

MU Guide

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Spray Mix Calculations

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Liquid pesticide sprayers must apply the proper amount of a carefully mixed spray solution to be effective in controlling weed and insect pests. MU publication G 1270, *Calibrating Field Sprayers*, provides procedures for calibrating sprayers and for determining how many gallons of spray mix a sprayer will apply per acre. This publication describes procedures for determining how much pesticide to mix in the tank so the right amount of pesticide will be applied per acre.

Pesticides formulated to be applied as sprays are sold both as liquids and as dry materials such as wettable powders. Calculations for mixing liquids are different from calculations for dry materials. This two-part guide provides specific instructions for mixing both liquid and dry pesticides.

Liquid pesticides

Step 1. Determine the recommended application rate. *Read the label!* The recommended range of application rates for the specific formulation is given on the label. The selected pesticide rate should be based on soil, target pest and crop conditions.

Caution: Normally, the label will list pesticide application rates per acre in quarts or pints. However, some labels may list the application rate in pounds (lb) of active ingredient. If so, continue with Step 2. If the label refers to quarts, pints, or other volume measurements, go directly to Step 4.

Step 2. Determine the concentration of active ingredient. *Read the label!* The label will show the amount of active ingredient in each gallon of pesticide formulation. This amount is normally shown as pounds of active ingredient per gallon (gal).

Example: acid equivalent = 4 lb/gal

Step 3. Calculate the volume of pesticide product to apply per acre. If the label gives the pesticide application rate in volume units such as quarts or pints, then the amount was found in Step 1. However, if the rate is shown as pounds of active ingredient per acre, then it is necessary to calculate the volume of pesticide to apply per acre. This volume can be found by dividing the pesticide application rate (Step 1) by

the number of pounds of active ingredient per gallon (Step 2).

$$\text{Gallons of pesticide per acre} = \frac{\text{application rate (lb/acre)}}{\text{concentration or acid equivalent}}$$

Example: Suppose you want to apply 1.5 lb of 2,4-D per acre and the 2,4-D contains 4 lb of active ingredient per gallon.

$$\text{Gallons of 2,4-D per acre} = \frac{1.5 \text{ lb/acre}}{4 \text{ lb/gal}} = 0.375 \text{ gal/acre or } \frac{3}{8} \text{ gal/acre}$$

You may find it useful to convert gallons per acre to pints/acre for measuring purposes.

$$\text{Pints of 2,4-D per acre} = \frac{3}{8} \text{ gal/acre} \times 8 \text{ pints/gal} = 3 \text{ pints/acre}$$

Step 4. Calculate the number of acres sprayed by a full tank of the spray mixture. Note: If you use a sprayer with two or more tanks remember to consider the total volume of all tanks and to divide all ingredients proportionally among the tanks. All references to "tank" in the following material refer to the combined capacity of all tanks.

The number of acres sprayed by a full tank is found by dividing the tank capacity by the sprayer application rate, which was found during calibration (refer to MU publication G 1270).

$$\text{Acres per tank} = \frac{\text{Total tank capacity (gal/tank)}}{\text{Application rate (gal/acre)}}$$

Example: Your spray tank holds 400 gallons and your sprayer application rate is 20 gallons per acre.

$$\text{Acres per tank} = \frac{400 \text{ gal/tank}}{20 \text{ gal/acre}} = 20 \text{ acres/tank}$$

Small fields can be sprayed with partially filled tanks. The pesticide and carrier (water) are added to the tank until the tank is filled to the correct level. The

correct volume of spray is the sprayer application rate multiplied by the number of acres.

Example: You want to spray a 12-acre field and your sprayer applies 20 gallons/acre.

$$\begin{aligned} &\text{Gallons of spray mixture} \\ &= \text{application rate (gal/acre)} \times \text{area to spray (acres)} \end{aligned}$$

Therefore, put (20×12) 240 gallons of pesticide and carrier in the tank.

Step 5. Calculate the volume of pesticide to mix in the tank. The volume of pesticide added to the tank is the number of acres per tank (Step 4) multiplied by the volume of pesticide per acre (Step 3).

$$\begin{aligned} &\text{Volume of pesticide per tank} \\ &= (\text{acres/tank}) \times \text{volume of pesticide per acre (gal)} \end{aligned}$$

Example: You want to spray a full 400-gallon tank.

$$\begin{aligned} &\text{Gallons of 2,4-D per tank} \\ &= 20 \text{ acres/tank (Step 4)} \times 0.375 \text{ gal/acre (Step 3)} \\ &= 7.5 \text{ gal/tank} \end{aligned}$$

If you want to spray the small 12-acre field, the amount of 2,4-D added to the tank before bringing the volume up to 240 gallons would be:

$$\begin{aligned} \text{Gallons of 2,4-D} &= 12 \text{ acres} \times 0.375 \text{ gal/acre} \\ &= 4.5 \text{ gal} \end{aligned}$$

Note: Partially fill the spray tank with water before adding pesticides.

Dry pesticides

Some pesticides are formulated and sold as powders and water dispersible granules for mixing with water. These dry formulations are recommended in units of weight per acre. The amount of active ingredient in these products is shown in percent.

Step 1. Determine the recommended rate of application.

Read the label! The recommended range of application rates is given on the label. Be sure the rate you use is the right rate for your soil, target pest, and crop conditions.

Caution: The rate can be shown in pounds of active ingredient or pounds of product. If the rate is shown as pounds of active ingredient, continue with Step 2. If the rate is shown as pounds of product, go directly to Step 4.

Step 2. Determine the concentration of active ingredient in the pesticide formulation. *Read the label!* The label will list the percentage of active ingredient.

Example: atrazine: 80 percent

Step 3. Calculate the weight of pesticide product to apply per acre. The weight of pesticide product to apply per acre is the pesticide application rate (lb/acre) divided by the percent concentration.

$$\begin{aligned} \text{Pounds of pesticide product} \\ \text{per acre} &= \frac{\text{application rate} \times 100}{\text{percent active ingredient}} \end{aligned}$$

Example: You want to apply 1.5 lb of atrazine and the label shows atrazine: 80 percent.

$$\begin{aligned} \text{Pounds of atrazine formulation} \\ \text{per acre} &= \frac{1.5 \text{ lb of atrazine/acre (Step 1)} \times 100}{80 \text{ (Step 3)}} \\ &= 1.875 \text{ lb/acre} \end{aligned}$$

Step 4. Calculate number of acres sprayed by each full tank. Follow the procedure provided in Step 4 for liquid pesticides.

Step 5. Calculate the weight of pesticide to mix in the tank. The weight of pesticide added to the tank is the number of acres per tank (Step 4) multiplied by the weight of pesticide per acre (Step 3).

$$\begin{aligned} \text{Weight of pesticide} \\ \text{product/acre} \\ \text{per tank} &= (\text{acres/tank}) \times \text{application rate (lb product/acre)} \end{aligned}$$

Example: You want to spray a full 400-gallon tank of spray.

$$\begin{aligned} \text{Pounds of atrazine product per tank} \\ &= 20 \text{ acres (Step 4)} \times 1.875 \text{ lb product/acre (Step 3)} \\ &= 37.5 \text{ lb/tank} \end{aligned}$$

If you want to spray the small 12-acre field, the weight of atrazine product added to the tank before bringing the volume up to 240 gallons would be:

$$\begin{aligned} \text{Pounds of atrazine product} \\ &= 12 \text{ acres} \times 1.875 \text{ lb product/acre} \\ &= 22.5 \text{ lb} \end{aligned}$$

Note: Partially fill the spray tank with water before adding pesticides.

