AGRICULTURAL
GUIDE
Published by the University of Missouri-Columbia Extension Division
Farm Equipment

Sprayer calibration, Part 2—Band sprayers

Maurice R. Gebhardt, Agricultural Research Service, USDA

Pesticides are effective only after they have been applied in the correct amount. Too much pesticide can cause crop injury and leave harmful residues. Too little pesticide may cause inadequate and undependable control.

The number of gallons applied per acre depends on (1) nozzle size, (2) pressure of the spray, and (3) ground speed of the sprayer.

Spray calibration is a procedure to determine how much water and chemical is applied per acre.

Calibration

Step 1. Determine Width Covered by Sprayer. The width covered by the sprayer is equal to the number of nozzles multiplied by the band width applied with each nozzle. Divide this number by twelve to get the width covered in feet. Figure 1 shows a typical arrangement of nozzles on a band sprayer.

Step 2. Check General Sprayer Operation. Fill supply tank with water and operate pump. Check for leaks, proper operation of pressure gauge, and for clogged nozzles.

Place a container such as a quart fruit jar under each nozzle and see if all jars fill in about the same time. You may want to use a watch with a sweep second hand and collect the output from each nozzle for the same amount of time. If there is much variation, check for clogged nozzles and that all nozzles are the same size. Nozzles which continue to show a variance greater than 10 percent should be replaced.

Step 3. Time Sprayer Over a Measured Course. Measure a course in the field where you will be spraying. The length of this course should be 300 feet. Operate the sprayer at the speed to be used in the field. Mark the tachometer and record the tachometer reading for use when spraying. Spray at the same speed as when calibrating. If you do not have a tachometer, mark the throttle setting and gear. Measure the time required to make one round trip (don't include the time required for turning). An ordinary pocket or wrist watch with a second hand is sufficiently accurate. Record this time for use later in Step 5.

Step 4. Refill Spray Tank. Move the sprayer to a level area near a source of water. With the sprayer in a stationary position, completely fill the tank with water. Be sure that the tank is full so water is just beginning to spill over the edge.

Step 5. Operate Sprayer for Measured Time. Without moving the sprayer, operate it for a period of time equal to that required to make the round trip over the measured course as determined in Step 3. Be sure sprayer is operated at same pressure as will be used when spraying.

Step 6. Measure Amount of Water Required to Refill Supply Tank. Use a bucket graduated in gallons and half gallons. A quart fruit jar can also be used for finer measurements. Record this amount for use in Step 9.

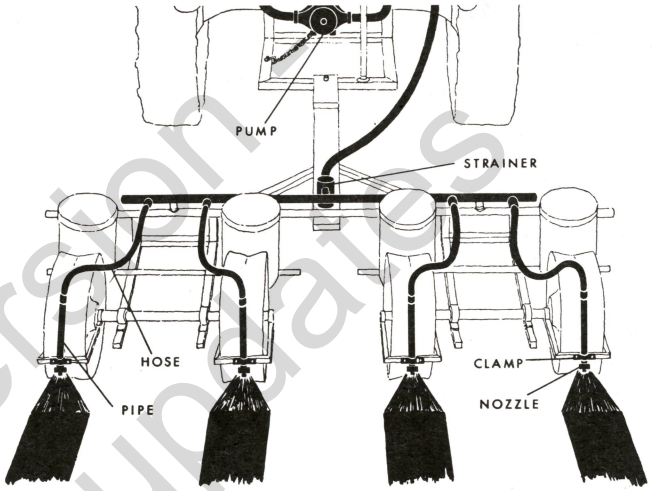

Figure 1. Typical arrangement of nozzles on a band sprayer. The spray width (w) is equal to the number of nozzles times the band width.

Step 7. Determine Area Covered. The area covered is equal to the width covered (Step 1) times the round trip distance (Skip this step if you use Table 2).

Area Covered = Width Covered x Round Trip Distance

Table 1. ACRES SPRAYED FOR BAND WIDTHS IN INCHES AND NUMBER OF ROWS WHEN SPRAYING A 600-FOOT COURSE.

Number of Rows	Band Width (inches) 10	12	14	16	18	20
2	.023	.028	.032	.037	.041	.046
4	.046	.055	.064	.073	.083	.092
6	.069	.083	.096	.110	.124	.138
8	.092	.110	.129	.147	.165	.184

Step 8. Determine Acres Covered. Divide area covered (Step 7) by 43,560 (number of square feet in one acre) or:

$$\text{Acres Covered} = \frac{\text{Area Covered}}{43{,}560}$$

You can use Table 1 which shows the acres for band widths and number of rows that are common to band sprayers rather than do the calculation. You must do the calculation if your band width is not listed in Table 1.

Table 2. MULTIPLICATION FACTORS FOR BAND WIDTHS AND NUMBER OF ROWS WHEN SPRAYING A 600-FOOT COURSE.

Multiply the number in this table by the gallons required to refill the tank (Step 6) to obtain the gallons per acre (GPA).

Number of Rows	Band Width (inches) 10	12	14	16	18	20
2	43.5	35.8	31.3	27.0	24.4	21.7
4	21.7	18.2	15.6	13.7	12.0	10.9
6	14.5	12.0	10.4	9.1	8.1	7.2
8	10.9	9.1	7.8	6.8	6.1	5.4

Step. 9 Determine Gallons Applied Per Acre. Divide gallons required to refill tank (from Step 6) by the acres covered (from Step 8) or:

$$\textbf{Gallons Per Acre (GPA)} = \frac{\textbf{Gallons to Refill Tank}}{\textbf{Acres Covered}}$$

As an alternative to the formula you can use Table 2 if your band width and number of rows are listed in this table. Multiply the factor opposite your number of rows and under your band width by the number of gallons required to refill the tank. The answer is the gallons applied per acre.

EXAMPLE

You have a 6-row planter equipped with six nozzles that apply a 14-inch band per nozzle.

Step 1. Determine Swath Width.

$$\text{Swath Width} = \frac{\text{No. of Nozzles x Band Width}}{\text{12 (inches/foot)}}$$

$$= \frac{6 \times 14}{12} = 7 \text{ feet}$$

Step 2. Checked sprayer and found two nozzles that needed cleaning, and one nozzle had to be replaced.

Step 3. Measured a 300-foot course in the field. You find that it takes 41 seconds to drive in one direction and 39 seconds to drive the other direction or a total of 80 seconds for the round trip.

Step 4. Moved the sprayer to a level area near a water supply. The spray tank was then filled.

Step 5. Operated the sprayer for 80 seconds with the pressure adjusted for 40 psi.

Step 6. Measured the water required to refill the tank and found this to be 1½ gallons.

Step 7. Determine area covered (Skip this step if you use Table 2).

$$\text{Area covered} = \text{Width Covered (feet)} \times \text{Round Trip Distance (feet)}$$

$$= 7 \times 600 = 4200 \text{ square feet}$$

Step 8. Determine acres covered.

$$\text{Acres covered} = \frac{\text{Area Covered (Step 7)}}{43{,}560 \text{ (feet}^2\text{/acre)}}$$

$$= \frac{4{,}200}{43{,}560} = .096$$

If Table 1 is used for this step, the acres covered can be found by looking up a band width of 14 inches and six rows which is .096 acres. This agrees with our calculation.

Step 9. Determine gallons per acre (GPA).

$$\text{GPA} = \frac{\text{Gallons to Refill Tank (Step 6)}}{\text{Acres Covered (Step 8)}}$$

$$= \frac{1.5}{.096} = \textbf{15.6 gallons/acre} = \textbf{16 (to nearest gallon)}$$

This answer can be also found much easier if Table 2 is used. Opposite six rows and under the band width of 14 inches, find the factor 10.4. Multiply this number by the gallons measured in Step 6 and find:

GPA = 10.4 x 1.5 = 15.6 = 16 (to nearest gallon)

Again, find that this agrees with our calculation. The tables eliminate long division required in sprayer calibration.

Calibration Check

You can check calibration in a few minutes if you have a container with ounce graduations and a watch. You must know the speed and be sure the pressure used in the field is the same as used during this check.

Step 1. Place a container, such as a quart fruit jar, under each nozzle and see if all jars fill in about the same time. You may want to use a watch with a sweep second hand and collect the output from each nozzle for the same amount of time. If there is much variation, check for clogged nozzles and that all nozzles are the same size. Replace nozzles that continue to vary more than 10 percent.

Step 2. Collect output from at least three nozzles for one minute. Average these amounts and record this for use in the next step.

Step 3. Determine GPA—

$$\textbf{GPA} = \frac{\textbf{46.4 x oz. per minute}}{\textbf{Band Width x MPH}}$$

Example. You measured the output from three nozzles and the average flow rate was found to be 24 oz. per minute. Each nozzle applies a 14-inch band. You have checked your tachometer/speedometer and know your field speed will be 5 MPH.

Calculation—

$$\textbf{GPA} = \frac{\textbf{46.4 x 24}}{\textbf{14 x 5}}$$

= 15.9 gallons/acre
= 16 (to nearest gallon)

Note: This check can also be used for calibration if you are sure the assumed speed used in Step 3 is the same as you will be using in the field.

Check your field speed with this formula:

$$\textbf{MPH} = \frac{\textbf{distance traveled x 60}}{\textbf{time (seconds) x 88}}$$

Example—

$$\textbf{MPH} = \frac{\textbf{600 x 60}}{\textbf{80 x 88}}$$

= 5.11 miles/hour
= 5 (nearest MPH)

■ Issued in furtherance of Cooperative Extension Work Acts of May 8 and June 30, 1914 in cooperation with the United States Department of Agriculture. John W. Oren, Director, Cooperative Extension Service, University of Missouri and Lincoln University, Columbia, Missouri 65211. ■ An equal opportunity institution.