Orchard Sprayer Calibration

Measured Release Method for Airblast or High-Pressure Sprayers. Due to the air blast or high pressures of larger sprayers, it is not possible to collect ejected liquid into a container. Therefore you must measure the output of the sprayer over a period of time by determining how much water was used.

Start by moving the sprayer to a level surface and fill the tank to its maximum with clean water; liquid must be at a level that can be duplicated when refilling. A convenient technique is to fill the tank with clean water to the point where it just begins to overflow. Use low-volume, low-pressure water, such as from a garden hose, for topping off the tank. Check for leaks around tank seals and in hoses. All nozzles must be clean and operating properly or the results will be inaccurate.

Stand upwind and operate the sprayer at its normal operating speed and pressure. Open the valves to all nozzles, starting a stopwatch at the



FIGURE 11-5.

It is not possible to collect the sprayed liquid from some types of sprayers. To determine the amount of liquid expelled by these sprayers: (1) fill the tank to a known level; (2) run the sprayer under normal conditions for a timed period; and (3) refill the tank to its original level, measuring the amount of water used.

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same time. Continue to run the sprayer for several minutes, then close the valves to all nozzles and record the elapsed time

If the tank has been calibrated and marked, the amount of liquid used will be apparent or can be determined with a calibrated dipstick. Otherwise, use a flow meter attached to a low-pressure filling hose and refill the sprayer to the original level. Record the gallons of water used; this volume is the amount of liquid sprayed during the timed run. Repeat this process two more times to get an average of sprayer output. Determine the gallons-per-minute output of the sprayer by using the calculations shown in Table 11-8.

TABLE 11-8.

Calculating Gallons-per-Minute for High Pressure Sprayers.

1. Record the elapsed time during each trial run and the amount of liquid sprayed:

EXAMPLE:

Run #	Time	Volume
1	1 min 45 sec	37.5 gal
2	1 min 30 sec	33.5 gal
3	1 min 50 sec	38.0 gal

2. Convert the time from minutes and seconds to minutes by dividing the seconds by 60 and adding this decimal to the minutes.

EXAMPLE:

Run #	min	sec	sec/60 = min
1	1	45	0.75 1.75
2	1	30	0.50 1.50
3	1	50	0.83 1.83

3. Divide the collected gallons for each run by the minutes, resulting in gallons-per-minute.

EXAMPLE:

Run #	gal/min = gpm
1	37.5/1.75 = 21.4
2	33.5/1.50 = 22.3
3	38.0/1.83 = 20.8

4. Add all the gallon-per-minute figures and divide this total by the number of runs (3 in this example) to get the average gallon-per-minute output.

EXAMPLE:

Run #	gpm
1	21.4
2	22.3
3	20.8

Total = 64.5

64.5/3 = 21.5 gpm average output

Width of Spray Swath. The final measurement needed to complete calibration is the width of spray swath being applied by the sprayer.

If the sprayer is used to apply pesticides to crop plants in an orchard or vineyard and plants on both sides of the sprayer are treated with one pass, the spray swath is equal to the width of the tree or vine row (Figure 11-12). But if spray is being applied only out of one side of the sprayer and the sprayer is moved along both sides of the tree or vine row, the swath is one-half the width of the tree or vine spacing

Use a tape measure to determine tree or vine row width; take several measurements within the orchard or vineyard to check if row spacing is uniform and consistent; average the results if any variation is found

To adjust an air blast orchard or vineyard sprayer to apply a given volume of water per acre, it is convenient to know the number of trees or vines per acre. After a tank of known volume is sprayed out, the number of trees or vines completely sprayed can be counted and the proportion of an acre covered is then easily figured. Travel speed can be

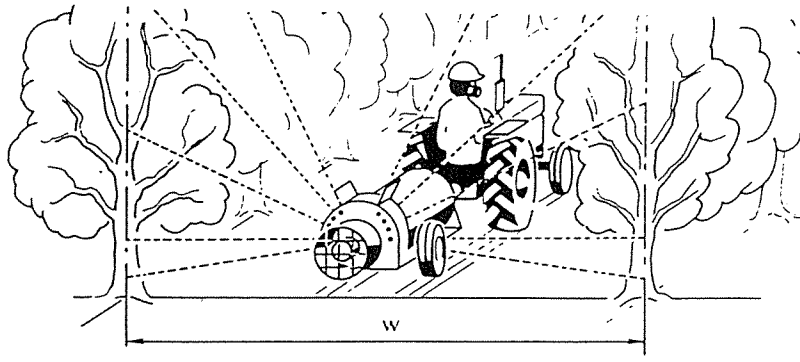
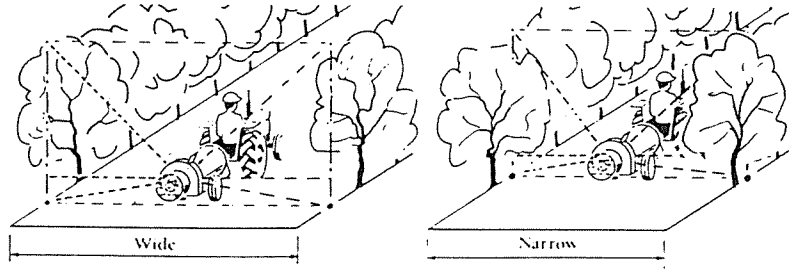


FIGURE 11-12.

In orchards or vineyards, if plants on both sides of the sprayer are being sprayed simultaneously with an air blast sprayer or high-pressure boom sprayer, the swath width is the distance between plant rows.

increased or decreased slightly to apply less or more liquid per acre, or nozzle sizes can be changed.



Wide	Narrow
sprayer output 10 gpm	sprayer output 10 gpm
travel speed 2.0 mph	travel speed 2.22 mph
spray rate 123.7 gal/acre	spray rate 123.9 gal/acre
acres sprayed 4.85 acre/hr	acres sprayed 4.84 acre/hr

Sprayer must travel faster to keep spray application rate the same

FIGURE 11-18

Changes in row spacing in an orchard or vineyard affect the amount of spray being applied per acre. Increasing or decreasing ground speed can accommodate for the difference in spacing so the correct amount of pesticide per acre will be applied. Variations in the size of trees or vines may also influence the rate of application.

TABLE 11-11.

Orchard Sprayer Calibration Worksheet. A worksheet such as this can be helpful in recording and computing the figures necessary for calibration. Similar worksheets can be developed for other types of sprayers. (In this example, notice the difference between the rated output of the nozzles and the actual output. Nozzles are worn).

ORCHARD SPRAYER CALIBRATION

Grower: D. BROWN Date: 1-29-88 Sprayer Type: AIRBLAST

CHECK: ☑ 1. Filter screens and strainers clean?
☑ 2. Tank clean and free of scale and sediment?
☑ 3. Pressure gauge operating?
☑ 4. Nozzles working properly?

Sprayer operating pressure: 100 psi

I-A. GALLONS/HOUR:
(Method I – using nozzle chart from manufacturer's catalog)

Nozzle Size	Number (N)		Rated Output (gallons/minute)		Minutes Per Hour		Gallons Per Hour
D2-25	8	×	0.25	×	60	=	120
D4-25	8	×	0.45	×	60	=	216
		×		×	60	=	

TOTAL GALLONS PER HOUR = 336

I-B. GALLONS/HOUR: (Method 2 – measurement)

1. Fill sprayer to verifiable level.
2. Run sprayer for a measured period of time (T), spraying under the same conditions as in the orchard. T = 3.53
3. Refill sprayer, measuring the amount of water used (GAL) in gallons. GAL = 20.4
4. Calculate: gallons/hour = (GAL × 60)/T
   TOTAL GALLONS/HOUR = 346.7

II. MILES/HOUR:

1. Establish distance (D) in feet. D = 253
2. Measure elapsed time for sprayer to travel the distance. Make 3 runs and average results.
   a. First run: Time = 1.05 minutes.
   b. Second run: Time = 1.15 minutes.
   c. Third run: Time = 1.13 minutes.
3. Average of three runs (T) = 1.11 minutes.
4. Calculate miles per hour:
   MPH = (D/T)/88 MPH = 2.59

III. ACRES/HOUR:

1. Measure width of tree row (W) in feet. W = 22
2. Calculate miles per acre:
   miles/acre = (43560/W)/5280 MILES/ACRE = 0.375
3. Calculate acres per hour:
   acres/hour = MPH/(miles/acre) ACRES/HOUR = 6.91

iV. GALLONS/ACRE:
(gallons/hour)/(acres/hour) = gallons/acre GALLONS/ACRE = 50.17

V. ACRES/TANK:
Tank size = 500 gallons/tank
(gallons/tank)/(gallons/acre) = acres/tank ACRES/TANK = 9.97

VI. AMOUNT OF PESTICIDE/TANK:
Recommended amount of pesticide/acre = 2.5 lb.
(pesticide/acre) × (acres/tank) = pesticide/tank
PESTICIDE/TANK = 24.9 lb.

VII. CALIBRATION CHECK:
1. Tree spacing (S) = 22 × 22 feet — S = 484
2. Trees per acre (T) = 43560/S — T = 90
3. Count the actual number of trees sprayed (N) with one tank: — N = 918
4. Actual acres sprayed = N/T — ACTUAL ACRES = 10.2
5. Calculated acres per tank (from "V" above) — CALCULATED ACRES/TANK = 9.97
6. Percent accuracy = calculated acres/actual acres × 100
ACCURACY = 97.7%

Second Method

Calibrating Air Blast Sprayers

Calibrating air blast sprayers is very similar to boom sprayers; the main difference is in how the amount of spray is measured. Since it is very difficult to collect the spray output from an air blast sprayer, the amount sprayed over a given area can be measured as follows:

1. Fill the sprayer completely or to some mark on the inside of the tank with water. Place a marker on the ground next to where the sprayer wheels are sitting so that the sprayer can be returned to this exact same spot.

2. Measure and mark off a test course and measure the width of the swath covered by the air blast spray. The test course should be at least an acre.

3. Spray the test course.

4. Return the sprayer to the place it was filled and measure the amount of water it takes to refill the sprayer to the mark established in Step 1.

5. Convert the amount determined in Step 4 to gallons per acre using the following equation:

$$\frac{\text{Gal}}{\text{Acre}} = \frac{\text{Total Water Sprayed (Gal)}}{\text{Course Length (ft)} \times \text{Swath Width (ft)}} \times \text{Conversion Factor (F)}$$

The conversion factor (F) is used to transform the amount measured in the test to gallons per acre. For this equation the values used for the conversion factor are as follows:

F = 340.3, when the amount determined in Step 4 is in fluid ounces;

F = 5,445, when the amount determined in Step 4 is in pints;

F = 10,890, when the amount determined in Step 4 is in quarts;

F = 43,560, when the amount determined in Step 4 is in gallons;

For example, 50 gallons of water were applied in a calibration test that covered a course 800 feet long and 30 feet wide. The gallons delivered per acre is 90.75 gallons (50/800/30 × 43,560).

6. Calculate the number of acres that can be treated by one tankful by the following equation:

$$\text{acres treated per tank} = \text{tank capacity (gallons)} / \text{application rate (gallons/acre)}$$

Using the value of 90.75 gallons per acre determined in the above example and a sprayer tank size of 400 gallons, the number of acres that can be treated by one tankful is 4.41 acres (400/90.75).

7. Determine the amount of pesticide to be added to the tank by multiplying the number of acres treated with one tankful by the recommended pesticide rate. If the recommended rate of pesticide is 1 quart/acre in the above example, 4.40 quarts or 1 gallon plus 12 fluid ounces of formulated pesticide would be added to the tank.