver a pesticide to the intended target site at an adjustable volume. Pesticide labels may state a minimum or maximum gallonage of water that is required per acre of grove. If a gallonage range is stated on the label, applicators are required to be within those stated volumes within applications.

The most common type of sprayer will use water or some other liquid carrier to distribute the pesticide to the target crop. The exception to these liquid sprayers would be the ultra-low volume sprayers where the pesticide is applied directly as formulated product and not mixed with water.

Liquid or hydraulic sprayers utilize pressure from a pump to distribute the spray mixture to a nozzle where the liquid is atomized and then carried in the air to the target. When spraying large trees, an air-blast sprayer is typically used where the fast flowing stream of air will then carry the pesticide mix to the target. These hydraulic sprayers can be as large as a 1,000-gallon tank or as simple as a handheld compressed-air sprayer.

SPRAYER ELEMENTS

A basic sprayer design consists of a tank, pump, nozzle and a valve-type device to regulate flow.

The tank should be large enough to eliminate frequent refills but not so large as to limit the ability to move the sprayer within the grove or field. The tank should be constructed of a material that does not corrode and can be easily cleaned. Any corrosion or other debris in the tank can clog the nozzles and increase the wear on the pump. An opening in the bottom of the tank should allow for easy removal of any fluid in the tank and aid in inspection and cleaning. The opening in the top of the tank should be large enough for filling and inspection. The tank opening must be able to be sealed to minimize spillage. The tank must also have some form of agitation to ensure that all spray materials will remain in suspension or solution during the application. These agitation systems can be either mechanical or hydraulic or a combination of both.

The sprayer pump will supply the needed pressure and volume to the nozzles and, in the case of hydraulic agitation, provide sufficient flow to aid in keeping the spray solution adequately mixed. The pump should be made of materials that resist both corrosion and abrasion and are capable of generating the desired pressure range and flow.

The nozzles control the amount of spray material applied, droplet size, distribution pattern and flow rate. In most cases, applicators will generally prefer larger droplet sizes to minimize drift and off-site movement of the spray.

Nozzles are available in a wide range of materials from brass to

ceramic. While brass is the least expensive, it will wear easily and should never be used with abrasive materials such as wettable powders and dry flowable materials. Ceramic or stainless steel nozzles will resist abrasion better than other nozzle types. Nozzle wear will impact not only the flow rate, but the distribution pattern of the nozzles.

EQUIPMENT CALIBRATION

All application equipment should be calibrated frequently. Calibration is the process of measuring and adjusting the equipment to ensure it is applying or metering the proper amount of chemical per unit area. Charts or tables supplied by the manufacturer will assist the operator in making necessary adjustments to ensure proper calibration.

When adjusting or calibrating the equipment, the application rate will be affected by the travel speed, nozzle type, orifice size and pressure.

When measuring travel speed of equipment, it is best to use a test run of at least 300 feet. To determine speed, make at least three test runs over the application site and then average the speed for the three test runs to obtain an average speed. The site should be on the same type of field surface as where the application will take place. Once the desirable average speed is calibrated, be sure to record the engine speed (RPM) and gear selection for future reference.

For pressure, select a pressure that will minimize small droplet size as smaller droplets tend to drift more than larger sizes. The flow rate from each nozzle should be compared to determine if all nozzles are applying the same volume per unit of time. Any nozzles that apply 10 percent more or less than the average should be replaced.

Choosing the proper application method and frequently calibrating the equipment will avoid misapplication and will aid in effective pest control. Applicators should be reminded to wear the proper PPE as listed on the label when mixing, loading, applying or cleaning up after chemical application.

Safe and effective pesticide application is a goal of all pest control operations.

Source: Applying Pesticides Correctly, SM1, UF IFAS, Gainesville, FL

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"Pesticide application procedures" test

To receive one CORE continuing education unit (CEU), read "***Pesticide application procedures"*** in this issue of *Citrus Industry* magazine. Answer the 20 questions on the magazine's website (www.citrusindustry.net) or mail the answers and application information to the address at the bottom of this 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.

1.	*Proper application procedures require knowledge of only the target pest and crop being treated.*	T	F
2.	*Application method will be impacted by the target pest, site characteristics, pesticide properties, application equipment and cost of the application and pesticide material selected.*	T	F
3.	*In a citrus grove, herbicide application is commonly applied as a uniform application to the entire grove area.*	T	F
4.	*Chemigation is the term used when chemicals are directly injected into an irrigation system.*	T	F
5.	*When using the cut stump treatment method, spray material should be applied to the entire stump, including enough material to thoroughly wet the entire stump and have some extra material run off onto the soil adjacent to the stump.*	T	F
6.	*To improve foliar applications, the entire leaf surface should be covered to provide protection from pests and/or diseases.*	T	F
7.	*Rope-wick applicators are used to eliminate lower-growing vegetation species while not impacting the taller-growing vegetation species.*	T	F
8.	*A closed mixing and handling system prevents pesticides from contacting the handlers or other persons involved in the mixing and/or loading process.*	T	F
9.	*Water-soluble packages are an example of a closed mixing and handling system.*	T	F
10.	*The use of mechanical transfer systems will not reduce the risk of slips, trips or falls while handling pesticides.*	T	F
11.	*Due to the accuracy of mechanical loading systems, the frequent calibration of the device is not necessary.*	T	F
12.	*The use of an enclosed cab will negate the requirement for wearing PPE during the pesticide application process.*	T	F
13.	*The use of containment systems reduces the risk of site contamination due to spills or tank overflows.*	T	F
14.	*All pesticide labels state the minimum or maximum gallonage per acre that is required during pesticide application.*	T	F
15.	*The most common type of sprayer will only use water as a liquid carrier to distribute the pesticide to the target crop.*	T	F
16.	*Sprayers consist of pumps, nozzles and a device to regulate flow.*	T	F
17.	*All large spray tanks should have only one opening in the tank placed in the bottom to aid in removal of tank liquid and for tank inspection.*	T	F
18.	*The nozzle impacts the amount of spray material applied, droplet size and distribution pattern.*	T	F
19.	*Calibration is the process of measuring and adjusting the equipment to ensure it is applying or delivering the proper volume per unit area.*	T	F
20.	*Safe and effective pesticide application is a goal of all pest control operations.*	T	F

Pesticide Applicator CEU Form

First Name: _____ **Last Name:** _____

Email: _____

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, email Steve Futch at shf@ufl.edu or call (863) 956-8644.