

CALIBRATION

Air-blast sprayers use high-speed, fan driven air-stream to disperse spray from nozzle through the foliage. The introduction of varying sizes of fruit trees has caused some growers to be faced with multiple calibrations in a single orchard or vineyard. The procedures described in the following pages have long been the standard method of calibration to ensure pesticide or organic chemicals are applied at the recommended amounts per acre or hectare. Whether you use traditional spray methods or adopt TRV techniques, these calibration procedures will continue to ensure that you are actually applying the amount of pesticide intended.

If you need further advice about set-up, nozzle selection or calibration, or for further information on Tree Row Volume spraying, contact your District Horticulturist or local field rep.

SET-UP

Basic activities involved in setting up an air-blast sprayer for proper calibration and sprayer operation are:

1. Inspecting the equipment
2. Adjusting the air-stream
3. Adjusting spray pressure
4. Selecting spray volume
5. Measure forward speed
6. Calculating required output per side
7. Selecting a set of nozzles
8. Measure delivery rates
9. Adjusting output

Each of these is described in moved detail below. All of them should be done when setting up a new sprayer or adapting a sprayer to different sizes of trees or vines.

1. Inspecting the Equipment

Inspecting before start-up – check that:

- Tire pressure of both the tractor and sprayer are correct.
- All hoses are in good condition and of the proper rating.
- All filters, strainers, and screens are clean and in place.
- Nozzles are clean and are the intended type and size.

Inspection with sprayer operating: Fill the tank about half full of clean water. Start the pump and set the tractor engine speed to obtain the rpm recommended for the pump

(usually 540 rpm). Open the valve to the manifold to fill the lines and begin spraying. Once all the nozzles are spraying, adjust the pressure regulator to the operating pressure recommended for your pump and spraying operation (using the lowest pressure recommended will extend pump life and reduce the amount of small droplets that may drift).

With the sprayer running:

- Check that each ON/OFF valve is working.
- Test pressure gauges for accuracy by installing a second gauge at the boom and comparing the pressure.
- Check that the agitation system is working properly.
- Make sure there are no leaks in the spray system.

2. Adjusting the Air-stream

The air-stream created by the sprayer fan carries the spray mixture into the trees or vines and distributes it throughout the foliage. To reach all leaf surfaces and obtain complete pesticide coverage, all of the air around the foliage must be replaced by the spray-laden air-stream. Both the **speed** of the air and the **volume** of the air from the outlet are important.

Speed of Air-stream – For sprayer with cone nozzles the minimum air speed at the fan outlet should be at least 100 mph (160 km/h).

TUBO-MIST AIRSPEEDS

19” turbine 110 - 130 MPH

24” turbine 110 - 130 MPH

30” turbine 130 - 150 MPH

Volume of Air-stream – Large trees require a greater volume of air than small ones. Air-stream volume is determined by the size of the fan-housing opening and by air speed. Air volume can be varied by simply increasing or decreasing the PTO rpm, but remember the air-speed rule mentioned above.

Air-stream Direction – More important than air speed and volume to coverage, is air direction or angle of attack to the foliage. The foliage must be hit by air at an angle to cause the leaf to rotate and allow the spray-laden air to enter the center of the spray target. Your Turbo-mist has adjustable outlets to maximize this benefit of angle of air attack.

3. Adjusting Spray Pressure

The spray pressure affects both the volume of spray output and the size of spray droplets. As pressure increases, spray output increases but droplet size gets smaller. Excessive pressure can result in too many small droplets, which are prone to drift far away from the target. Excessive pressure also increases wear on the pump, hoses, and nozzles.

As pressure decreases, spray output decreases but droplet sizes gets larger. Too low a pressure causes spray so coarse that it does not penetrate foliage properly. For low volume spraying with hollow cone nozzles, adequate spray breakup can be obtained at a pressure of 100 PSI (690 KPA). For medium and high volume spraying, lower pressure can be used because spray breakup is not as critical. Droplet size charts for varying pressures through nozzle equipment are included in this manual.

One of the most common problems with piston diaphragm or plunger pump equipped sprayers is accuracy of application rates when dealing with single sided spraying. Most units will experience a pressure increase, therefore increasing the rate of application during this process. Your Turbo-mist (piston diaphragm pump models only) are equipped with a unique feature to maintain constant pressure called the “bypass valve”. The bypass valve works in the following manner. When any of the boom control switches are turned off, this automatically activates the electric bypass valve, therefore dumping the extra water and pressure back to the tank. Just before entering the tank is a throttling valve. This is so the water returning to the tank can be adjusted to copy the amount of water that would be spraying out the closed boom. By doing this, the pressure should remain the same when a boom is shut off. This feature also helps extend pump life by reducing the pressure during start up and reducing pressure spikes. The procedure for setting the bypass valve:

Step #1: Set the desired pressure at the regulator with both booms running.

Step #2: Turn either boom off (one boom only).

Step #3: Note the pressure change; if the pressure increases then go to the back of the tank and open the throttling valve until the pressure is the same as if you had both booms running, if the pressure decreases do the reverse. This procedure will have to be repeated every time the calibration is changed.

Units equipped with a piston diaphragm pump have an additional water relief circuit located near the regulator at the front of the tank. This is used when extremely low rates of application are required, it is important to note that this must be used in

conjunction with the existing regulator. Simply open or close this valve to achieve the desired lower pressure.

4. Selecting Spray Volume

Spray volume is the amount of dilutant (usually water) in which a pesticide is mixed and sprayed for a specific area. The choice of spray volume depends on the pesticide, the pest being controlled and the application equipment.

Most insects and diseases of fruit trees and vineyards can be controlled with low volume sprays (60 to 90 GPA or 225 to 340 litres/acre). Some pests may require volume spraying (120 to 250 GPA or 440 to 880 litres/acre) or high volume spraying (300 to 600 GPA or 1,120 to 2,240 litres/acre). High-volume spraying is characterized by considerable runoff and may be required for control of fruit tree scale insects.

5. Measuring Forward Speed

Forward speed must be slow enough to allow the air-stream to completely replace the air in the foliage, but not so slow that excessive blow-through results. The choice of forward speed for orchards depends on the tree size and spacing, density of foliage, and air-stream speed and volume. The recommended range of forward speeds is from 1 to 3 mph (1.6 to 4.8 km/h). The sprayer speed selected for use during application must be accurately measured in order to select nozzles and to calculate sprayer delivery rate.

Measure forward speed for various gears as follows:

Step #1: Mark off a test strip which is reasonably long 200 ft or (60 metres) and which represents typical field driving conditions. Make sure tire pressures are correct. Fill your tank about half full; you won't be spraying now, but this gives an average weight load.

Step #2: Select a gear and a tachometer to give you 540 PTO. Be sure that the blower is going without discharging water. Reach and hold your forward speed before entering the test strip.

Step #3: Use a stopwatch or watch with a second hand to measure the exact time required to travel the test trip and record.

Step #4: Repeat steps 2 and 3 at least 3 times for each gear selection.

Step #5: Calculate forward speed using in the desired unit by following formula.

FORWARD SPEED = (MPH)	$\frac{\text{total distance traveled (ft)} \times .68}{\text{total time required (sec)}}$
FORWARD SPEED = (Km/h)	$\frac{\text{total distance traveled (m)} \times 3.6}{\text{total time required (sec)}}$

6. Calculating Required Output per Side

Air-blast spray nozzles are sold on the basis of their output per minute. You select a set of nozzles whose individual outputs, added together, equal the required output per side. Choose either of the following formulas, depending on the units you are using:

Output per side = (US GPMP)	$\frac{\text{recommended spray volume (GPA)} \times \text{forward speed (MPH)}}{1000} \times \text{row spacing (FT)}$
Output per side = (L/MIN/SIDE)	$\frac{\text{recommended spray volume (L/Acre)} \times \text{forward speed (Km/H)}}{1200} \times \text{row spacing (M)}$
Output per side = (L/MIN/SIDE)	$\frac{\text{recommended spray volume (L/ha)} \times \text{forward speed (Km/H)}}{990} \times \text{row spacing (M)}$

7. Selecting a Set of Nozzles

You can now select a set of nozzles to give you the required sprayer output (US GPM or L/MIN/SIDE) at the selected operating pressure. They are chosen not only to give a correct total output, but also to produce the desired spray pattern.

Nozzles of different outputs may be placed in appropriate locations on the sprayer manifold in order to achieve the desired spray pattern. Usually most of the spray volume is directed at the thickest foliage. For vineyard spraying, nozzles may be placed only in the lower half of the manifold.

If you set up your manifold for mature or nearly mature trees, a typical spray pattern is to approximately two thirds (67%) of the spray material through the upper half and about one third (33%) through the lower half. This means nozzles in the lower part will be much smaller than those in upper part. Most air-blast sprayers use seven nozzles on the manifold when applying low-volume sprays, so half the output of the middle (4th) nozzle is included in both upper and lower outputs.

8. Measuring Delivery Rate

In theory, the sprayer has been set up to deliver a certain output per side. In fact, the output may be different than expected. This is true both of new nozzles and of old ones, which may have worn through use. You must measure the actual output per minute in order to calculate the delivery rate. You need to know the delivery rate to determine how much pesticide to add to the spray tank and to ensure it is within the range to recommended spray volumes.

First measure actual sprayer output per minute. Then, having already tested your true forward speed, you can calculate the delivery rate.

Step #1: Position the sprayer on a level location and fill it approximately half full of water. Measure the water level in the tank (use a calibrated measuring stick). Write down the water level.

Step #2: Start the sprayer pump operating. Set the pressure to that used when selecting nozzles.

Step #3: Spray out water from the booms for a measured time, ten minutes is usually enough. You do not have to be moving to complete this test.

Step #4: Measure the amount sprayed by either measuring the amount of water left in the tank with a calibrated stick or accurate tank gauge, or by refilling the tank to the original level with an accurate measuring container.

Step #5: Calculate the sprayer output per minute for the sprayer from both booms.

$\begin{array}{l} \text{Sprayer output} \\ \text{(GPM or Litres/Min)} \end{array} = \frac{\text{amount sprayed (Gal) or (Litres)}}{\text{time of test (min)}}$
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9. Adjusting Output

Changing nozzle sizes is the only way you should make large changes in output.

Changing forward speed for PTO-driven sprayers must only be done by making a full gear change. Such as moving from second low to third low so that PTO speed and engine rpm are maintained.

Change pressure is a way to get a small change in output. It is not advisable for large changes. To double sprayer output you would have to increase spray pressure four times.

A FEW TIPS ON MANAGING SPRAY DRIFT

Know when not to spray. Delay application if; wind speeds exceed 2.5 mph or 5 km/h, or temperatures is higher that 85 degrees Fahrenheit or 30 Celsius and relative humidity is less that 50 percent. All nozzles produce a spectrum of droplet sizes within the same spray pattern. Spray droplets are measured in microns and categorized as follows:

Fine	0 – 200 microns	30 – 40 microns	Visibility Threshold
Medium	201 – 300 microns	100 microns	Human Hair
Coarse	301 – 400 microns	500 microns	Table Salt
Very Coarse	401 – microns and larger	1000 microns	Thickness of a Dime

The shorter the distance a droplet has to travel, the less chance for a drift. Lower the pressure to produce larger droplets. The easiest and most economical way to control drift is to use the right tip. The goal is to get the largest droplets without sacrificing good target coverage. Today's advance tip design produces large droplets less prone to drift, while maintaining a high quality spray pattern. In applications where maximum coverage is critical, higher carrier volumes may be necessary when droplet sizes are very coarse.

