# SPRAYER CALIBRATION AND CLEANING

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## General Information

Accurate application of herbicides is essential to adequately control weeds, avoid excessive crop injury and minimize chemical costs. This has become even more critical in recent years as we have seen some herbicide rates go from pounds per acre to fractions of one ounce per acre. Sprayer calibration, unfortunately, is often neglected or avoided. There are many ways to calibrate a sprayer, some more difficult than others, if you have a reliable method with which you are comfortable, stick with it. The following information is provided as a guide to a couple of simple, straightforward methods.

Regardless of the method, sprayer calibration should be done with clean water, not with the chemical mix in the spray system. Prior to beginning calibration, thoroughly clean your sprayer. Also, be sure to check for nozzle uniformity, as defects or uneven wear may cause some nozzles to put out significantly more than others of the same type. To do this, catch and measure the output of *each* nozzle for a specific length of time (30 seconds, 1 minute, etc.) and determine the average output per nozzle (total combined output of all nozzles divided by the number of nozzles). Discard and replace any nozzle that varies more than 5 percent from the average.

## 1/128 acre method

This is perhaps the most frequently used and quickest method of calibration. Unlike the previous method, it involves measuring a specific driving distance rather than an area. Follow these steps to calibrate by the 1/128 acre method.

1. Measure a specific distance in a field according to the table below. Select a driving distance which matches the nozzle spacing on your boom (for broadcast sprays) or row spacing you use (for band applications). The distance should be measured in a field typical of those you will be spraying.

| Nozzle or Row spacing (inches) | Distance to time for calibration (feet) | Nozzle or Row spacing (inches) | Distance to time for calibration (feet) |
|---|---|---|---|
| 40 | 102 | 26 | 157 |
| 38 | 107 | 24 | 170 |
| 36 | 113 | 22 | 185 |
| 34 | 120 | 20 | 204 |
| 32 | 127 | 18 | 227 |
| 30 | 136 | 16 | 255 |
| 28 | 146 | 14 | 291 |

2. Select a gear and engine speed combination which will allow you to comfortably drive across your fields and develop adequate spray pressure for the particular nozzles on your rig. Drive the measured distance at the preselected gear and engine speed combination and record the time required to drive the distance in seconds. To improve precision, you may want to time two separate runs and take the average of two runs.

3. Park the sprayer and using a measuring cup or bucket, catch the spray output from a single nozzle for the length of time it took you to drive the measured distance in step one. Be sure

that the sprayer is running at the same engine speed and spray pressure. Note: For banding rigs where you used row spacing to determine the distance in step 1 and where more than one nozzle is directed to the row, catch the output for all nozzles directed to a single row.

4. The total amount of water, measured in ounces, collected per nozzle or row in step 3 equals gallons per acre (GPA).

## Determining how much chemical to add to the tank.

Now that you have successfully calibrated your sprayer, the next step is to determine how much chemical you need to add to the tank.

1. Divide the tank capacity by gallons per acre to calculate the number of acres a full tank can spray.

$$\frac{\textbf{Tank capacity (gallons)}}{\textbf{GPA}} = \textbf{Number of acres covered by one full tank}$$

2. Multiply the recommended herbicide rate (pts./A, oz./A, lbs./A, etc.) by the number of acres covered by a full tank.

3. Note: All herbicide rates in this weed control manual are expressed as broadcast rates. For band applications, you must adjust the rate using the following formula:

$$\frac{\textbf{Band Width X Broadcast Rate}}{\textbf{Row Width}} = \textbf{Band Rate}$$

Use the previous formula to adjust rates if you have calibrated your sprayer on a row width basis for band applications.

## Calibration Examples

**Broadcast Application**

A producer plans to spray generic glyphosate plus nonionic surfactant for burndown on cotton ground. His sprayer has a uniform nozzle spacing of 18 inches. He has thoroughly cleaned his sprayer and replaced all non-uniform nozzles.

1. From the chart, note that the distance to drive is 227 feet. Measure this distance in the field to be sprayed.
2. At the desired engine speed and gear combination, let’s assume it took 39 seconds to cover 227 feet. This is 4 mph.
3. At the same engine speed and spray pressure, catch the output in ounces. Our producer caught 20 ounces during the 39 second time period. Output is therefore 20 GPA.
4. After reading the generic glyphosate label and the weed control manual recommendations for cotton, he decides to spray glyphosate at 1.5 pts./A plus nonionic surfactant at 1 qt./100 gallons of spray mix. Let’s assume he has a 500 gallon spray tank.

$$\frac{\textbf{500 gal per tank load}}{\textbf{20 GPA}} = \textbf{25 acres covered by one tank load}$$

1.5 pts./A X 20 acres = 30 pints (3.75 gallons) of glyphosate per tank load

**What about the surfactant?**

500 gal. X 1 qt. / 100 gal = 5 qts. per tank load.

**Band Application**

A producer wants to apply Staple plus nonionic surfactant in a 19 inch band on 38 inch rows. His banding rig is set up with three nozzles directed to the band on each row. The sprayer has been thoroughly cleaned, and the nozzles are uniform in output.

1. The distance to travel for a 38 inch row is 107 feet. The course is measured and he drives it. Let's assume it took 18 seconds (4 mph).
2. Park the sprayer and at the same engine speed and pressure, collect the output of each of the three nozzles for 18 seconds. If the combined total output of the three nozzles is, for example, 25 ounces, the sprayer is applying 25 gallons per acre.
3. The sprayer has a 200 gallon tank. The broadcast rate for Staple is 1.2 oz./A, and nonionic surfactant is to be added at 1 qt./100 gal. of spray mix.

$$\frac{\textbf{200 gal. tank}}{\textbf{25 GPA}} = \textbf{8 acres covered per tank}$$

4. Now, reduce the rate for a 19 inch band.

$$\frac{\textbf{19 inch band}}{\textbf{38 inch row}} \times \textbf{1.2 oz./A} = \textbf{0.6 oz.}$$

8 acres X 0.6 oz./A = 4.8 oz. Staple per tank

200 gallons X 1 qt./100 gal. = 2 qts. nonionic surfactant per tank

Note that since the surfactant rate in this example is based on amount per volume of spray mix, rather than amount per acre, it is calculated the same as for broadcast applications.

**Post-Directed and Hood Applications**

A producer plans to use a hooded sprayer to make post-directed and hooded applications in his 38 inch row cotton. The producer realizes that the gallons per acre (GPA) under the hood needs to be as close as possible to the GPA of his post-directed band. The hooded rig is set up to use two nozzles post-directing on a 13 inch band and has three nozzles under the hood spraying a 25 inch band.

**Scenario 1: One pump applying one tank mix.**

1. The distance to travel for a 38 inch row is 107 feet. The course is measured and he drives it. Lets assume it took 18 seconds (4mph).

2. Park the sprayer and at the same engine speed and pressure, collect the output of the three nozzles under the hood for 18 seconds. Combine the output of the three nozzles and measure. The combined total, for example 20 ounces, equals the application rate in GPA. In this case the hoods are applying at 20 GPA.

3. Next, with the sprayer running at the same engine speed and pressure, collect the output of the two post-directing nozzles. Combine the output from these two nozzles and measure. The combined total, for example 13 ounces, equals the application rate in GPA. In this case the post directing nozzles are applying at 13 GPA.

4. Remember, you want the application rate to be the same for both the post-directed and hooded application. To accomplish this, decide which application rate fits your particular needs. In this example we will assume that 13 GPA post-directed is ideal. To get your hooded application to be 13 GPA instead of 20 GPA, reduce the size of the spray tips under the hood and re-run the calibration procedure. Continue this process until your hooded application rate and post-directed application rate are similar.

**Scenario 2. Two pumps applying separate tank mixes.**

1. The distance to travel for a 38 inch row is 107 feet. The course is measured and he drives it. Let’s ssume it took 18 seconds (4mph).

2. Park the sprayer and at the same engine speed and pressure, collect the output of the three nozzles under the hood for 18 seconds. Combine the output of the three nozzles and measure. The combined total, for example 18 ounces, equals the application rate in GPA. In this case the hoods are applying at 18 GPA.

3. Next, with the sprayer running at the same engine speed and pressure, collect the output of the two post-directing nozzles. Combine the output from these two nozzles and measure. The combined total, for example 15 ounces, equals the application rate in GPA. In this case the post directing nozzles are applying at 15 GPA.

4. Remember, you want the application rate to be the same for both the post-directed and hooded application. To accomplish this, decide which application rate fits your particular needs. In this example we will assume that 15 GPA post-directed is ideal. To get your hooded application to be 15 GPA instead of 18 GPA, you have two options. First reduce the pressure for the pump applying under the hood. Caution: Be sure that after reducing the pressure the spray tip still produces an acceptable spray pattern. Re-run the calibration procedure. Continue this process until your hooded application rate and post-directed application rate are similar. The second option is to change to a smaller spray tip size under the hood to reduce the application rate to 15 GPA. Then re-run the calibration procedure. Continue this process until your hooded application rate and post-directed application rate are similar.

## Proper Sprayer System Cleaning

Small amounts of herbicides left in sprayers can cause serious damage to sensitive crops. Traces of phenoxy (and phenoxy type) herbicides commonly used for pasture weed control such as 2,4-D, Banvel, Weedmaster, Crossbow, etc. can create serious problems if sprayed on crops such as tobacco, cotton, tomatoes and many other vegetables. Most of these herbicides, particularly the ester formulation of 2,4-D and Crossbow, are difficult to thoroughly wash out of a sprayer. For this reason, we recommend using a dedicated sprayer for pasture and brush control herbicides. The “new” herbicide chemistry (sulfonylureas and imidazolinones) has created sprayer cleaning challenges. Herbicides such as Accent, Classic, Exceed, Staple, Scepter and others have a high unit activity (very active at a small amount per acre). Small amounts of these materials to cause serious damage to non-target, susceptible crops.

Tank is only one part of the sprayer. You can do an excellent job of cleaning the tank, but if residues are left in the hoses, strainers and pump, serious damage can still occur. Herbicides can be absorbed into the lines, in addition to polyethylene or fiberglass tanks, where they can remain for a long time. Some dry flowable and wettable powder formulations build up on the bottoms of spray tanks, particularly in sprayers with inadequate agitation. The longer a spray mix is left in the system, the greater is the potential contamination problem. **Sprayers should be cleaned as soon as practical and herbicide spray mixtures should never be allowed to dry in the sprayer.** Personal protective equipment, as outlined on the label for that herbicide, should be worn during clean-up. Do not clean sprayers near wells, sink holes, creeks or other surface water, or near desirable vegetation.

Many herbicide labels have sprayer cleanup recommendations on the label. For example, the sprayer cleanup guidelines on the Classic label outline a procedure using household ammonia at 1 gal. of ammonia for each 100 gallons of water. The guidelines for other sulfonylurea herbicides are similar. Ammonia is also useful for helping to clean 2,4-D ester residues out of the sprayer, in that the ammonia actually changes the less soluble ester into a more highly water soluble ammonium salt of 2,4-D. Many commercial tank cleaners are available and most do a good job, if properly used, of cleaning a sprayer. They are just like ammonia, in that plenty of water and proper procedure are required.

**Sprayer cleaning procedure:**

1. Drain spray equipment. Rinse the tank and flush hoses, boom and nozzles with clean water. Loosen and physically remove any visible deposits.

2. Fill the sprayer with clean water and add household ammonia (one gallon of a 3% active ammonia product for every 100 gallons of water). Flush the hoses, boom and nozzles. Shut-off the boom and then top-off the tank with water. Let the material circulate for at least 15 minutes, then flush the hoses, boom and nozzles again. Drain the tank.

3. Remove screens, strainers and tips and clean in a bucket of water.

4. Repeat step 2.

5. Thoroughly rinse the tank, hoses, boom and nozzles.

Remember to clean all other associated application equipment. Personal protective equipment, as outlined on the label for that herbicide, should be worn during clean-up. Do not clean sprayers near wells, sink holes, creeks or other surface water, or near desirable vegetation.