

Calibrating a Tractor Mounted Sprayer

J.F. Ahrens^{1/}

To calibrate means to determine the volume of liquid applied per sprayed acre. This volume in gallons per acre (GPA) is determined by three variables: a) speed, measured in feet per minute (ft/min); b) nozzle output in gallons per minute (gal/min); c) swath width in feet. The spray volume in GPA is determined by the following formula:

$$\text{GPA} = \frac{\text{nozzle output in gal/min} \times 43,560 \text{ ft}^2 \text{ per acre}}{\text{swath width in ft} \times \text{speed in ft/min}}$$

1. Tractor speed. 1 mph = 88 ft/min, 2 mph = 176 ft/min, 3 mph = 264 ft/min, etc. Three mph is about the maximum speed that can be maintained in ornamental nurseries and Christmas trees, especially on rough ground. Whether you have a speedometer or tachometer select a comfortable speed and measure it in ft/min. Mark off any known distance under field conditions and measure the time required to cover it at a given throttle setting or tachometer reading. The tractor should be up to speed as you pass each point. Example: 200 ft. in 55 seconds = $200/55 = 3.64 \text{ ft/sec} \times 60 \text{ sec/min} = 218 \text{ ft/min}$. Record the throttle setting or tachometer reading and the gear, so it can be repeated. Note that the ground speed and gear combination should provide a PTO speed adequate to run the sprayer.

2. Nozzle output in gal/min is next measured while running the pump at the same speed as used in practice. For PTO operated sprayers this is the same throttle setting or tachometer reading as determined above. Turn on the boom and catch the liquid (water, for calibration) from one or more nozzles for 60 seconds (1 min). Measure the volume in fluid ounces. Average the output for 2 or more nozzles on multiple nozzle booms. Record the pressure on the gauge so it can be repeated.

$$\text{Gal/min} = \frac{\text{nozzle output in oz/min per nozzle} \times \text{no. of nozzles on boom}}{128 \text{ oz/gal}}$$

Note that on broadcast booms all nozzles must be of the same size and evenly spaced on the boom. (See manufacturers recommendations for nozzle spacing and pressure and approximate spray volume per acre).

3. Swath width on multiple nozzle boom sprayers in feet =

$$\frac{\text{no. of nozzles on boom} \times \text{distance between nozzles in inches}}{12 \text{ inches per ft.}}$$

Swath width on single nozzle booms is measured on a dry surface such as blacktop. Remember that for off-center nozzles which spray half a row from each side and overlap in the row center, the swath width is 1/2 the distance of the full swath covered by the 2 passes.

^{1/} Plant Physiologist, The Connecticut Agricultural Experiment Station, Valley Laboratory, 153 Cook Hill Road, Windsor, CT 06095. (203) 688-3647 (July 1990).

4. Having determined the speed, nozzle output and swath width, compute the GPA as mentioned above. To make small changes in GPA, adjust the pressure with the pressure regulator, and remeasure nozzle output. To make large changes either change the speed or the nozzle size and recalculate.

Example a: broadcast boom spraying, with tractor speed 218 ft/min, swath width of 7 nozzles at 20 inches (140 in.) = 11.7 ft, average nozzle output is 38 oz/min/nozzle x 7 = 266 oz/min ÷ 128 oz/gal = 2.08 gal/min.

$$\text{GPA} = \frac{2.08 \text{ gal/min} \times 43,560 \text{ ft}^2/\text{A}}{11.7 \text{ ft} \times 218 \text{ ft/min}} = \frac{90,604.8}{2,550.6} = 35.5 \text{ or } \underline{36}$$

Example b: Single flood jet nozzle spraying a 6 ft. swath, tractor speed 218 ft/min, nozzle output 38 oz/min.

$$\text{GPA} = \frac{0.3 \text{ gal/min} \times 43,560 \text{ ft}^2/\text{A}}{6 \text{ ft} \times 218 \text{ ft/min}} = \frac{13,068}{1,308} = \underline{10}$$

Example c: Band spraying a 2 ft. swath in rows spaced 6 ft. apart, tractor speed 218 ft/min, nozzle output 38 oz/minute.

$$\text{GPA} = \frac{0.3 \text{ gal/min} \times 43,560 \text{ ft}^2/\text{A}}{2 \text{ ft.} \times 218 \text{ ft/min}} = \frac{13,068}{436} = \underline{30}$$

Note that in example c only 2 ft. of each 6 ft. is sprayed; therefore only 2/6 or 1/3 of each acre of land is sprayed; the volume per sprayed acre is 30 but the volume of spray per acre of land is 10. This is important in determining the total volume of spray mix to prepare.

Remember: The desired rate of pesticide per acre is always added to water and made up to the volume delivered per sprayed acre.