and the nozzle spacing or spray width on the sprayer. The rate can also be determined using the rate table (Table 3).

$$\text{Discharge Rate} = \frac{\text{Application Rate} \times \text{Speed} \times \text{Nozzle Spacing}}{5{,}940}$$

Table 3. Nozzle Discharge Rate Chart

	GPM for 20-inch nozzle spacing speed			
GPA	**3 MPH**	**4 MPH**	**5 MPH**	**7 MPH**
5	0.05	0.07	0.08	0.12
10	0.10	0.13	0.17	0.24
15	0.15	0.20	0.25	0.35
20	0.20	0.27	0.34	0.47
25	0.25	0.34	0.42	0.59
30	0.30	0.40	0.51	0.71

3. Set the sprayer as recommended for field operation and collect the spray from each nozzle. Determine the average discharge rate for the nozzles. If you selected a quick check nozzle during sprayer preparation, you can use it instead of collecting from each nozzle.

4. Compare the rate calculated in Step 2 to the rate determined in Step 3. If the two do not match, make the recommended adjustment as explained in Making Adjustments and repeat the calibration steps until the rates match.

AREA METHOD

1. Determine the distance (feet) that can be sprayed by one full sprayer tank using the full working width of the boom.

$$\text{Spray Distance} = \frac{\text{Tank Volume} \times 43{,}560}{\text{Application Rate} \times \text{Boom Width}}$$

2. Layout a test course that is at least 10% of this distance. If this distance is too long to be practical in the field, select a shorter distance. Set the sprayer as recommended, mark the level in the tank, and drive the course while spraying water.

3. Carefully measure the volume of water required to refill the tank to the original mark. Calculate the application rate with the equation below.

$$\text{Application Rate (GPA)} = \frac{\text{Volume Sprayed (gal)} \times 43{,}560}{\text{Spray Distance (ft)} \times \text{Boom Width (ft)}}$$

4. Compare the application rate measured for the nozzle to the rate determined in Step 3. If the two do not match, make the recommended adjustments explained in Making Adjustments and repeat the calibration steps until the rates match.

Making Adjustments

If the sprayer calibration is not correct, choose one of the following adjustments to improve accuracy.

- Pressure–adjust if error in rate is less than 10%.
- Ground Speed–adjust if error, in rate is greater than 10% but less than 25%.
- Nozzle Size–change if error in rate is greater than 25%.

Your goal should be application rate errors less than 5%. Once you have the required accuracy, calibration is complete.

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5,000 copies of this public document were printed at a cost of $1,341 or $0.27 per copy.

Published by
North Carolina Cooperative Extension Service

3/04–5M–JMG (Reprint) AG-587
E04 43966

CALIBRATING FIELD SPRAYERS

Preparing to Calibrate

Before beginning to calibrate, carefully inspect the sprayer to be sure it is in proper operating condition. Check all nozzles on the sprayer for proper type and pattern. Check the output or discharge rate of each sprayer nozzle, and determine the average nozzle discharge rate for the sprayer. The nozzle discharge rate can be checked with a nozzle flow meter that measures in gallons per minute (GPM) or by using a measuring cup and stopwatch.

To calculate discharge rate using the cup and stopwatch, use the following equation.

$$\text{Nozzle Discharge Rate (GPM)} = \frac{\text{Ounces Collected} \times 60}{\text{Collection Time (seconds)} \times 128}$$

Replace any nozzles that are more than 10% above or below the average rate determined for the sprayer.

Review some key information about the product you are spraying:

- Application rate–gallons per acre (GPA)
- Nozzle type and size, droplet size, shape of pattern
- Nozzle pressure–pounds per square inch (PSI)

Next, determine or decide how the sprayer is to be operated:

- Type of application–broadcast, band, or directed
- Nozzle spray width–inches (in.)
- Ground speed–miles per hour (MPH)

For broadcast applications, nozzle spray width is the nozzle spacing on the boom. For band applications, nozzle spray width is the width of the treated band on the ground. Unless otherwise stated, chemical application rates are quoted as broadcast rates. Band application will yield the same chemical rate per acre of treated land but less chemical will be used in the field due to the untreated area between the

bands. For directed sprays (multiple nozzles per row), nozzle spray width is the row width divided by the number of nozzles per row.

Set the sprayer for the operating conditions and adjustments you plan to use. Be sure the sprayer tank and components are clean. Use water only for calibration, filling the tank half full. If the spray mix has a density different than water, use the correction factor suggested by the chemical manufacturer in your calibration.

Select the gear and throttle setting on the tractor for the required ground speed. Measure a test course in the field (see Table 1) and drive the sprayer across the course at least twice, once in each direction. Average the times required for the course distance, and determine true ground speed (MPH) from the ground speed equation or use Table 1.

$$\text{Ground Speed (MPH)} = \frac{\text{Distance (ft)}}{\text{Seconds x 1.47}}$$

Table 1. Ground Speed Chart

Speed	Time (seconds) required to cover course distance				
MPH	100 ft	200 ft	300 ft	400 ft	500 ft
2	34	68	102	136	170
3	23	45	68	91	114
4	17	34	51	68	85
5	x	27	41	54	68
6	x	23	34	46	57
7	x	19	29	39	49
8	x	17	26	34	43
9	x	15	23	30	38
10	x	x	21	27	34

x = not recommended

If the tractor or sprayer is equipped with a true ground speed indicator, such as radar or ultrasonic, use this speed for calibration. Be sure the indicator itself has been properly calibrated.

Calibration Methods

Choose one of the following methods that best suits the type of equipment or application to be used.

BASIC METHOD

1. Set the sprayer as recommended for field operation. Collect the output from each nozzle and calculate the average nozzle discharge rate in gallons per minute (GPM). Use a flowmeter or the cup and stopwatch method explained in Preparing to Calibrate.

2. Set the tractor for the desired ground speed. Be sure to maintain accurate and consistent speed.

3. Calculate the application rate based on the average discharge rate for the nozzles, the ground speed and nozzle spacing (or spray width) on the sprayer.

$$\text{Application Rate} = \frac{\text{5,940 x Discharge Rate}}{\text{Ground Speed x Nozzle Spacing}}$$

4. Compare the application rate required to the rate determined in Step 3. lf the two do not match, make the recommended adjustment. Repeat the calibration steps until the rates match.

1/128th ACRE METHOD

1. The distance for one nozzle to cover 1/128th of an acre must be calculated from the equation below or use the distance table (Table 2).

$$\text{Spray Distance} = \frac{\text{4,084}}{\text{Nozzle Spacing (inches)}}$$

2. Measure the distance (feet) on a test course in the field. Set the gear and throttle speed of the tractor or sprayer as recommended. Drive the course at least twice, once in each direction, and calculate the average time to cover the course.

Table 2. Distance to Cover for Each Nozzle to Spray 1/128th Acre

Average Nozzle Spacing (inches)	Distance to Cover (feet)
6	681
8	510
10	408
12	340
14	292
16	255
18	227
20	204
22	186
24	170
30	136
36	113
38	107
40	102
42	97
48	85

3. Park the sprayer, set the recommended pressure, collect the output from all the nozzles, and calculate the average or select the nozzle closest to the average and collect the output for the time determined in Step 2. The number of ounces collected will indicate the application rate in GPA. For example, if 15 ounces are collected then the application rate would be 15 GPA.

4. Compare the application rate required to the rate determinted in Step 3. If the two do not match, make the recommended adjustments explained in Making Adjustments, and repeat the calibration steps until the rates match.

NOZZLE METHOD

1. Set sprayer ground speed as recommended. Be sure to maintain accurate and consistent speed.

2. Calculate the nozzle discharge rate in gallons per minute (GPM) based on the application rate required, the true ground speed determined over the test course,