Improving Sprayer Accuracy

Simple Methods for Correct Calibration

by Tom Karsky

Accurate sprayer application is important for good farm management. Improper calibration is not only expensive, resulting in the overuse of materials, but it can be damaging to crops as well. Proper sprayer application is also necessary for human and environmental safety. The following methods will help you determine correct calibration.

Suppose you intend to apply an herbicide at a rate of 3/4-pound active ingredient (a.i.) per acre at a cost of $25 per pound a.i. The cost of material is $18.75 per acre. If you make an application error and over apply by 30 percent, for example, you'll waste $5.75 an acre (30% of .75 lbs = .23 lb; .23 lbs @ $25/lb = $5.75). If this application covers 200 acres, you are wasting $1,150 in excess material.

It takes approximately one hour to calibrate a spray rig. In that time you can earn $1,150 for yourself.

The other possibility is under application. It has been estimated that a 20 percent under application of an herbicide can reduce control by 50-60 percent. This may require a repeat application and a doubling of cost.

Methods for Correct Calibration

To get the most efficient use out of your sprayer and avoid unnecessary costs, correct calibration is important. Before you calibrate your sprayer, however, make sure that it is working properly and that all the nozzles are cleaned and the system flushed out. The general formula for calibration is:

$$GPA \text{ (gallons per acre)} = \frac{5940 \times GPM \text{ (gallons per minute) per nozzle}}{MPH \text{ (speed)} \times W \text{ (nozzle spacing in inches)}}$$

The first thing you want to check is the ***sprayer speed*** (MPH). Even if you are using a speedometer to gauge speed, slippage on the ground surface can cause speedometer errors of as much as 30 percent. You need to mark a course and time how long it takes to travel that distance. The minimum distance should be 100 feet. The longer the distance, the more accurate your speed determination will be. Use the following table to determine the actual speed. This formula will help you determine proper calibration, of the amount of material to apply in gallons per acre (GPA). You can also rewrite this formula to calculate sprayer speed in MPH. That is, if you want to know what speed is required to apply a certain amount of material in gallons per acre, then use

$$MPH = \frac{5940 \times GPM^{*}}{GPA \times W}$$

* Abreviations:
GPA = Gallons Per Acre
GPM = Gallons Per Minute Per Nozzle
MPH = Miles Per Hour
W = Nozzle Spacing in Inches
5940 = A constant to convert gallons per minute, miles per hour, and inches to gallons per acre.

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Speed in MPH	Time required in SECONDS to travel a distance of:		
(miles per hour)	100 feet	200 feet	300 feet
3.0	23	45	68
3.5	20	39	58
4.0	17	34	51
4.5	15	30	45
5.0	14	27	41
5.5	12	25	37
6.0	—	23	34
6.5	—	21	31
7.0	—	19	29
7.5	—	18	27
8.0	—	17	26
8.5	—	16	24
9.0	—	15	23

The next step is to determine the ***nozzle output****. To do this, you need a calibrated catch container. This can be any container that has markings on it for ounces, such as a measuring cup or baby bottle. Make sure that the difference between markings is small. For example, do not use a container that has markings every four ounces. Ideally, it should have markings every one or two ounces. Spray equipment suppliers should have calibrated containers available.

An easy way to determine the output of the nozzle is to use the ***47 second catch*** method where the ounces you collect in 47 seconds divided by 100 equals the GPM (gallons per minute) output of the nozzles. You need to check all the nozzles to determine if any or all are worn.

The 47 Second Catch Method

$$GPM = \frac{\text{ounces collected in 47 seconds}}{100}$$

To determine the gallons per acre, use one of these formulas:

For 20" spacing GPA = $\frac{300 \times GPM}{MPH}$ *or* $\frac{3 \times ozs^*}{MPH}$

For 30" spacing GPA = $\frac{225 \times GPM}{MPH}$ *or* $\frac{2.25 \times ozs^*}{MPH}$

For 40" spacing GPA = $\frac{150\ GPM}{MPH}$ *or* $\frac{1.5 \times ozs^*}{MPH}$

**Ounces collected in 47 seconds*

* *Once the GPM has been determined then select the proper nozzle size from spray nozzle catalog charts.* ***Note****: These charts are calibrated for water, if the solution is heavier or lighter than water use the conversion charts in the catalog. Charts are also available in catalogs to determine pressure drop in the system due to hoses.*

Record the amounts and average them. If any vary more than 10 percent from the average, replace them. If several fall into that category, replace the whole set. With the ***47 second catch*** method you can simplify the math by using the following formulas:

If you have a ground-driven sprayer, or choose to collect output from the sprayer as it is traveling, you may want to use the ***ounce method*** to determine sprayer output. When using this method, ***the ounces that you collect are equal to gallons per acre output*** of the sprayer. Use the following chart to determine the distance you need to collect spray. Make sure you flush the system and that the sprayer is operating fully for some time at the proper speed before you collect spray. Collect from several nozzles and average them.

Ounce Collected Method

Calibration Distances

Row or Nozzle Spacing (inches)	Calibration Distances (feet)*
40	102
38	107
36	113
34	120
32	127
30	136
28	146
26	157
24	170
22	185
20	204
18	227

* Number of feet to collect output so that ounces collected per nozzle = Gallons Per Acre

Adding Tank Material

After you have determined that your sprayer is delivering the amount of spray that it should, you need to add the correct ***amount of material to the tank.*** Always follow label directions for adding material to the tank. See the *Useful Formulas and Equivalents* section for conversion of ounces to pints on the back of this publication.

Suppose that you have a liquid material recommendation that calls for .5 lb/a.i. per acre and it