

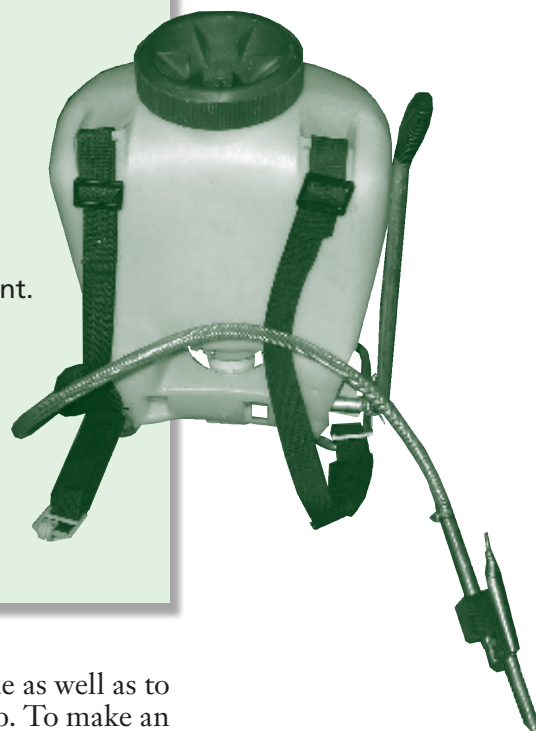
## CHAPTER 11

# PESTICIDE APPLICATION PROCEDURES

### LEARNING OBJECTIVES

After studying this chapter, you should be able to:

- Name several different application procedures and types of equipment.
- Discuss appropriate safety systems (e.g., closed mixing and loading, enclosed cab, and pesticide containment).
- Identify the factors (e.g., nozzles, volumes, pressures, and speeds) that affect calibration.
- Explain the importance of calibrating application equipment.
- Show how to calculate the size of the application area.
- Indicate how to determine the pesticide application rate.
- Demonstrate how to determine the amount of pesticide concentrate and diluent to use.
- Explain how to choose appropriate drift reduction practices.



Today's pest management practices require modern equipment to apply a variety of pesticides. Pesticides may be applied as sprays, dusts, granules, gases (vapors), fogs, baits, rubs, or dips. The vast array of application equipment must

be matched to the pesticide as well as to the size and type of the job. To make an effective, safe, and efficient application, ***read the label first***. In addition, you must properly select, operate, calibrate, and maintain your equipment.

### APPLICATION METHODS

The pesticide application method you choose depends on the nature and habits of the target pest, characteristics of the target site, properties of the pesticide, suitability of the application

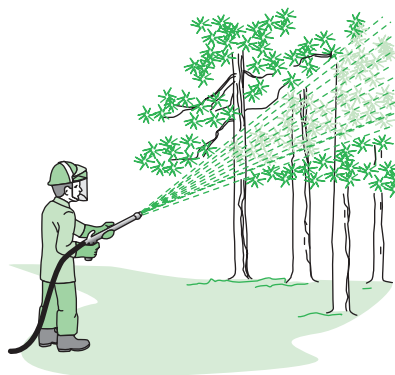
equipment, and cost and efficiency of alternative methods. Your choice is often predetermined by one or more of these factors. The following are some common application methods:



Broadcast application



Crack and crevice application



Foliar application

- **Crack-and-crevice application**—placing small amounts of pesticide into cracks and crevices in buildings, such as along baseboards and in cabinets.
- **Directed-spray application**—specifically targeting pests to minimize pesticide contact with nontarget plants and animals.
- **Foliar application**—directing pesticide to the leafy portions of a plant.
- **Rope-wick or wiper treatments**—releasing pesticides onto a device that is wiped onto weeds taller than the crop, or wiped selectively onto individual weeds in an ornamental planting bed.
- **Soil application**—placing pesticide directly on or in the soil instead of on a growing plant.
- **Soil incorporation**—using tillage, rainfall, or irrigation equipment to move pesticide into the soil.
- **Soil injection**—applying a pesticide under pressure beneath the soil surface.
- **Space treatment**—applying a pesticide in an enclosed area.
- **Spot treatment**—applying a pesticide to small, distinct areas.
- **Tree injection**—applying pesticides under the bark of trees.

- **Band application**—applying a pesticide in parallel strips or bands, such as between or over rows of crops.
- **Basal application**—directing herbicides to the lower portions of brush or small trees.
- **Broadcast application**—uniformly applying a pesticide to an entire area or field.

### Closed systems...

- Increase handler safety.
- Reduce the need for some personal protective equipment.
- Decrease the occurrence of spills.
- Provide a more accurate measurement of pesticide concentrate, which reduces overdosing or underdosing.

## SAFETY SYSTEMS

Closed mixing and loading systems, enclosed application systems (e.g., enclosed cabs), and pesticide containment systems are excellent investments if you use large quantities of pesticides or the kind that is very hazardous to humans or to the environment.

### Closed Mixing and Loading Systems

Closed mixing and loading systems are designed to prevent

pesticides from contacting handlers or other persons during mixing and loading. Sometimes the label of pesticides with a high risk of causing human health effects may require the use of a closed mixing and loading system.

There are two primary types of closed mixing and loading systems. One type uses mechanical devices to deliver the pesticide from the container to the equipment. The other type uses water-soluble packaging.



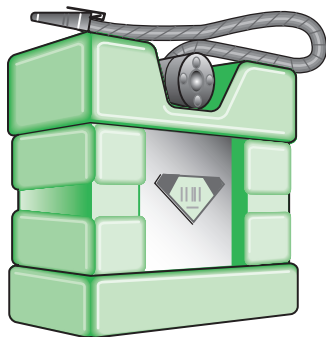
A closed loading system.

## Mechanical Systems

Mechanical systems often consist of a series of interconnected equipment parts that allow for the safe removal of a pesticide concentrate from its original container, either by gravity or by suction. These systems minimize exposure when rinsing the empty container and transferring the pesticide and rinseate to the application equipment.

Mechanical systems are often custom-made with components from several commercial sources. These systems are available for containers as small as 2.5 gallons. Because pesticide container openings vary in shape and size, no single closed system can be used with all containers.

A mechanical loading system is often used with **minibulk containers**. These containers range in volume from 40 to 330 gallons and are adapted to closed systems. Typically, pump-and-drive units deliver the product. A meter allows accurate measuring from the minibulk tank to the sprayer. Minibulks usually must be returned to the dealer for refilling. This process eliminates the need to triple rinse or pressure rinse multiple small containers and reduces the volume of used plastic containers.



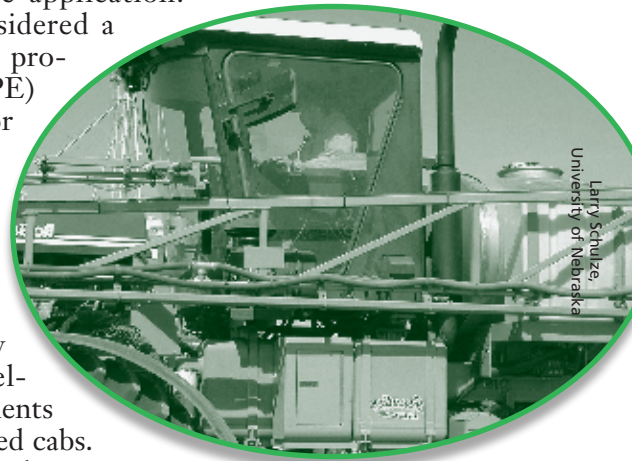
Mini-bulk tank.

## Water-Soluble Packaging

**Water-soluble bags** are a simple type of closed mixing and loading system. The premeasured pesticide is contained inside a water-soluble bag or packet. The pesticide bag is placed unopened into the water or fertilizer in the mixing tank. Few manufacturers, however, provide water-soluble bags for small-volume applications. There must be ample time during mixing to allow for the bags to dissolve.

## Enclosed Cabs

An **enclosed cab** (such as a tractor cab, cockpit, or truck/vehicle cab) surrounds the occupant(s) and may prevent pesticide exposure as long as the doors, hatches, and windows are kept closed at all times during the application. Enclosed cabs are considered a supplement to personal protective equipment (PPE)—not a replacement for it. So, you must wear all PPE specified on the label while working inside the enclosed cab. However, the labeling of some agricultural use pesticides may allow exceptions to the label-specified PPE requirements for applicators in enclosed cabs. Check with your state, tribe, or territory pesticide regulatory agency for any other requirements regarding PPE and enclosed cabs. Remember, outside surfaces of the application equipment and cab are contaminated. Be sure to wear appropriate PPE when getting in and out of the cab or performing routine equipment maintenance.

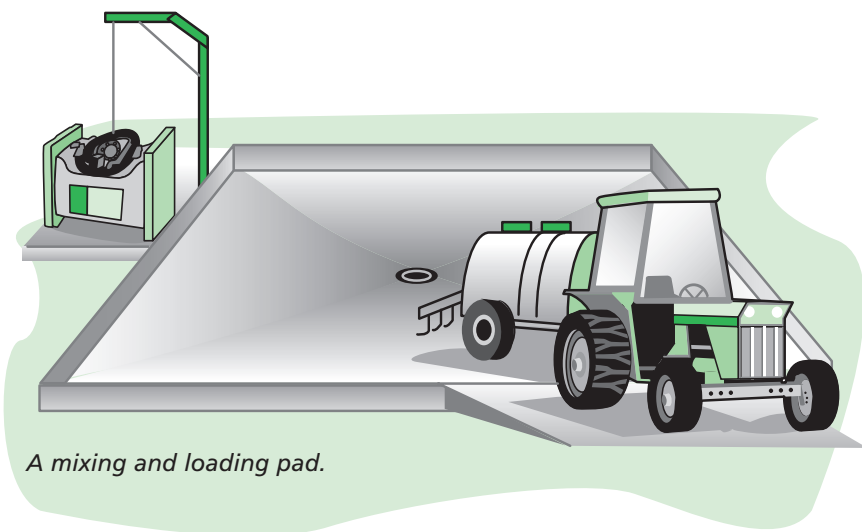


Larry Schuitze,  
University of Nebraska

*Enclosed cabs are considered a supplement to PPE, not a replacement for it.*

## Pesticide Containment Systems

If you often use the same location to mix and load pesticides or clean equipment, you may have to install a **pesticide containment pad**. Check U.S. Environmental Protection Agency and state, tribe, or territory regulations to determine when a containment pad is required. Keep spray tanks containing pesticides on a pad. These pads are



A mixing and loading pad.

designed to contain spills, leaks, overflows, and wastewater for reuse by the applicator or disposal by a commercial waste management contractor. They make it easier to clean up spills and help prevent environmental contamination.

Use a permanently installed containment pad to mix, load, and clean equipment and in areas where large quantities of pesticides are handled or stored. Generally, the containment pad must be made of impermeable material. It should be concave or have curbs, berms, or walls high enough to hold the largest amount of spill, leak, or equipment wash water likely to occur at the site. It also must be equipped with a system to remove and recover spilled, leaked, or released material by either an automatic sump system or a manually operated pump. Smaller, portable pads and lightweight trays made of heavy-duty plastic may be used when mixing and loading at the application site. Again, check regulations for containment pad design requirements.

## APPLICATION EQUIPMENT

The application equipment or device must be able to apply the pesticide to the intended target at the proper rate. The label specifies the legal application rate and may suggest the appropriate equipment for use with the product. Application equipment may range from an aerosol can to hand equipment to power equipment, including aircraft. The equipment may be carried, towed, or self-propelled.

### Sprayers

The most common type of pesticide application equipment is the sprayer: nearly 90% of all pesticides are formulated for spraying. A **hydraulic** (liquid) **sprayer** uses water or other liquid carrier for the pesticide. However, in the case of ultra-low-volume spraying, the pesticide is either applied directly as formulated or with dramatically reduced carrier volumes. Hydraulic sprayers range from large agricultural sprayers with multiple-nozzle **booms** and power sprayers to small



A backpack sprayer is a type of hydraulic sprayer.

manual backpack and hand-held compressed-air sprayers. In all cases, pressure from either a pump or compressed gas or air is used to atomize the spray mix at the nozzle.

Manual sprayers are designed for spot treatments and for areas unsuitable



A hydraulic sprayer with a spray boom.

for larger units. They are relatively inexpensive, simple to operate, maneuverable, and easy to clean and store. Adjustable spray guns are often used with these units, but some models have the option for a spray boom.

The **air-blast** (or mist) **sprayer** uses both water and air as carriers. Spray droplets are formed by the nozzles and delivered to the target by an airstream. Air-blast sprayers are typically used for disease and insect control on fruit trees, vineyards, vegetables, and Christmas trees.

tanks require an opening in the bottom to aid in cleaning and draining. A large top opening is useful for filling, cleaning, and inspecting the tank. The opening must have a watertight cover to prevent spillage. A tank agitation system/device is useful for most sprayable formulations, especially for wettable powders or dry flowables. Constant mixing of a pesticide and liquid carrier produces a uniform spray mixture (suspension or solution), resulting in an even application of the chemical.

Sprayers use a pump to produce the flow of spray material to the nozzles and for agitation. The pump parts must resist corrosion and be abrasion-resistant, especially when wettable powders or other abrasive formulations are used. Never operate a sprayer pump at speeds or pressures above those recommended by the manufacturer. You may damage the pump if it is operated dry or with a restricted flow at the inlet or outlet. Pumps depend on the spray liquid for lubrication and to prevent overheating.

Nozzles control the amount of material applied, droplet formation and size (coverage and drift), and the distribution and pattern of the droplets. A nozzle's spray pattern is made up of a wide variety of spray droplet sizes. Nozzles are classified based on the spray pattern they produce (see Figure 11.1). The size of the nozzle opening



Ground sprayer.

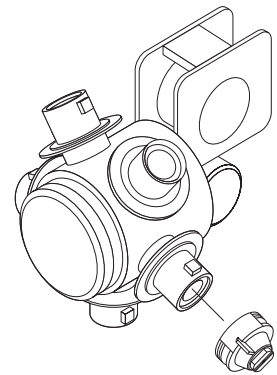
M.J. Weaver, Virginia Tech Pesticide Programs



An air blast sprayer uses both water and air as carriers.

## Sprayer Components

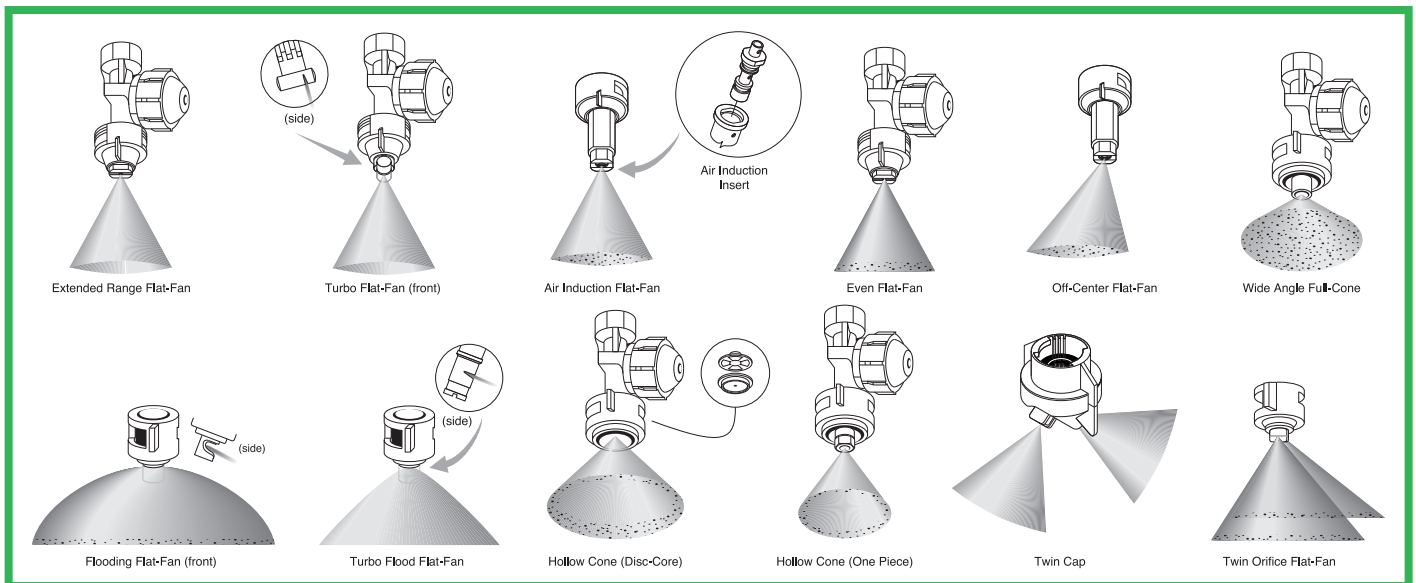
Because sprayers use water or other liquids to dilute and carry a pesticide, a tank is necessary to contain the spray mix. Choose a tank made of or coated with a material that does not corrode and can be easily cleaned. Corrosion and dirt clog screens and nozzles and increase wear on the equipment. Large



Illinois PSEP program.

Rotating turret nozzle body with five nozzle positions. The position pointing down is the active nozzle.

Figure 11.1  
Nozzle Spray Patterns



Illinois PSEP program.



**Figure 11.2**  
A device to measure nozzle flow.

(**orifice**) affects the droplet size and flow rate. A nozzle that primarily produces larger droplets is most likely to minimize off-target drift. A nozzle that mainly produces smaller droplets will maximize surface coverage of the target. See Chapter 7 (Pesticides in the Environment) for a more detailed discussion of droplet size classification. Choose nozzles based on the target pest, type of application, coverage desired, and drift potential.

Nozzles are available in various materials: brass, aluminum, plastic, stainless steel, hardened stainless steel, and ceramic. Select the nozzle material best suited for the pesticide formulation. Never use brass or aluminum tips to apply abrasive materials (such as wettable powders and dry flowables) because they wear too fast. Since wear destroys the proper working of a nozzle, replace worn nozzles. To reduce wear, use nozzle tips made of a hard, wear-resistant material, such as plastic, hardened stainless steel, or ceramic. Also, be sure you have the correct nozzle screen size for each nozzle.

Flow meters and other devices measure nozzle flow rate and the uniformity of flow from nozzles along a boom. Figure 11.2 is a device that measures flow over time. It can be used to check nozzles for output and is also useful during calibration, particularly when sprayers are set up with multiple nozzles.

### Granular Applicators

Granular applicators are available for either band or broadcast application. They may be operated as separate units. However, they are often attached to other equipment (such as planters or cultivating equipment) to combine two or more operations. Granular applicators usually operate by gravity feed and have an adjustable opening to regulate the flow.

Band applicators use hoses or tubes with deflectors on the bottom. Broadcast applicators use a system of tubes and deflectors or a spinner to

spread the granules. The application rate is affected by ground speed; granule size, shape, and density; field terrain; and even relative humidity and air temperature. When multiple band applicators are used, each individual unit must be calibrated with the specific material to be applied to ensure accurate application.

**Rotary** and **drop spreaders** are two common types of granular applicators. Rotary spreaders distribute the granules to the front and sides of the spreader, usually by means of a spinning disk or fan. In a drop spreader, an adjustable sliding gate opens holes in the bottom of the hopper. Granules flow out by gravity feed. Drop spreaders are superior to rotary spreaders when more precise placement of the pesticide is desired.

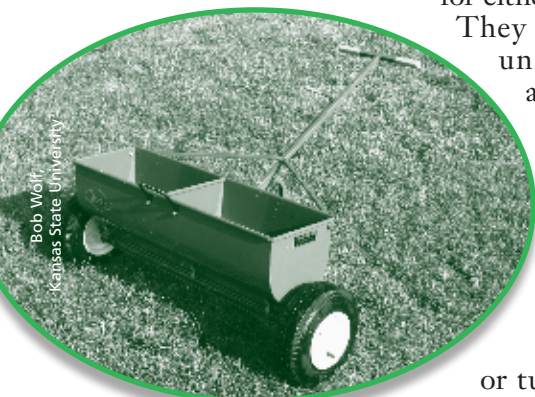
### Other Application Equipment

Additional types of application equipment include:

- Rubs, walk-through sprayers, and dipping vats to control pests on animals.
- Bait dispensers to control rodents, insects, and predators.
- Foggers for indoor pest control and for some outdoor insect control.
- Chemigation systems for greenhouses and field crops.
- Dusters for small-scale disease and insect control.



A rotary spreader.



A drop spreader.



Rubs are used for applying pesticides to livestock.

## EQUIPMENT CALIBRATION

**C**alibration is the process of measuring and adjusting the amount of pesticide your equipment applies or delivers to a specific area. The purpose of calibration is to ensure that your equipment is applying the correct amount of material uniformly over a given area.

Equipment is made to be adjustable. Charts or tables assist the operator in adjusting the settings. These recommended settings, however, are only approximate and may not be appropriate for all situations. Therefore, your equipment must be calibrated periodically. How often depends on the type of equipment and the frequency of use. The application rate of a sprayer is affected by travel speed, nozzle size, and sprayer pressure. Even with the widespread use of electronics to monitor and control the pesticide application, a thorough sprayer calibration procedure is essential to avoid misapplication.

Equipment can be calibrated by making a trial run on some premeasured area and measuring the output. For example, using a hand-held sprayer, spray a premeasured test area with water using the same pressure and techniques (i.e., travel speed and equipment) you would use when applying the pesticide. After spraying the test area, determine how much water was used. This volume can then be used to calculate the amount of water and pesticide needed to cover the intended application area.

When calibrating a boom sprayer, there are three variables that affect the amount of spray material applied per area of measurement (i.e., gallons per acre or gallons per 1,000 square feet):

1. Nozzle flow rate.
2. Ground speed of the sprayer.
3. Width sprayed per nozzle.

To calibrate and operate a sprayer properly, it is important to understand how each of these variables affects sprayer output. The nozzle flow rate varies according to the size of the orifice, the nozzle pressure, and the density of the spray liquid. The spray application rate varies inversely with the ground speed. Doubling the ground speed of the sprayer reduces the gallons of spray applied per acre by one-half. Likewise, doubling the effective width sprayed per nozzle decreases the applied amount by one-half.

The time invested in calibrating your equipment is time well-spent. Accurate calibration to determine the application volume under your operating conditions is important for cost, efficiency, and safety. Without properly calibrating the sprayer to deliver the correct application volume, you will not be able to apply the pesticide at the proper rate to control the pest.

Your category-specific manual will explain in detail how to calibrate your application equipment.



Calibrating a backpack sprayer.

### Why Calibrate?

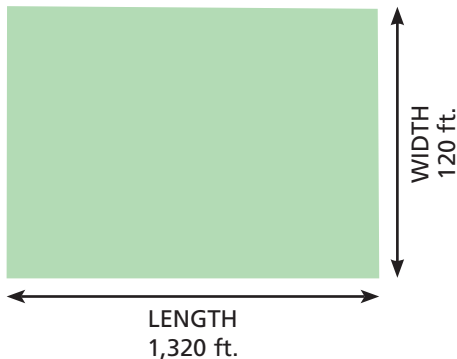
The purpose of calibration is to ensure that your equipment is applying the correct amount of pesticide material uniformly over a given area. Too little pesticide may fail to control the target pest. Too much pesticide is illegal and can result in damage to the treated plant, animal, or surface; can produce illegal residues on treated crops and animals; and can cause adverse effects to the environment and non-target organisms.

## CALCULATING AREA

For precise application, you need to know the size of the area to be treated. The following examples show how to determine the size of rectangular, triangular, and circular areas.

### Rectangular Areas

You want to apply a pesticide to an area that measures 1,320 feet by 120 feet. What is the area in square feet and in acres?



$$\text{Area} = \text{length} \times \text{width}$$

Area in square feet (sq. ft.)

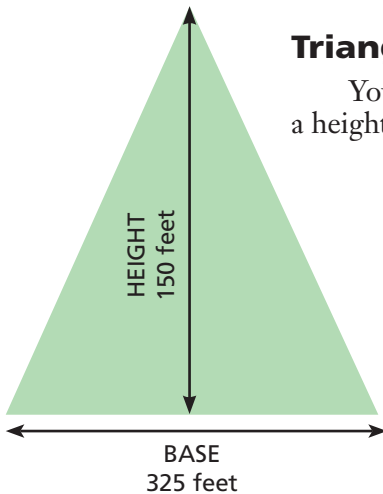
$$1,320 \text{ ft.} \times 120 \text{ ft.} = 158,400 \text{ sq. ft.}$$

$$\text{Area in acres (A)} = \frac{158,400 \text{ sq. ft.}}{43,560 \text{ sq. ft./A}} = 3.6 \text{ A}$$

**Note:** 1 acre (A) = 43,560 sq. ft.

### Triangular Areas

You are applying a pesticide to a triangular area that has a base of 325 feet and a height of 150 feet. What is the area?



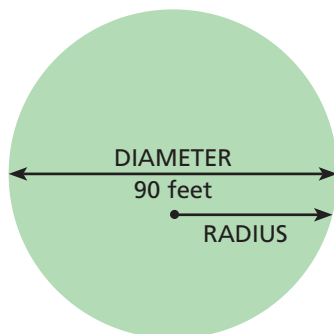
$$\text{Area} = \frac{\text{base} \times \text{height}}{2}$$

$$\text{Area in square feet} = \frac{325 \text{ ft.} \times 150 \text{ ft.}}{2} = 24,375 \text{ sq. ft.}$$

$$\text{Area in acres} = \frac{24,375 \text{ sq. ft.}}{43,560 \text{ sq. ft./A}} = 0.6 \text{ A}$$

### Circular Areas

If you have a circular area that has a 90-foot diameter, the radius (r) is 45 ft. What is the area?



$$\text{Area} = 3.14r^2$$

**Note:** 3.14 ( $\pi$ ) is a constant.  
Radius is 1/2 diameter.

Area in square feet =

$$3.14 \times 45^2 = 6,358.5 \text{ sq. ft.}$$

$$\text{Area in acres} = \frac{6,358.5 \text{ sq. ft.}}{43,560 \text{ sq. ft./A}} = 0.15 \text{ A}$$

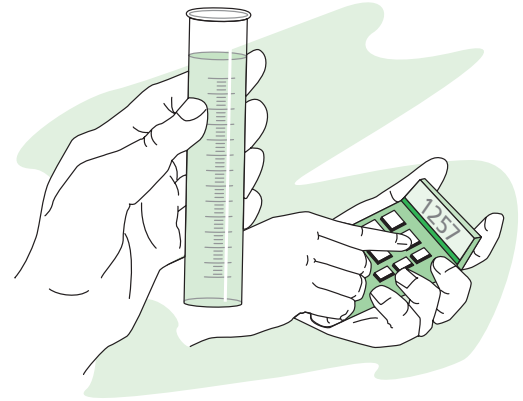


## CALCULATING THE APPLICATION RATE

Use the volume from your calibration test area to determine the amount of pesticide product and total spray mixture needed for your application area. First, convert your calibrated rate to one based on the area units found on the label. For example, assume that when you calibrated the sprayer, it delivered 2 gallons of water over a 250-square-foot test area. Your application area measures 1,000 square feet (i.e., four times the test area). Therefore, you need to use 8 gallons of spray mixture to cover

1,000 square feet (multiplying 2 gallons of water by 4).

Check the pesticide label to determine the amount of pesticide to add to the spray mixture. For example, if the label recommends adding 4 ounces of a liquid pesticide product to give a desired finished spray mixture of 1 gallon, you



*Calculate the application rate and measure the amount of pesticide needed.*

### Calculating the Application Rate

You determined from a calibration test that your boom sprayer delivered 10 gallons of water over a one-quarter (0.25) acre test area. You need to apply a pesticide product to a 10-acre field (43,560 square feet = 1 acre). The pesticide label recommends that 4 ounces of liquid product be added to give a desired finished spray mixture of 1 gallon (there are 128 fluid ounces = 1 gallon). How much spray volume and how much product are needed?

**Step 1.** How much spray mixture is needed for the 10-acre application area? Always use information from the calibration test. In this example, 10 gallons of water was used over a 0.25-acre calibration test area.

$$\frac{10 \text{ gallons}}{0.25 \text{ acre}} = \frac{Y \text{ gallons}}{10 \text{ acres}}$$

Cross multiplication:

$$Y = \frac{(10 \text{ gallons} \times 10 \text{ acres})}{0.25 \text{ acre}} = 400 \text{ gallons of spray mixture needed}$$

**Step 2.** How much pesticide product is needed to make up 400 gallons of spray mixture? Use the label rate of 4 oz. product per 1 gal. spray.

400 gallons spray mixture x 4 ounces of liquid pesticide product per gallon = 1,600 ounces of product needed

**Step 3.** How many gallons of product are needed? Remember, 128 ounces = 1 gallon.

$$\frac{1,600 \text{ ounces of product}}{128 \text{ ounces/gallon}} = 12.5 \text{ gallons of product}$$

**Final result:** To treat 10 acres, you need a total final spray mix of 400 gallons that includes 12.5 gallons of the concentrated product.

would add 4 ounces of product to 124 ounces of water (1 gallon equals 128 fluid ounces). If you needed to apply 8 gallons of spray mixture to cover 1,000 square feet, then you must add 32 ounces (8 times 4 ounces) of pesticide product to 7.75 gallons of water. If the tank capacity of the sprayer is 4 gallons, you need to fill up the tank twice, using 16 fluid ounces of product each time.

Labels vary in how they recommend pesticide application rates. Some examples include ounces of product per 1,000 square feet, pints/quarts/gallons per 100 gallons, pounds of product per acre, or percent product in the tank. Be sure you understand how to calculate the correct amount of pesticide product and diluent needed before making the final mixture. See Appendix C, Conversions and Calculations, for more information.

## TECHNIQUES TO MINIMIZE DRIFT

**A**pplication techniques and equipment greatly influence the amount of spray drift that occurs. Off-target movement is affected by the type of nozzle, nozzle orifice size, sprayer pressure, and the height or distance of the nozzles from the target. It is important to review the pesticide label for specific information on drift reduction techniques or requirements. You must also check weather conditions (such as air stability, wind direction, and speed) at the time and place of the application and follow all weather-related restrictions on the label.

Of the many nozzle types available for applying pesticides, several are specifically designed to reduce drift. Select nozzles to give the largest droplet size that provides adequate coverage at the intended application volume and pressure.

In addition to the size of the nozzle orifice, some new nozzle designs help reduce drift by incorporating air into the spray to form an air-fluid mix. These air-induction nozzles, known as venturi nozzles, form a larger spray droplet, produce fewer fine particles, and provide energy to help transport the droplets to the target. These nozzles, however, require higher spray pressures (40 to 100 pounds per square inch) to be effective. Even at these higher pressures, venturi nozzles still dramatically reduce the likelihood of drift.

Operating pressure also affects the droplet size and output volume of the sprayer. Doubling the pressure does not double the flow rate. To double the flow rate, you must increase the pressure

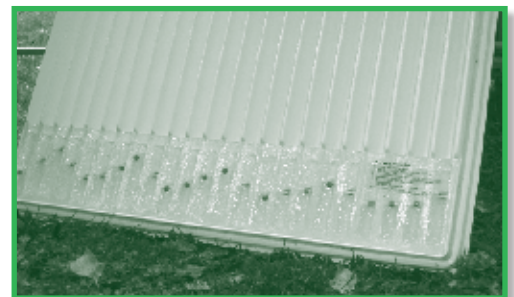
four times. Pressure cannot be used to make major changes in application rate, but it can be used to correct minor changes due to nozzle wear. To obtain a uniform spray pattern and to minimize drift, keep the operating pressure within the recommended range for each nozzle tip. Exceeding the recommended pressure range often results in more drift potential. To maintain a proper spray pattern, adjust nozzles according to the manufacturer's recommendations on nozzle spacing and spray angle.

Applications made with an electronic rate controller are subject to pressure changes as the operating speed varies. Even though the purpose of the rate controller is to help make



Bob Wolf, Kansas State University

*A wind meter is useful for determining when to spray.*



Pat Hopkins, Virginia Tech Pesticide Programs

*A demonstration of a method to determine the uniformity of a nozzle spray pattern.*

application volumes more uniform as sprayer speed changes, major adjustments in speed can affect pressure. For example, doubling the speed will result in a fourfold pressure increase in an attempt to maintain the correct volume. The increased pressure without changing nozzle orifice size will dramatically increase the potential for

drift. Likewise, reduced speed can lower the pressure, which may affect coverage and, ultimately, pattern quality.

Spray height, or distance from the target site, is also an important factor in reducing drift. The closer the boom or spray nozzle is to the ground or target site, the less chance for drift. However, watch for pattern uniformity.

**Table 11.1. Recommended Techniques to Reduce Drift**

Recommended Technique	Explanation
Follow label directions for reducing drift.	Read the label and reference the nozzle manufacturer's guide to determine which nozzle and pressure combinations are needed.
Select a nozzle to increase droplet size.	Large droplets are less prone to drift. Use the largest droplets that provide necessary coverage.
Increase nozzle size resulting in higher application volumes.	Larger capacity nozzles can reduce the amount of spray deposited off-target.
Consider using new technologies.	Certain nozzles (e.g., air-induction and venturi nozzles) may help reduce drift.
Lower boom height.	The higher the boom height is above the target, the greater the potential for drift. Lowering the boom height a few inches can reduce off-target drift.
Maintain appropriate travel speed.	High travel speeds may result in an unstable boom, high boom positions and increased drift potential.
Keep nozzle close to the target.	When using hand-held equipment, keeping the nozzle close reduces the potential for drift.
Avoid high application ground speeds or major speed changes across the field.	Speed changes may result in pressure adjustments, causing droplet size variability. Sudden increases in speed may create high pressure that results in more drift potential.
Avoid applications during times of high wind speeds.	More of the spray volume moves off-target as wind increases. Wind currents can drastically affect spray droplet deposition.
Do not spray in the presence of a temperature inversion.	Temperature inversions prevent the dissipation of spray particles.
Consider using buffer zones/no-spray zones near sensitive areas.	Leave a buffer zone/no-spray zone if sensitive areas are downwind.
Use a drift-control additive when needed.	Drift-control additives increase the average droplet size produced by the nozzles. These additives must not become your only drift reducing technique. They do not make up for poor spraying practices.

To maintain uniformity, most nozzle types require some amount of overlap. Maintaining a 1:1 ratio of boom height above the target to the nozzle spacing on the boom will satisfy most overlap requirements. For air-blast sprayers, reduce drift by minimizing spraying over the canopy top. Use the minimum airspeed that will still give good penetration into the canopy, and consider the use of tower sprayers.

Another way to minimize drift is to use drift control additives. Tests indicate that the use of some additives reduces downwind drift deposits by 50% to 80%. Drift control additives are a specific type of chemical adjuvant. They must be mixed and applied according to label directions to be

effective. Research, however, has shown that some products intended to reduce drift in fact increase drift potential. This research also shows that although some of these additives dramatically increase droplet size, they may also reduce coverage and lessen the overall effectiveness of the pesticide. Thoroughly evaluate drift control additives before using them. Using approved application techniques and adopting new technologies designed to reduce spray drift can improve the performance of spray mixes, benefit the environment, and be more cost-effective. Any one practice used alone may not sufficiently reduce drift. Therefore, incorporate as many drift-reduction techniques as practical into your spray program (Table 11.1).

## SUMMARY

**T**o choose the most suitable pesticide application method, you must consider factors such as the target site, target pest, and which pesticide formulation you intend to use.

Further, you must wear all PPE specified on the label for a specific task and, when required, use closed mixing and loading systems, enclosed cabs, and pesticide containment systems. Even if not required, using these safety systems will help protect humans and the environment from exposure to pesticides.

Your application equipment must be able to deliver the correct amount of pesticide to the intended target.

The most common type of application equipment used in pest management is the hydraulic sprayer. Regardless of what type of sprayer you use, you must understand its parts and how they work. This includes how to adjust nozzles, spray volume, and pressure to reduce off-target drift. Spraying under the right weather conditions using proper application procedures can help reduce drift.

Before making an application, be sure your equipment is properly calibrated and know how to use the label information to calculate the correct amount of pesticide.

## Review Questions

### CHAPTER 11: PESTICIDE APPLICATION PROCEDURES

Write the answers to the following questions, and then check your answers with those in Appendix A.

- Which application method involves uniformly applying a pesticide to an entire area or field?**
  - Broadcast.
  - Band.
  - Directed spray.
- Which type of pesticide application would you use to control cockroaches inside buildings?**
  - Basal.
  - Band.
  - Crack and crevice.
- Which statement about containment pads is true?**
  - Pads make spill cleanup more difficult.
  - Pads should be made of permeable materials.
  - Pads should be used where large quantities of pesticides are handled or mixed.
- Which statement about sprayer nozzles is true?**
  - A nozzle that mainly produces fine droplets is likely to minimize off-target drift.
  - Coarse-sized droplets provide maximum coverage of the target.
  - Nozzles control the amount of material applied and type of pattern created.
- Which statement about granular applicators is true?**
  - Ground speed has no effect on the application rate.
  - In a rotary spreader, lighter granules are thrown farther than heavier ones.
  - Drop spreaders are superior to rotary spreaders when more precise placement of the pesticide is desired.
- Which technique would help minimize off-target drift?**
  - Spraying during a temperature inversion.
  - Using the largest droplets practical to provide necessary coverage.
  - Increasing the height of the nozzles above the target.
- You are applying a pesticide to a triangular area that has a base of 60 feet and a height of 30 feet. How many square feet is the area?**
  - 450.
  - 900.
  - 1,800.
- You are applying a pesticide to a circular area with a 20-foot diameter. How many square feet is the area?**
  - 128.
  - 314.
  - 400.
- You have calibrated your equipment to spray 50 gallons per acre. You need to spray 1 acre. The label calls for 3 pounds of formulation per 100 gallons of water. How many pounds of formulation should you add to the tank to make 50 gallons of finished spray?**
  - 1.5.
  - 3.
  - 6.