PENN STATE

**Wildland Weed Management**
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# Simple Sprayer Calibration

*Calibration* is determining the output of a sprayer so that you know how much spray material you are applying to a given area. You must know this if you wish to apply an herbicide at a specific dosage, which is described as an amount of product per given area (ex. ounces per acre).

We will use a backpack to do simple calibration, simulating a fixed speed, fixed pattern application; and simulating a spot treatment.

When calibrating a backpack sprayer, we can simplify the procedure by using the 'Ounces to Gallon' method.

This method is based on making the calibration application to an area of 1/128 of an acre, or 340 square feet (43,560/128=340). We do this because 1 gallon equals 128 ounces. By treating 1/128th of an acre, we can convert a measurement of *ounces* of water sprayed to the 340 sq. ft calibration area directly to *gallons* sprayed per acre. Applying 30 ounces to 340 sq. ft. is the same coverage as applying 30 gallons to an acre.

Once we have determined our coverage in gallons per acre (GPA), we can determine how much area our sprayer will cover and how much herbicide we need to add to cover that area.

We will use this method to calibrate two types of application:

- a band application simulating a fenceline application
- a spot treatment simulating a handgun application

## *Example: Band Application*

A band application is a fixed-width, fixed speed application. Use the following steps to calibrate this application:

- lay out a treatment area equal to 340 sq. ft.
- measure the time it takes to treat the sample area.
- measure how many ounces you apply in the amount of time it takes to treat the sample area.

### Lay Out the Sample Area

The sample area will cover 340 sq. ft. To determine the length, determine the width of your treated band, and divide the width (in feet) into 340. If you are going to treat a 4-foot wide pattern, then the length of the sample row is 85 feet (340/4=85).

### Time Your Application to the Sample Area

When you measure the time required to treat the sample area, operate the backpack as you will when spraying. Therefore, determine how high you need to hold the boom to treat a 4-foot width, and treat the 85-foot course with only water in your backpack as you are measuring your time to cover the distance.

Measure the time it takes to cover the sample distance several times to get a reliable average time.

### Measure the Ounces Needed to Treat the Sample Area

Once you know how long it takes to treat the sample area, collect the amount of spray solution your sprayer delivers in that time to determine the GPA of your application.

If it took you 15 seconds to cover the sample area, then you collect the spray from your sprayer for 15 seconds and measure it in ounces.

When collecting, it is important to pump the sprayer the same way you will pump it when you are making the application. If you pump less frequently when you collect the solution from your sprayer, you will underestimate your volume and coverage. This means you will cover less area with your sprayer than you estimated and apply a higher dose of herbicide than you intended. If you pump more during the measurement than you would in the field, you will overestimate your volume. You will cover more area than you calculated, and you will apply a lower dosage than you intended.

To get a reliable average volume, repeat the measurement. An alternative is to collect the solution for a 'multiple' time period. If the sample collection time is 15 seconds, you could collect the solution for 30 seconds, and divide the collected ounces by 2 to get the ounces collected per 15 seconds (or collect for 45 seconds and divide by 3, etc.).

### Determine Your Mixture

Now that you have determined your GPA, you can calculate how much of an acre your sprayer will cover. For our example, let's assume you have a 3-gallon backpack sprayer that you will fill to 2.5 gallons. Set up a comparison, as shown below, to determine how much of an acre your backpack sprayer will cover.

If we collected 20 oz (20 GPA), we would do the following calculation:

$$\frac{20 \text{ gal}}{1 \text{ acre}} = \frac{2.5 \text{ gal}}{\_?\_ \text{ acre}}$$

You 'cross multiply' to determine '?', as follows:

2.5 gal X 1 acre ÷ 20 gal = 0.12 acre.

Therefore, our 2.5 gallons of mix will cover 0.12 acres.

We will use '0.12' as our 'acre fraction' to determine how much herbicide to add to our backpack sprayer.

For our example, we'll use the following mix to prevent Japanese stiltgrass from growing along a trail:

| | |
|---|---|
| 'Plateau' | 2 oz/acre |
| 'Pendulum AquaCap' | 96 oz/acre |

When we apply our 'acre fraction', we determine the

following amounts to add to our 2.5 gallons of solution:

'Plateau' 0.12 X 2 oz = .24 ≈ **0.25 oz**

'Pendulum AquaCap' 0.12 X 96 oz = 11.5 ≈ **12 oz**

For small volumes, such as for 'Plateau', it is best to convert to metric measurement and determine your amount in milliliters (mL). You can purchase graduated cylinders in sizes such as 10 mL, 25 mL, and 50 mL to handle measurement of small quantities. This is more precise than using teaspoons and tablespoons, which are the English-system measurements that would accommodate volumes less than an ounce.

1 oz = 29.6 ≈ 30 mL

0.25 oz X 30 mL/oz = 7.5 mL

If wish to keep all your measurements metric, you can convert the 'Pendulum AquaCap' values as well.

12 oz X 30 mL/oz = 360 mL

### Determine Your Coverage

To provide a check on how reliable your calibration is, determine how much area you will cover. The 'acre fraction' we calculated for 2.5 gallons, applied at 20 GPA was 0.12. If we multiply the 'acre fraction' by the square feet in an acre, we can calculate how many feet of row we should be covering with our sprayer.

'acre fraction' X sq. ft in acre = sq. ft. treated

or, with numbers

0.12 X 43,560 sq. ft. = 5,227 sq. ft

Our sprayer delivering 20 GPA should cover about 5,227 sq. ft per 2.5 gallon load. If we divide 5,227 sq. ft by the width of our pattern, 4 feet, we will know the length of row we should treat with each backpack.

5,227 sq. ft ÷ 4 feet = 1307 feet

Knowing how far you should cover provides you a way to 'field check' your calibration.

## *Example: Spot Application*

A second variation for calibrating your backpack sprayer is spot application of weeds growing in desirable groundcover. For example, if you have some mile-a-minute you wish to treat, you can estimate your spray coverage so that your mix will be effective without over-applying. For this procedure, use the following steps:

- measure a test area of 340 sq. ft (ex. 17 by 20 ft.) that has vegetation representative of what you will target with your spot application
- treat *all* the vegetation in the test area the same way you would treat the target weed
- using the 'subtraction method', determine how many ounces you applied to the test area.

In this procedure, you estimate your GPA by treating all the vegetation in a known area in the manner you intend to treat isolated targets. This will provide you a reasonable estimate of your coverage, and allow you mix more precisely than simply guessing a percent solution.

To determine your GPA, you will mark the water level in your sprayer prior to the test application, and *determine by subtraction* what volume you sprayed as you refill the sprayer to the original water level from a graduated container with a known amount a solution. If you start with 64 oz in the container, and have 29 oz left when you refill the sprayer, your application volume is
64 oz – 29 oz = 35 oz = 35 GPA

For this example, we want to apply 'Garlon 3A' at 32 oz/ac, and we are going to mix 2.5 gallon of solution for each backpack load.

To determine how much 'Garlon 3A' to add to our backpack, we do the same calculation we did in the fixed pattern example.

$$\frac{35 \text{ gal}}{1 \text{ acre}} = \frac{2.5 \text{ gal}}{\_?\_ \text{ acre}}$$

You 'cross multiply' to determine '?', as follows:

2.5 gal X 1 acre ÷ 35 gal = 0.071 acre.

We will use '0.071' as our 'acre fraction' to determine how much of our intended herbicide mix to add to our backpack sprayer. For our example, we'll use the following mix:

'Garlon 3A 32 oz/acre

'Timberland 90' (surfactant) 0.25 % by volume

When apply our 'acre fraction', we determine the following amounts to add to make 2.5 gallons of solution:

'Garlon 3A' 0.071 X 32 oz = **2.3 oz**

surfactant: 2.5 gal X 128 oz/gal = 320 oz;

320 oz X 0.0025 = **0.8 oz**

2.3 oz X 30 mL/oz = 69 mL

0.8 oz X 30 mL/oz = 2.4 mL

Therefore, for 2.5 gallons of mix, add 69 mL of 'Garlon 3A' and 2.4 mL of 'Timberland 90'.

There will always be variation in spot treatment, but taking the time to calibrate the application will ensure that you are using the dose of herbicide that you need.

You should also do this for each applicator if you have more than one person doing the treatment. Each applicator's idea of adequate coverage is different.

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