CALIBRATING BACKPACK SPRAYERS (per 1,000 Square Feet)

Gary L. Hawkins, Extension Engineer
Glen C. Rains, Extension Engineer

Backpack sprayers are often used to treat ornamental plants or small areas of turf. Pesticide recommendations are often based on amount per acre or other defined areas, such as amount per 1000 square feet. Regardless of the type of sprayer used to apply pesticides, the speed, pressure and nozzle height should be kept constant for accurate application. The backpack sprayer may require some modification so that it is better suited for application. A pressure gauge mounted on the tank side of the shutoff valve will allow continuous monitoring of the tank pressure, which must remain uniform. Optimum pressure control can be achieved by inserting a pressure regulator between the pressure gauge and nozzle. To prevent dripping after the shutoff valve is closed, use a quick, positive-pressure shutoff valve or a strainer with a check valve. Nozzle clogging, a problem associated with the use of wettable powders, dry flowable (DF) and water dispersible granules (WDG) formulations can be reduced by inserting a 50 mesh in-line strainer and keeping the solution constantly agitated. The following is a procedure for determining the amount of pesticide for use on a given target site using rates expressed in amount per 1000 square feet.

Step 1. Measure the length and width of the test area to be sprayed. Then calculate the area to be covered.

Test Area is: length _____ ft X width _____ ft = _____ sq ft

Step 2. Fill sprayer with water and spray the test area. Record the amount of water needed to refill the sprayer.

Volume (ounces) per test area _____

Step 3. Find the label rate of material to be applied per 1000 square feet.

Rate _____ per 1000 sq ft

Step 4. $$\frac{\textit{1000 sq ft x Volume (ounces) per test area}}{\textit{Test Area (sq ft)}} = \textit{Volume (ounces) per 1000 sq ft}$$

Step 5. Calculate the area covered per tank as follows:

$$\frac{\textit{Tank volume (ounces) x 1000 sq ft}}{\textit{Volume per 1000 sq ft}} = \textit{Area covered per tank (sq ft)}$$

Step 6. Calculate amount of material to add to tank.

$$\frac{\textit{Area per tank (sq ft) x Label rate per 1000}}{\textit{1000 sq ft}} = \textit{Amount to add (rate units)}$$

Solutions derived from above may need to be converted to a smaller unit in order to accurately measure the pesticide. The following conversions will help simplify this process.

Conversions:

Volume	Weight
gallon x 128 = fluid ounces (fl oz) pints x 16 = fluid ounces (fl oz) fl oz x 29.57 = milliliters (ml) gallon x 4 = quarts (qts) quarts x 2 = pints (pts) fl oz x 2 = Tablespoons (Tbsp) tsp x 3 = Tablespoons (Tbsp) tsp x 5 = milliliters (ml)	weight ounces (wt oz) = pounds x $\frac{16 \text{ wt oz}}{\text{pound}}$ grams (g) = wt ounces x $\frac{28.35 \text{ g}}{\text{wt oz}}$ milligrams (mg) = grams x $\frac{1000 \text{ mg}}{\text{gram}}$

An example of using this conversion chart. If the rate calls for 0.25 gallons of material then converting to ounces would be done as follows: 1 gallon has 128 ounces, so multiply 0.25 gallons by 128 to get 32 ounces. So, you would need to measure out 32 ounces for your application. The same thing for a weight. If you need 0.25 pounds, then multiply 0.25 by 16. This is calculated as 0.25 pounds times 16 to get 4 weight ounces of material.

CALIBRATING TURFGRASS SPRAYERS (Gallons per 1,000 Square Feet)

Gary L. Hawkins, Extension Engineer
Glen C. Rains, Extension Engineer

Low-pressure boom sprayers are used frequently for applying chemicals on large areas such as golf courses and recreational areas. Application rates for turf are normally given in gallons per 1000 square feet. Calibrating a boom sprayer is not as difficult as it sounds. Calibrate your sprayer often to compensate for nozzle wear, pump wear and speed changes.

Calibrate with clean water. Check uniformity of nozzle output across the boom. Collect from each nozzle for a known time period. Each nozzle should be within 10 percent of the average output. Replace with new nozzles if necessary. When applying materials that are appreciably different from water in weight or flow characteristics, such as fertilizer solutions, etc., calibrate with the material to be applied. Exercise extreme care and use protective equipment when an active ingredient is involved.

Step 1. Determine the Effective Swath Width (W) per Nozzle
For boom spraying, the effective spray width of each nozzle (W) is equal to the distance in inches between two nozzles.

Step 2: Determine Travel Speed (MPH)
To determine the travel speed, measure a known distance. Use fence posts or flags to identify this distance. A distance over 200 feet and a tank at least half full are recommended. Travel the distance determined at your normal spraying speed and record the elapsed time in seconds. Repeat this step and take the average of the two measurements. Use the following equation to determine the travel speed in miles per hour:

$$\textit{Travel Speed (MPH)} = \frac{\textit{Distance (feet) x 0.68}}{\textit{Time (seconds)}}$$

(0.68 is a constant to convert feet/second to miles/hour)

Step 3. Determine Nozzle Flow Rate (GPM)
With the sprayer parked, operate the sprayer at the same pressure level and catch the output from each nozzle in a measuring jar for one minute (or collect output for half a minute and then double the ounces collected) to determine the nozzle flow rate in ounces per minute (OPM) Then, convert the final average output in OPM to gallons per minute (GPM) using the following equation:

GPM = OPM/128 (1 Gallon = 128 ounces)

Step 4. Determine the Actual Application Rate in Gallons per 1000 sq ft
Use the following equation to determine the gallons per acre application rate:

$$\textit{Gallons per 1000 sq ft} = \frac{\textit{136 x gpm (per nozzle)}}{\textit{MPH x W}}$$

GPM: average nozzle flow rate in gallons per minute
MPH: travel speed in miles per hour
W: distance between two nozzles in inches
136 is a constant to convert units to gallons per 1000 sq ft

Step 5. Calculate the area covered per tank as follows:

$$\frac{\textit{Tank Volume (gallons) x 1000}}{\textit{Application Rate (gallons per 1000 sq ft)}} = \textit{Area covered per tank (sq ft)}$$

Step 6. Calculate amount of material to add to tank.

$$\frac{\textit{Area covered per tank (sq ft) x Material rate per 1000 sq ft}}{\textit{1000}} = \textit{Amount to add (rate units)}$$

HAND SPRAYER CALIBRATION FOR ORNAMENTALS AND TURF

Gary L. Hawkins, Extension Engineer
Glen C. Rains, Extension Engineer

Hand sprayers are often used to treat ornamental plants or small areas of turf. The directions on many ornamental pesticide product labels say to "spray until foliage is wet" or perhaps "spray until runoff." Unfortunately, these directions are subject to each applicator's interpretation of what "wet" or "runoff" is.

Recommendations are based on amount per 100 gallons. This is the dilution ratio for the chemical applied. Use the following to convert the 100 gallon rate to bed area rate.

1. Measure the length and width of the area to be sprayed. Then calculate the area to be covered.

Bed Area is: length _____ X width _____ = _____ square feet

2. Fill sprayer with water and spray the area. Record the amount of water to refill the sprayer.
   Gallons per bed area _____

3. Obtain the rate of material to be applied per 100 gallons.
   Rate _____

4. $$\frac{\textit{Rate x Gallons per bed area}}{\textit{100}} = \textit{Amount per bed area}$$

5. Calculate the total amount of material to be used for the application (total bed area) as follows:

$$\frac{\textit{Amount per bed area x Area to be sprayed}}{\textit{Bed area in square feet}} = \textit{Amount of material}$$

6. Total solution to prepare is:

$$\frac{\textit{Gallons per bed area x Area to be sprayed (sq ft)}}{\textit{Bed area in square feet (sq ft)}} = \textit{Total Solution}$$

Solutions derived from above may need to be converted to a smaller unit in order to accurately measure the pesticide. The following conversions will help simplify this process.

Conversions:

Volume	Weight
gallon x 128 = fluid ounces (fl oz) pints x 16 = fluid ounces (fl oz) fl oz x 29.57 = milliliters (ml) gallon x 4 = quarts (qts) quarts x 2 = pints (pts) fl oz x 2 = Tablespoons (Tbsp) tsp x 3 = Tablespoons (Tbsp) tsp x 5 = milliliters (ml)	weight ounces (wt oz) = pounds x $\frac{16 \text{ wt oz}}{\text{pound}}$ grams (g) = wt ounces x $\frac{28.35 \text{ g}}{\text{wt oz}}$ milligrams (mg) = grams x $\frac{1000 \text{ mg}}{\text{gram}}$

An example of using this conversion chart. If the rate calls for 0.25 gallons of material then converting to ounces would be done as follows: 1 gallon has 128 ounces, so multiply 0.25 gallons by 128 to get 32 ounces. So, you would need to measure out 32 ounces for your application. The same thing for a weight. If you need 0.25 pounds, then multiply 0.25 by 16. This is calculated as 0.25 pounds times 16 to get 4 weight ounces of material.