

# Sprayer Calibration and Cleaning

M.W. Marshall, Ph.D., Extension Weed Specialist

## 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.

- 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.
- 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.

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

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

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

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

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.

- From the chart, note that the distance to drive is 227 feet. Measure this distance in the field to be sprayed.
- At the desired engine speed and gear combination, let's assume it took 39 seconds to cover 227 feet. This is 4 mph.
- 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.
- 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.

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

$$1.5 \text{ pts./A} \times 25 \text{ acres} = 37.5 \text{ pints (3.75 gallons) of glyphosate per tank load}$$

### What about the surfactant?

$$500 \text{ gal.} \times 1 \text{ qt. / 100 gal} = 5 \text{ qts. per tank load.}$$

## 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.

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

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

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

$$8 \text{ acres} \times 0.6 \text{ oz./A} = 4.8 \text{ oz. Staple per tank}$$

$$200 \text{ gallons} \times 1 \text{ qt./100 gal.} = 2 \text{ qts. nonionic surfactant per tank}$$

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 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 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.

