



Calibrating Airblast Sprayers

Prepared By: Ken Sapsford P.Ag. March 2021

Introduction

Calibration is one of the most important aspects of spray application as it will ensure that the proper rate is applied, reduce off target drift and improve efficacy of the product. Yet it is often overlooked and not given consideration by many operators.

Common reasons for not calibrating are:

- difficulty
- length of time required to calibrate
- confusing terminology
- multiple methods for calibration
- the incorrect belief that calibration has very little impact

This Factsheet describes a simple and effective method for calibrating an airblast sprayer, with clear terminology and equally clear reasons for calibrating regularly.

It is very important that any calibration technique be followed exactly. Do not mix and match parts of different calibration techniques. It is important that protective safety clothing is used while calibrating and adjusting spray equipment.

Defining Terminology

“**Application rate**” (also known as Product Rate) is a term used to describe the amount of formulated product that is applied to a treatment area.

“**Delivery rate**” (also known as Sprayer Output) describes the total amount of material that is delivered by the sprayer to the treatment area (e.g., 500 L/ha).

Why Calibrate?

Calibration is essential because it:

- confirms that the delivery rate is accurate
- ensures that the correct application rate is applied
- reduces product waste, drift, and environmental impact
- confirms that each nozzle is delivering the desired output

That final point is very important. A boom that has both worn and plugged nozzles can still deliver the calculated sprayer output, as some nozzles may be over applying and some under applying, so every nozzle must be tested.

When to Calibrate

Application rates and delivery rate requirements change, depending on the crop type, the plant spacing and the crop and pest staging. Therefore, calibrate for each significantly different situation.

Calibrate airblast sprayers:

- at the beginning of each season
- mid-way through each season as crops grow and fill in
- after changes to application equipment or settings (e.g., nozzles, operating pressure, pump or tractor)

Where to Calibrate

Calibrate sprayers in the actual planting (e.g. orchard, nursery, vineyard). Calibrating a sprayer on a hard surface (such as pavement) can induce errors as high as 15% compared to calibrating in a tilled field. Calibrate away from buildings and wells.

How to Calibrate

There is more than one way to calibrate a sprayer. Essentially, every method requires you to find:

- True ground speed of the sprayer
- Air setting for accurate coverage
- Delivery rate per nozzle
- Total delivery rate of the sprayer

Calibration Step-by-Step

1) Perform a pre-calibration inspection (refer to Appendix A)

Fill the cleaned sprayer with clean water.

Start the pump and set the tractor engine speed to the desired rpm. Open the manifold valve to fill the lines and begin spraying. Adjust the pressure regulator, or set the main by-pass, to obtain the desired operating pressure. Perform the following steps:

- Check that each nozzle shut-off valve is working.
- Check that the agitation system is functioning properly.
- Search for and correct any leaks.

2) Set travel speed

This is done to correct speedometer errors due to wheel slippage. Fill the cleaned sprayer half-full with clean water to represent the average weight. It is important to perform this step in the planting area so it accounts for soil type and slope of terrain. Be sure to drive both up and down hill during testing if applicable.

- 1) You can use a GPS speed tracking app on your smart phone or
- 2) measure the time for the sprayer to drive a known distance and calculate the speed with the steps bellow.
 - Measure out a distance of at least 50 m and mark the start and finish positions with stakes or flags.
 - Select the gear and engine speed in which you intend to spray. Be sure that the blower is going, without discharging spray.

- Bring the sprayer up to speed and begin timing as the front wheel passes the first flag.
- Stop the timer as the front wheel passes the second flag.
- Stay out of any ruts and run the course two more times.
- Determine the average time for the three runs.
- Calculate forward speed using one of the following formulae, depending on the units used:

Forward speed (**km/h**) = Distance travelled (m) / Average drive time in seconds x 3.6 (a constant)
or

Forward speed (**mph**) = Distance travelled (ft) / Average drive time in seconds x 0.682 (a constant)

3) Adjust 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 achieve adequate pesticide coverage, all the air around the foliage must be replaced by the spray-laden air stream.

Early-season airblast spraying generally requires very little air. Larger, fuller canopies require a greater volume of air. In some cases, air volume can be varied by increasing or decreasing the power take-off speed (PTO rpm), engine rpm or the fan gear.

The air direction or angle of attack to the foliage is equally important:

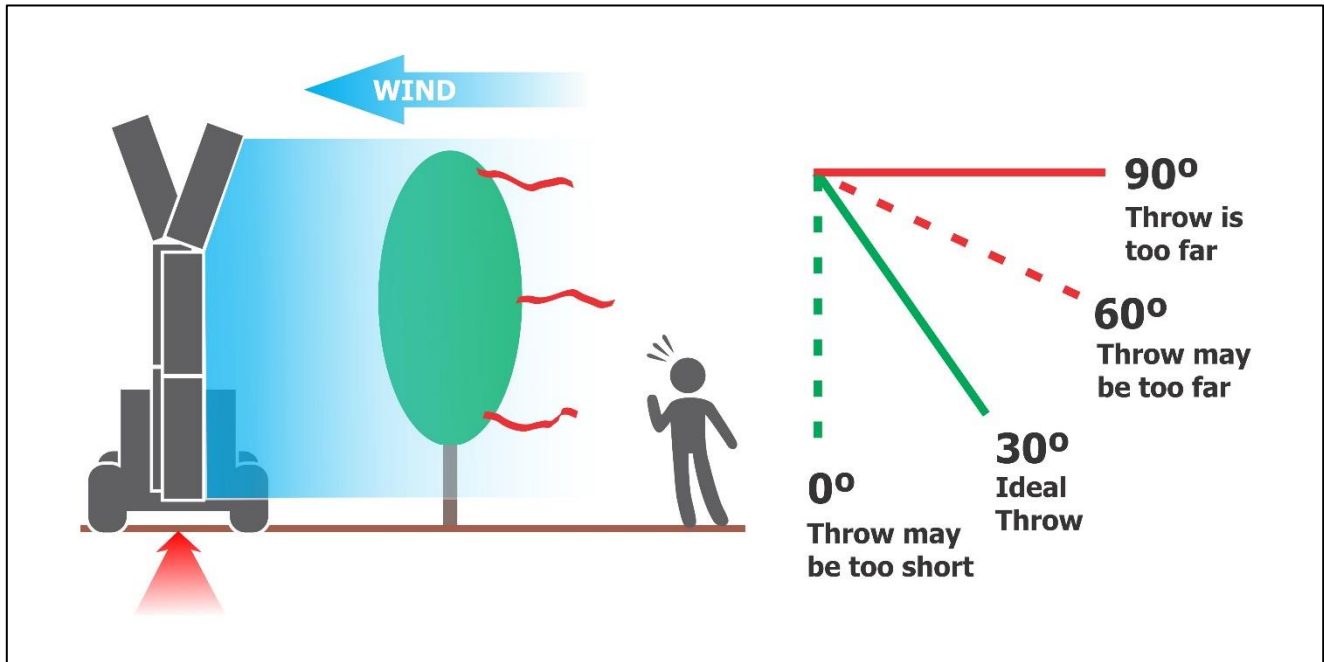
- Attach 25 cm (~10 in) lengths of ribbon to the nozzle bodies and deflectors and turn on the air.
- Adjust outlets and/or deflectors to aim air into the canopy. Air should only just exceed canopy height. (Figure 1)



(Figure 1)

Ribbons tied to each active nozzle position will show where air (and spray) is aimed. Note the slight downward direction of the air on the bottom-left side of the sprayer versus the bottom-right. This is due to the misalignment of the bottom deflectors. Don't use flagging tape, as shown here. It will stretch and could be sucked into the intake. Length of strong ribbon are preferred.

- Three ribbons are positioned on the far side of the upwind target canopy. An observer watches the ribbons as the sprayer drives past with the air on (not the spray). It is ideal for the ribbon to briefly flutter 0 to 60 degrees. The ribbon in the location that is the toughest area to get the spray into should be the one of most concern. This may be the top ribbon or the one where the canopy is the densest, depending on your crop. (Figure 2)



(Figure 2 source: Jason Deveau)

- Adjust fan speed to obtain the ideal air penetration through the canopy.

4) Calculate the target output for each side

Airblast nozzles are sold based on their output per minute. A set of nozzles on one boom, when added together, should produce the required output per side. Use either of the following formulae, depending on preferred units:

a) For litres per hectare

Output per side (**L/min/side**) = Target Delivery rate (**L/ha**) x Forward speed (**km/h**) x Row spacing (**m**) / 1,220

b) For gallons per acres

Output per side (**US gal/min/side**) = Target Delivery rate (**US gal/acre**) x Forward speed (**mph**) x Row spacing (**ft**) / 990

Select a set of nozzles that will produce the required spray output when operated in the middle of their pressure range. This range should reflect the typical operating pressure of the sprayer.

5) Measuring actual delivery rate

In theory, the sprayer has been set up to deliver a specific output per side. In fact, the output may be different than expected. This is true both of new nozzles, which can vary in output by as much as 15%, and of old ones, which may be worn through use. To calculate the total delivery rate, measure the actual output per minute of each nozzle.

- This can be done with a stopwatch and graduated cylinder (Figure 3)
- or a device such as a SpotOn calibrator that does all the calculations for you. (Figure 4)



(Figure 3)



(Figure 4)

- Position the sprayer on a level location and fill it approximately half full of water.
- Start the sprayer pump. Set the pressure to that used when selecting nozzles (step 4).
- Use a length of hose to direct spray from each nozzle into a graduated cylinder for 1 minute or collection vessel.
- Replace any nozzles that are 10% more or less than the manufactured rated.
- Calculate the total output of one boom and compare to the targeted total output from step 4.

a) For litres per hectare

$$\text{Actual Delivery rate (L/ha)} = \frac{\text{Output per side (L/min/side)} \times 1,220}{\text{Forward speed (km/h)} \times \text{Row spacing (m)}}$$

b) For gallons per acres

$$\text{Actual Delivery rate (US gal/acre)} = \frac{\text{Output per side (US gal/min/side)} \times 990}{\text{Forward speed (mph)} \times \text{Row spacing (ft)}}$$

- Once you have calculated the Actual Delivery Rate you can determine how much product to put in the tank as you can calculate how large of an area one tank will cover.

For More Information

AgriService BC

Telephone: 1 888 221-7141

E-mail: AgriServiceBC@gov.bc.ca

Airblast 101

Your Guide to Effective and Efficient Spraying

<https://sprayers101.com/airblast101/>

Video: Airblast Air

<https://sprayers101.com/esm9/>

Video: Airblast Coverage

<https://sprayers101.com/esm10/>

Pesticide Applicator Certification and Training

<https://www2.gov.bc.ca/gov/content/environment/pesticides-pest-management/certification-training>

Appendix A

SPRAYER INSPECTION CHECKLIST

PUMP AND HOSES

- Leaky pump valves, diaphragms and/or plungers checked/replaced
- All hoses and fittings sound (while under pressure)
- Pump flushed and spray discharge clear
- Pump lubricated

FILTERS, STRAINERS AND NOZZLES

- All filters (tank basket, suction filter, in-line filters and nozzle strainers) clear and not damaged
- Check valve diaphragms clean and function
- All nozzles clean and unbroken
- Each nozzle shut-off and/or flip body is working

REGULATORS, GAUGES AND CONTROLS

- All gauges accurate
- Pressure and shut-off valves (ball or solenoid) work smoothly
- Regulator(s) and/or bypass valve(s) move easily
- Pressure gauge defaults to zero and does not bounce or leak

BELTS AND POWER TAKE OFF

- All belts have proper tension and no wear or cracks
- PTO greased, connection zones checked and guard in place

PROPELLER AND AGITATION

- Propeller has no nicks, cracks or residue, turns freely and has no lateral play
- Mechanical agitation shaft is supported, bearings lubricated and shaft packing suitably tight (no leaks)

AIRFLOW AND DIRECTION

- Ducts or deflectors are residue-free and can be adjusted
- Blade pitch and fan gear can be adjusted

SPRAY PRESSURE ADJUSTMENT

- Regulator/bypass adjusted to achieve desired pressure at usual tractor RPM
- Each boom operating at desired pressure for each nozzle combination

TIRES AND TANK

- Tires have correct pressure, tight bearings and no cuts
- Drain plug can be removed
- Tank has clear vents, is secure to chassis and has no punctures or damage