# Air-assisted Sprayer Calibration – Precision Ag Agent Training

## To-do-list Before Calibration

1. Triple rinse tank and piping.
2. Pressure wash sprayers.
3. Clean nozzles and record orifice and whirl disc sizes.
4. Flush out the line to the pressure gauge.
5. Clean filters, including tank filters, suction filters, final filters, and the screen behind nozzles.
6. Ensure all valves, diaphragms, and O-rings are in good condition and working properly.
7. Check tire pressures on both sprayer and tractor.
8. Fill the sprayer ½ full of clean water.
9. Have the sprayer operator's manual on hand.

## Calibration (Step-by-step)

1. **Place flags to mark a known distance (100 or 200ft)**
2. **Drive the tractor (With half a tank full) at your usual speed (<2.5mph recommended for pecans) and usual RPM.**
3. **Mark the time in seconds it takes to drive the known distance.**
4. **Take notes on the spreadsheet below.**
5. **Calculate the miles per hour (MPH) using the MPH formula (shown below).**

Tractor _____ Sprayer _____ Tractor Gear _____ Tank (Gallons) _____

Tractor RPM _____ Pump Pressure (PSI) _____ Measured Distance (Ft) _____

Time (Seconds) = Time #1 _____; Time #2 _____; Time #3 _____ Average Time (Seconds) _____

Miles per hour (MPH) = $\frac{Distance\ in\ feet\ x\ 60\ (Converts\ seconds\ to\ minutes)}{Time\ in\ seconds\ x\ 88\ (Converts\ feets\ per\ minute\ to\ MPH\ (1\ mph{=}88ft/min))}$

6. **After calculating the MPH, we can estimate the GPM* using the MPH, the desired gallons per acre (GPA), and the row spacing in ft (formula below).**

* Orchards are sprayed on one or two sides at a time, depending on size. For old pecan orchards (tall trees and >50ft spacing), for example, growers usually only spray with one side of the sprayer closer to the canopy. Two formulas are used to meet these two spacing criteria, one for each spacing.

**Formula for one-sided spraying:**

$$GPM = \frac{Gallons\ per\ Acre\ (GPA)\ x\ Miles\ per\ Hour\ (MPH)\ x\ Row\ Spacing\ (ft)}{495\ (Constant)}$$

**Formula for two-sided spraying:**

$$GPM = \frac{Gallons\ per\ Acre\ (GPA)\ x\ Miles\ per\ Hour\ (MPH)\ x\ Row\ Spacing\ (ft)}{990\ (Constant)}$$

7. **Divide this output by the number of nozzles and you will find the GPM per nozzle.**
8. **To verify the actual GPM from each nozzle**, use a hose and a volumetric pitcher to collect the output in ounces for 1 minute (60 seconds) from each nozzle. The formula below converts from oz/minutes to gallons/minutes.**

$$GPM = \frac{Ounces\ per\ minute\ (oz/min)}{128}$$

**You must know your RPM and Pressure (PSI).

9. **To find an estimated GPM, you can also look at the manufacturer's catalog and look for the nozzle orifice opening and the pressure (PSI).**

**Formula for adjusting sprayer output**

**Desired Speed**

$$\textbf{MPHDesired} = \frac{Actual\ Application\ Rate\ x\ Actual\ Speed}{Desired\ Application\ Rate}$$

**Desired PSI**

$$\textbf{PSIDesired} = \frac{GPMDesired^2\ x\ PSIMeasured}{GPMMesured^2}$$

**Considerations for Old and Tall Tree Orchards**

Table 1. Recommended total spray volume of application for pecan.

| Tree Height (feet) | Total Volume (Gallons per Acre ) |
|---|---|
| Up to 25 | 25 |
| 25 to 50 | 50 to 90 |
| 50 and Up | 100 to 150 |

An air-carrier sprayer must be capable of displacing the air in and around the trees and replacing it with a mixture of pesticide and air. Nozzle arrangement and air guide or director vane settings should place most of the spray in the top half of the trees, where most of the foliage and fruit are located.

Air blast sprayers are typically set up to apply 2/3 to 3/4 of the spray to the top half of trees, and 1/3 to 1/4 to the bottom half (Figure 1). This targeted spraying is accomplished by placing more or larger nozzles on manifolds in the area that supplies spray to the upper half of the trees and setting the air directors on the fan outlet to direct the air stream accordingly. Tree growth and target pest habits should be considered in determining the setup for specific applications.

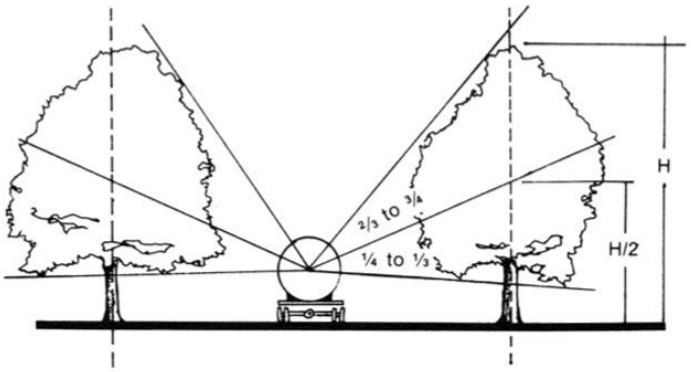


Figure 1. Recommended proportioning of air-assisted sprayer for large trees. (Sumner, 2005; Adapted from Cromwell, 1975).

To place ¾ of the spray volume in the top half of the trees, the nozzles placed on the top half of each manifold will need a combined output between ¾ x the actual output for the set of nozzles.

An example below shows how this is done.

As mentioned above, spray nozzle manufacturers publish tables showing the GPM capacity of various nozzle sizes for various pressures. Two or more nozzle sizes are normally required to produce the desired spray volume and pattern.

A variety of nozzle arrangements can be used to achieve the volume and spray distribution needed. A good selection would be as follows (Figure 2).

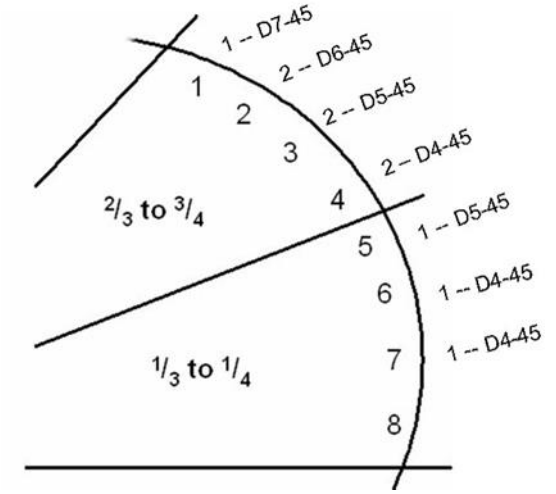


Figure 2. Nozzle placement for proportioning spray material on each manifold.

**Top Tree Half**
(1) D7-45 tips = (1 X 1.35) = 1.35 GPM
(2) D6-45 tips = (2 x 1.15) = 2.30 GPM
(2) D5-45 tips = (2 X 0.86) = 1.72 GPM
(2) D4-45 tips = (2 X 0.68) = 1.36 GPM
**Total Top Tree Half = 6.73 GPM (75%)**

**Bottom Tree Half**
(1) D5-45 nozzles = (1 x 0.86) = 0.86 GPM
(2) D4-45 nozzle = (2 X 0.68) = 1.36 GPM
**Total Bottom Tree Half = 2.22 GPM (25%)**

**Calibration Notes**

It's important to record and keep your sprayer calibration calculations. By having a record, you can compare your sprayer calibration calculations from calibration to calibration. This information can be useful to you or someone from your operation the next time you check the calibration.

**Next steps? Application Technology! Spraying coverage, droplet density, etc.**

**Questions? Email luan@uga.edu or call me at 334-444-7012**