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Vineyard canopy sprayer calibration worksheet

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Introduction

The purpose of this worksheet is to provide a guide to properly calibrate canopy sprayers for vineyards. This is a general guide to meet many types of air blast sprayer configurations. Make sure to consult to your sprayer's manufacturer's manual for the detailed configurations.

Preparations

What you will need are:

- a stopwatch
- a 50-m measuring tape or measuring wheel
- two stakes or flags (Or an app for tractor speed estimation)
- graduated cylinders (large-mouth, 1,000-mL capacity with raised graduations) (Or a flow meter)
- lengths of hose to direct output into collection vessel
- a reliable, spare oil-filled pressure gauge
- a calculator
- a pen and hard-covered notebook
- a proven calibration formula and technique

Stage 1: Sprayer Checklist

Mechanical integrity
- ☐ Is attachment to the tractor secure?
- ☐ Is the chassis and structure free of cracks and rust?
- ☐ Are the wheels and tires in good condition?
- ☐ Are guards, including PTO shaft guard, secure and undamaged?

Hydraulic system
- ☐ Are they free from leaks under pressure?
- ☐ Are the hoses and connections worn or cracked?

Pneumatic system
- ☐ Is the system free from leaks when working under operation pressures?

Electrical system
- ☐ Is the wiring undamaged, and are all connections properly insulated?
- ☐ Do all the lights work properly?

Sprayer tank
- ☐ Are tank/chassis fasteners secure?
- ☐ Free from leaks?

- ☐ Does the lid fit securely and free from leaks?
- ☐ Is the contents gauge clearly legible?

Chemical induction (eductor/inducer) system

- ☐ Are the system and controls working properly?
- ☐ Is it free from leaks under pressure?
- ☐ Are all labels appropriate and readable?
- ☐ Is the rinse system and container wash system working properly?

Spray lines and filters

- ☐ Are they free from leaks under pressure?
- ☐ No hoses and connectors worn or cracked?
- ☐ Are all valves and filters in good condition?

Controls and valves

- ☐ Are the master on/off switches working correctly?
- ☐ Are left and right section switches (if you have one) functioning?
- ☐ Can you read the pressure gauges easily?
- ☐ Are all labels appropriate and legible?
- ☐ Is the pressure adjustment stable?
- ☐ Pressure gauge reading zero?

Nozzles

- ☐ Are all fitting in good condition?
- ☐ Are all nozzles correctly oriented?
- ☐ Are all check valves working properly?
- ☐ Is the spray/distribution pattern visually correct?

Stage 2: Calculations

2.1 Tractor speed

1. Check the tractor (sprayer) speed. It is better to measure speed rather than relying on your speedometer.
    a. You can measure 100-200 ft distance, mark the start and end of it with flags, and measure the time (in second) your tractor takes to travel the measured distance. Then you can estimate miles per hour (MPH) as:

$$MPH = \frac{ft.\ traveled}{Seconds\ traveled} \times \frac{60}{88}$$

e.g. (200 ft/39 sec) x (60/88) = 3.5 MPH

    b. OR you use a smartphone app to estimate MPH, if you wish.

2.2 Determine target output per nozzle

1. Fill in the table below:

Measurement	Unit	Example	Your record
Measured sprayer speed	MPH	3.5	
Recommended application volume	GPA	50	
Pressure	psi	100	
Row width	feet	9	
Nozzle type	n/a	Teejet D6 w/ D23 (core)	
Number of nozzles per side	n/a	5	

2. Calculate the required nozzle output based on your numbers.

$$total\ \frac{Gallons}{minute}\ (GPM) = \frac{GPA\ \times\ MPH\ \times\ Row\ width\ (ft)}{495}$$

(based on the example above…)

$$total\ GPM = \frac{50\ GPA\ \times\ 3.5\ MPH\ \times\ 9\ Row\ width\ (ft)}{495} = \frac{1575}{495} = 3.18$$

$$GPM\ per\ side = \frac{3.18}{2} = 1.59$$

$$GPM\ per\ nozzle = \frac{1.59}{5} = 0.318$$

(Converting to fluid ounces)

$$0.318\ GPM\ x\ 128\ \frac{fl\ ounces}{gallon} = 40.7\ fl\ oz.per\ min$$

Space for your calculation

$$total\ \frac{Gallons}{minute}(GPM) = \frac{GPA\ \times\ MPH\ \times\ Row\ width\ (ft)}{495}$$

GPM per side:

GPM per nozzle:

Fl oz per min:

Stage 3: Take measurements

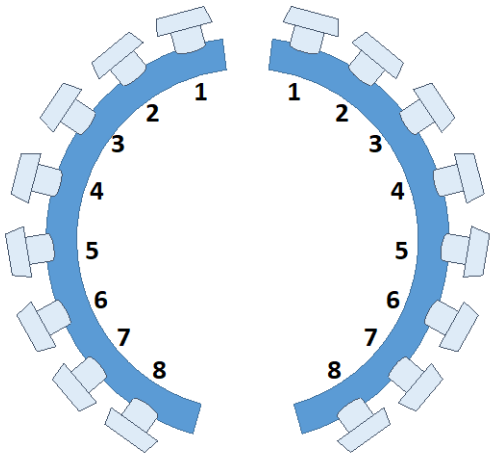
1. Fill the tank with clean water
2. Apply the tractor break
3. Run the tractor engine to provide TPO speed of 540 rpm
    a. Operate the sprayer
    b. Check that each nozzle shut-off valve is working.
    c. Check that the agitation system is functioning properly.
4. Search for and correct any leaks
    a. Set the correct pressure at the gauge
    b. Temporarily install a second oil-filled gauge in-line beside the main pressure gauge.
    c. Place the pressure gauge on the nozzle fitting farthest away from the pump and turn the sprayer on. If pressure is lower at the nozzle than specified, increase pressure at the regulator.
5. Record pressures:

    i. Pressure at nozzle _____psi

    ii. Pressure at sprayer gauge _____psi

6. Connect a horse + a jug (or other way to collect water) to each nozzle
    a. Collect water for 1 minute
    b. Record the amount of water for each nozzle
    c. Alternatively, you can use a flow meter (obtainable from Gemplers, Spraying Systems, Amazon, etc.) attached to individual nozzles

Nozzle	GPM
1	
2	
3	
4	
5	
6	
7	
8	
Subtotal Left	



Total sprayer GPM	

Nozzle	GPM
1	
2	
3	
4	
5	
6	
7	
8	
Subtotal Right	

1. Check the water output for each nozzle

a. If the outputs are within 5% error, adjust pressure or speed
b. If the outputs are over 10% error, change nozzles
c. If more than 20% of nozzles need replacing, replace all the nozzles on the sprayer.

Back conversion to obtain Gallons per acre

$$GPA = \frac{Total\ GPM\ collected\ \times\ 495}{MHP\ \times\ Row\ width\ (ft)}$$

Based on the example above:

$$GPA = \frac{Total\ GPM\ collected\ \times\ 495}{MHP\ \times\ Row\ width\ (ft)}$$

$$GPA = \frac{3.18\ GPM\ \times\ 495}{3.5\ MHP\ \times\ 9\ Row\ width\ (ft)} = \frac{1574}{31.5} = 50$$

References

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