



SPRAYER CALIBRATION

Accurate calibration of orchard spray equipment is a must if you plan to grow insect-, mite-, and disease-free fruit in your orchard.

STEPS BEFORE CALIBRATION

Before starting the actual calibration steps needed to complete a successful spray season, first check your owner's manual for clean-up procedures. If you don't have an owner's manual, take the following steps:

1. Clean sprayer thoroughly; steam clean all parts as necessary; sandblast and recoat older tanks; remove and replace worn parts and accessories as needed.
2. For engine-driven sprayers, check engine for ease of starting, compression, and general condition; replace hoses, belts, etc., as needed.
3. Check pump and pressure regulator.
4. Replace pressure gauge often; most pressure gauges don't last long.
5. Flush lines; be sure they are free of rust, corrosion, and chemical sludge.
6. Check nozzles for wear. Standard size drill bits may be used to check nozzle wear:

Nozzle Size	Drill Size
D 4	1/16"
D 5	5/64"
D 7	7/64"

Obtain an up-to-date nozzle chart for your sprayer.

7. For PTO units, be sure that all parts of the PTO mechanism are well-greased and working smoothly.
8. Check tractor for operation. Tractors must be operating at peak efficiency to do a good job of pulling your sprayer, particularly PTO sprayers.

After completing the steps above, you may now calibrate your sprayer.

CALIBRATION

There are many types of orchard sprayers on the market today; each type has different nozzle setups. Sprayers, such as the air pressure and air-shear types, are designed on slightly different principles than are conventional nozzle sprayers. Read your owner's manual carefully for specific calibration instructions. Calibration procedures are the same on most sprayers but manifold arrangements, operational pump pressures, and the like may vary considerably with different types.

Let's use as an example a conventional nozzle sprayer applying high-moderate or low gallonage sprays 50 to 800 gallons per acre.

We must first answer several questions before a sprayer can be calibrated accurately: (1) How many gallons/acre do you plan to apply? (2)

What pump pressure at the nozzles? (3) What speed of travel (hopefully 1–2½ mph)? (4) How many nozzles per side? (5) What type nozzles? (6) What tree spacing(s) in the orchard?

Let's make a few assumptions so that we can discuss sprayer calibration. Let's say you plan to apply 100 gallons of spray/acre with pump pressure of 100 psi and plan to travel 2 mph. Your sprayer has 6 spray systems nozzles per side. Your tree spacing is 20 feet x 20 feet. By using a few facts and figures listed below, you will be able to develop a suitable nozzle arrangement which later must be checked for accuracy in the orchard.

To set up your manifold with the proper nozzles and nozzle arrangement, determine spray gallons/minute/side for your sprayer, using the following formulae:

$$\text{gal./minute (per side)} = \frac{\text{gal./acre} \times \text{mph} \times \text{tree spacing between rows (ft.)}}{1000}$$

Using suggested rates above, continue as follows:

$$\text{gal./minute} = \frac{100 \times 2 \times 20}{1000}$$

$$\text{gal./minute} = 4.0$$

This means we must apply 4 gallons of spray per side of your sprayers manifold per minute of operation through six spray nozzles to obtain 100 gallons of spray per acre at 2 mph.

SETTING UP THE MANIFOLD

If you set up your manifold for most mature or nearly mature trees, plan to apply 2/3 of the spray material in the upper half of the manifold and 1/3 in the lower half for most orchard trees. This means 2/3 of the spray will be applied

through the upper three nozzles and 1/3 through the lower three nozzles. You may wish to vary this ratio when you are protecting predatory mites in the lower portion of the trees or are applying special sprays during specific portions of the year, i.e., dormant sprays for scale, growth regulator sprays, etc.

Obtain a nozzle output chart for your type of nozzles and sprayer from your dealer or pest control consultant. Check chart carefully for nozzle orifice numbers and core numbers. Check across to the proper pounds per square inch column, obtain gallons/minute per nozzle in the table (see chart). *Remember: six nozzles apply 4 gallons/minute and 2/3 must be applied by the upper three nozzles.* In developing 2/3 to 1/3 ratio you should apply about 1.4 gallons/minute in the lower half of the manifold and 2.6 gallons/minute in the upper half.

Check the chart for three nozzles that add to a total of 1.4 gallons/minute (lower manifold nozzles) and another three that add to 2.6 gallons (upper manifold nozzles). Let's assume you have No. 25 cores. From the chart, we could use two No. 7 nozzles at .81 gallons/minute each and a No. 8 nozzle at .97 gallons/minute, to give us 2.59 gallons/minute! For the lower nozzles two No. 4's apply .45 gallons/minute each, plus a No. 5 at .54 gallons/minute, giving total gallonage from the lower nozzles of 1.44 gallons/minute and a total manifold gallonage of 4.03 gallons/minute. Other arrangements could also give the desired 4 gallons per minute.

FINAL CALIBRATION

1. Set up the manifold as above and fill your sprayer tank to a given point such as 100 gallons or fill the tank to the very top with water. Start the engine and spray from one side of the manifold for 5 minutes if your

calibration is correct you should be able to refill the tank to the original mark with 20 gallons of water. If not readjust nozzles or pressure to apply the correct amount of water.

2. Determine speed. Speed may be determined with a stopwatch or by checking tree spaces passed per minute. (If you are traveling 2 mph in a 20-foot orchard, you should pass 8 3/4 tree spaces in one minute. Or checking in a straight line, you should go 176 feet in one minute.) You can measure this in the orchard or along a roadway.
3. Now, with your gallonage determined and speed accurately set, you are ready to apply an accurate amount of water and chemical per acre. For final checking of coverage and pattern developed by your manifold, place a spray pole or orchard prop with paper cards

spaced every two feet in the center of one tree on either side of any row that you plan to spray. Use either a spray dye or sensitized paper to determine how well you are actually spraying throughout the trees. *Remember:* you are applying chemicals on a per-acre basis when you apply less than full volume (300 or more gallons per acre). This means that you must use the per-acre rates shown in EB 419 *Spray Guide for Tree Fruits in Eastern Washington* or the rates shown on the label(s) of the chemical(s) you are using.

More information on calibration and spraying can be obtained from your sprayer dealer, pest control consultant, pest management specialist, or county agent, any or all of these people can help you accurately set up and calibrate your equipment. Give them a call!

Table 1. Relative Gallon-per-Minute Capacity of Disc-Type Hollow-Cone Nozzles at Different Pressures

Nozzle Orifice No.	Core No.	PSI (lbs./square inch) and GPM (gal./min.) Nozzle Cap*									
		70	80	90	100	110	120	130	140	150	200
2	24				.20						
	25	.21	.22	.24	.25	.26	.27	.27	.28	.29	.34
3	24				.22						
	25	.25	.26	.28	.29	.30	.31	.32	.33	.35	.40
4	24				.32						
	25	.38	.40	.42	.45	.47	.49	.51	.53	.54	.62
5	24				.42						
	25	.45	.48	.51	.54	.56	.58	.60	.62	.65	.75
6	24				.50						
	25	.58	.62	.66	.70	.73	.76	.79	.82	.85	.97
7	24				.57						
	25	.68	.73	.77	.81	.84	.88	.91	.95	.98	1.18
8	24				.70						
	25	.82	.89	.93	.97	1.02	1.06	1.11	1.15	1.19	1.36

*Pressures less than 80 psi may not give satisfactory control, and those above 200 psi may cause additional nozzle wear and undesirable fogging of spray.

