Backpack Sprayers

Video 4 Companion Handout

Backpack Sprayers Apply Products Accurately with Proper Calibration

Calibration

This instruction assumes your backpack sprayer is set up with a CF valve as shown in the companion videos, and utilizes a TeeJet nozzle with gallons per minute (GPM) specified in the products catalog.

Three factors are required to be determined for calibration:

1. Maintaining constant spray volume
2. Maintaining spray width and holding boom at constant height
3. Maintaining constant walking travel speed

1. Using a CF valve with TeeJet nozzles maintains constant spray volume, greatly simplifying calibration. You may extract the nozzle GPM specification from the TeeJet catalog to use in the calibration formula provided here. However, we recommend that you measure the nozzle GPM using the following method provided rather than depending on the spray nozzle catalog. Your measured conditions may provide a different flow rate accounting for variation, worn, or defective spray nozzle tips.

2. The effective nozzle spray width is the next component of calibration. Walk with a constant height above the target to maintain uniform width. The spray tip catalog specifies some effective nozzle width calibration information (typically 20" or 30"), but your width may not be listed in the catalog. So determining your width, and using it in the formula provided here, assures your width is customized to your specific application, such as spraying the width of a bed, or width between rows.

3. Practice and record a constant walking speed. Let's begin with your walking speed.

Practice your walking MPH travel speed

Mark off 100 feet on the uneven ground you will be spraying. Practice walking a constant speed. With practice, your time in seconds to travel 100 ft. can accurately be paced to match 1st column times, and your walking speed in MPH can be read from the 2nd column.

Seconds/100 ft.	MPH
45	1.5
34	2.0
27	2.5
23	3.0
19	3.5
17	4.0
15	4.4
14	5.0

Effective Spray Width

Each nozzle type is manufactured with a spray angle and recommended spray height which provides a known width listed in the catalog. 20" or 30" widths are common for 110 degree nozzles. Hold the boom at a constant comfortable height and measure the width, leaving edges for spray overlap.

Measure GPM nozzle output for accuracy

Manufacturers provide specified output flow rate at a given pressure for each nozzle type and size for easy lookup in product catalogs. For accuracy, you will need the following to measure the flow rate: measuring container (units of fluid ounces); sprayer with CF valve and chosen nozzle; stopwatch.

1) Half-fill the sprayer with water (and a colorant)
2) Pump the sprayer; Release the hand trigger and timer
3) Hold a measuring container under a nozzle **for 1 minute**, collecting its output
4) Determine the volume and record it
5) Convert the flow rate to gallons per minute by the following equation:

   GPM nozzle = output in fluid ounces ÷ 128
   Example: 32 fluid ounces caught in 1 min is a flow of 0.25 GPM (32 ÷ 128)

If you build a spray boom with more than one nozzle, repeat steps 3 and 4 and measure output for each nozzle. Calculate the total sprayer output by adding the output for the nozzles. Most nozzles will have a slightly different output, but the variance should not exceed +/- 10 percent. Replace worn or faulty nozzles if the output is 10 percent more or less than the manufacturer's specifications and repeat steps 3 and 4.

Calculate sprayer output gallons per acre (GPA)

GPA =
(Nozzle GPM x 5,940) ÷ (MPH x W spray width)

GPA = the sprayer output in **gallons per acre**
GPM nozzle = the actual nozzle flow rate in **gallons per minute**
MPH = your walking speed - the sprayer - in **miles per hour**
W spray width = the nozzle spacing in inches
5,940 in the equation = a constant value needed for conversion of mixed units (feet, miles, and acres; minute and hour).

Calculate sprayer output gallons per 1,000 sq. ft.

Gal per 1,000 sq. ft. =
(Nozzle GPM x 136) ÷ (MPH x W spray width)

For determining the total spray volume gallons needed for treating areas
136 in the equation = a constant value needed for conversion of mixed units (feet, miles, and acres; minute and hour).

Backpack Sprayers

Video 4 & 7 Companion Handout

Video 4 - Backpack sprayers apply products accurately with proper calibration

Video 7 - Measuring small quantities safely

Calculate product mixing rate per spray gallon

Products have legal recommended application rates. Determine the product mixing rate (in pounds, ounces, or fluid ounces per gallon) with water in the backpack sprayer tank using this equation:

Product Mixing Rate = AR ÷ GPA where

AR = product Application Rate in pounds, ounces, or fluid ounces per acre
GPA = the sprayer output in gallons per acre

Typical Example: Treat crop rows on plastic mulch

10 single rows of a crop on plastic mulch 250 feet long
A crop protection product recommended application rate of 1 pint (16 oz.) per acre
Walking practiced at 2.5 MPH
TeeJet nozzle with 0.2 GPM output flow with 20 psi CF valve and 20" width
We have all the information needed

Sprayer output GPA = (Nozzle GPM x 5,940) ÷ (MPH x W spray width)
= (0.2 GPM x 5,940) ÷ (2.5 MPH x 20") = 1,188 ÷ 50 = 23.8 gallons per acre

Treated Area
= 10 rows x 250 feet x 20" width = 10 x 250 x 1.6' = ~ 4,000 sq. feet

Sprayer output GP 1,000 sq. ft. = (Nozzle GPM x 136) ÷ (MPH x W spray width)
= (0.2 GPM x 136) ÷ (2.5 MPH x 20") = 27.2 ÷ 50 = 0.55 gallons per 1,000 sq. ft.

= 4,000 sq. ft. at 0.55 gal per = 2.2 gallons total spray volume

Mixing Rate = AR ÷ GPA
= 16 oz./A ÷ 23.8 gallons/A = 0.67 ounces per gallon spray mix

Note: Product application rates specified in pounds, ounces, or fluid ounces per 1,000 square feet need to be converted to pounds, ounces, or fluid ounces per acre before performing the calculation above. Multiply pounds per 1,000 square feet by 44 to convert to pounds per acre.