

Determine Amount of Liquid Product Needed:

The label says to apply a fungicide at a rate of 10 fluid ounces per acre. How many gallons do you need to treat 45 acres?

We'll look at two ways to solve this, so you will be familiar with both tools for doing math work: cross multiplication and unit cancellation.

For **Cross Multiplication**, set up the problem as ratios or proportions. Have pounds on top for both sides, and acres on the bottom for both sides OR have acres on top for both sides and pounds on bottom for both sides; it doesn't matter which way you do it. Just make sure the same units are on the top, and the same units are on the bottom. You will have to do this in two steps.

$$\frac{10 \text{ fluid ounces}}{1 \text{ acre}} = \frac{N \text{ fluid ounces}}{45 \text{ acres}}$$

Then Cross Multiply:

$$\frac{10 \text{ fluid ounces}}{1 \text{ acre}} \times \frac{\text{fluid ounces}}{45 \text{ acres}}$$

This means you have $(10 \times 45) = (1 \times N)$ or $450 = 1N$

You'll need 450 ounces, and now will convert to gallons, knowing that 128 fluid ounces = 1 gallon.

$$\frac{128 \text{ fluid ounces}}{1 \text{ gallon}} = \frac{450 \text{ fluid ounces}}{N \text{ gallons}}$$

Then Cross Multiply:

$$\frac{128 \text{ fluid ounces}}{1 \text{ gallon}} = \frac{450 \text{ fluid ounces}}{N \text{ gallons}}$$

This means you have $(128 \times N) = (1 \times 450)$ or $1N = 3.5$ The answer is 3.5 gallons.

Practice Cross Multiplication:

1. **The label says to apply 10 fluid ounces of insecticide per 1,000 sq. ft. How many ounces do you need for 10,000 sq. ft.?**

2. **How many gallons would that be? 1 gallon = 128 fluid ounces**

3. *The label says to apply 0.5 gallons of herbicide per acre. How many gallons would you need to treat 200 acres?*

Answers for Cross Multiplication:

1. *The label says to apply 10 fluid ounces of insecticide per 1,000 sq. ft. How many ounces do you need for 10,000 sq. ft.?*

$$\frac{10 \text{ fl oz}}{1,000 \text{ sq ft}} = \frac{N \text{ fl ounces}}{10,000 \text{ sq. ft.}} = 100 \text{ fl oz}$$

2. *How many gallons would that be? 1 gallon = 128 fluid ounces*

$$\frac{1 \text{ gal}}{128 \text{ fl oz}} = \frac{N \text{ gallons}}{100 \text{ fl oz}} = 0.78 \text{ gallons}$$

3. *The label says to apply 0.5 gallons of herbicide per acre. How many gallons would you need to treat 200 acres?*

$$\frac{0.5 \text{ gal}}{1 \text{ acre}} \times \frac{N \text{ gallons}}{200 \text{ acres}} = 100 \text{ gallons}$$

We could use called **Unit Cancellation** for those problems as well. To review unit cancellation, set up the problem so that the units of measurement (inches, feet, seconds, ounces, gallons, etc.) cancel each other out. This is the opposite of the Cross multiplication process. The problem (*at a rate of 10 fluid ounces per acre, how much do you need to treat 45 acres*) is set up as follows, with a unit (acre) on top for one of the fractions and on the bottom for the other. A nice feature of unit cancellation is that you can convert a number of units in one setup. Below, we can find out the amount needed for 45 acres and convert the fluid ounces to gallons in one equation. Just remember to set up units correctly, with acres on top for one fraction and bottom for another, and fluid ounces on top for one fraction and on the bottom for another.

$$45 \text{ acres} \times \frac{10 \text{ fluid ounces}}{1 \text{ acre}} \times \frac{1 \text{ gallon}}{128 \text{ fluid ounces}} = N \text{ gallons}$$

You know you set it up right if you can cancel one unit on the top, and the same unit on the bottom. The unit that is left is what your answer will be.

$$45 \text{ acres} \times \frac{10 \text{ fluid ounces}}{1 \text{ acre}} \times \frac{1 \text{ gallon}}{128 \text{ fluid ounces}} = N \text{ gallons}$$

After setting it up, do the multiplication and division: 45 times 10 divided by 1 times 1 divided by 128 = 3.5 gallons.

The label says to apply 12 fluid ounces of insecticide per 1,000 sq. ft. How many gallons do you need for 10,000 sq. ft? 1 gallon = 128 fluid ounces.

$$10,000 \text{ sq. ft} \times \frac{12 \text{ fluid ounces}}{1,000 \text{ sq. ft}} \times \frac{1 \text{ gallon}}{128 \text{ fluid ounces}} = N \text{ gallons} \quad (0.9375 \text{ gallons})$$

Practice Unit Cancellation:

4. **The label says to apply 10 fluid ounces of insecticide per 1,000 sq. ft. How many ounces do you need for 10,000 sq. ft.?**

5. **How many gallons would that be? 1 gallon = 128 fluid ounces**

6. **The label says to apply 0.5 gallons of herbicide per acre. How many gallons would you need to treat 200 acres?**

Answers Unit Cancellation:

4. **The label says to apply 10 fluid ounces of insecticide per 1,000 sq. ft. How many ounces do you need for 10,000 sq. ft.?**

$$\frac{10 \text{ fl oz}}{1,000 \text{ sq ft}} \times 10,000 \text{ sq. ft.} = 100 \text{ fl oz}$$

5. **How many gallons would that be? 1 gallon = 128 fluid ounces**

$$\frac{1 \text{ gal}}{128 \text{ fl oz}} \times 100 \text{ fl oz} = 0.78 \text{ gallons}$$

6. **The label says to apply 0.5 gallons of herbicide per acre. How many gallons would you need to treat 200 acres?**

$$\frac{0.5 \text{ gal}}{1 \text{ acre}} \times 200 \text{ acres} = 100 \text{ gallons}$$

Answers for more Unit Cancellation problems:

7. ***The label says to apply 20 fluid ounces per acre. How many fluid ounces do you need to treat 4,356 sq. ft?***

$$\frac{20 \text{ fl oz}}{1 \text{ acre}} \times \frac{1 \text{ acre}}{43,560 \text{ sq ft}} \times 4,356 \text{ sq ft} = 2 \text{ fl oz}$$

8. ***The label says to apply 8 fluid ounces of pesticide per acre. How many fluid ounces of product do you need for 15 acres?***

$$\frac{8 \text{ fl oz}}{1 \text{ acre}} \times 15 \text{ acres} = 120 \text{ fl oz}$$

9. ***The label says to apply 2 fl. ounces of pesticide per 1,000 sq. ft. How many fluid ounces should you apply to 20 acres? How many gallons is this?***

$$\frac{2 \text{ fl oz}}{1,000 \text{ sq ft}} \times \frac{43,560 \text{ sq ft}}{1 \text{ acre}} \times 20 \text{ acres} = 1,742 \text{ fl oz}$$

$$\frac{1 \text{ gal}}{128 \text{ fl oz}} \times 1,742 \text{ fl oz} = 13.6 \text{ gallons}$$