



# Formulas to Aid in Selecting and Using Field Sprayers

A field sprayer is an important piece of farm equipment and its selection should be made on the basis of intended use and spraying capacity needed. Too often sprayers have been selected on purchase cost alone, and the grower soon finds out that the sprayer is not sufficient for his spray program. A wide variety of sprayer models and sizes are available which will do a good job of spraying. Listed here are formulas which can be used to aid in selecting the right size sprayer, or sprayer components if a grower plans to build a sprayer.

## 1. TO DETERMINE LENGTH OF BOOM FOR SPECIFIC SPRAYING OPERATION:

$$\text{Length of boom, in feet} = \frac{43,560 \times \text{acres}}{\text{working hours} \times 5,280 \times \text{mph (miles per hour)}}$$

Example: What length boom would be required for a sprayer which is to operate at 5 mph to spray a 60 acre field in 8 working hours? Consider that 75% of the time is spent in actually spraying and 25% in filling tank, turning at ends and other non-spraying tasks.

$$\text{Length of boom} = \frac{43,560 \times 60}{(8 \times 0.75) \times 5,280 \times 5} = \underline{16.5 \text{ feet}}$$

Select closest standard length of boom.

By rule of thumb, at 5 mph for three working days (8 hour days) each foot of boom will cover approximately 10 acres. Thus, 250 acres could be covered in three days at 5 mph with a 25 foot boom.

## 2. TO DETERMINE PUMP CAPACITY NEEDED FOR SPECIFIC SPRAYING OPERATION:

$$\text{Pump output in gpm} = \frac{\text{mph} \times \text{boom length} \times \text{gal. per acre}}{495} \times 1.3^*$$

(gallons per minute)

\*NOTE: Factor of 1.3 allows 30% additional pump capacity for tank agitation if hydraulic jet agitation is used.

Example: What minimum size pump is needed to apply a spray at 20 gallons per acre with a sprayer equipped with a 20 foot boom and operated at 5 mph?

$$\text{Pump output} = \frac{5 \times 20 \times 20}{495} \times 1.30 = \underline{5.25 \text{ gpm}}$$

3. TO DETERMINE ACRES COVERED PER HOUR:

$$\text{Acreage sprayed per hour} = \frac{\text{boom width} \times \text{mph}}{8.25 \times 1.25^*}$$

\*NOTE: Factor of 1.25 allows 25% of time for filling tank, turning at ends and other non-spraying tasks.

Example: How many acres can be sprayed per hour using a sprayer with a 20 foot boom and traveling at 5 mph?

$$\text{Acreage sprayed per hour} = \frac{20 \times 5}{8.25 \times 1.25} = \underline{9.7 \text{ acres per hour}}$$

4. TO DETERMINE GALLONS APPLIED PER ACRE:

$$\text{Gallons applied per acre} = \frac{\text{gallons per minute per nozzle} \times 5,940}{\text{nozzle spacing (inches)} \times \text{mph}}$$

Example: How many gallons will be applied per acre using a sprayer traveling at 5 mph with nozzles spaced 18 inches apart and with a nozzle output of 1 gallon per minute per nozzle?

$$\text{Gallons per acre} = \frac{1 \times 5,940}{18 \times 5} = \underline{66 \text{ gal. per acre}}$$

5. TO DETERMINE NOZZLE OUTPUT TO APPLY SPECIFIC GALLONS PER ACRE:

$$\text{Output per nozzle in gpm} = \frac{\text{gallons per acre} \times \text{mph} \times \text{nozzle spacing (inches)}}{5,940}$$

Example: What size nozzles should be used to apply 60 gallons per acre with the sprayer traveling 5 mph and the nozzles spaced 18 inches apart on the boom?

$$\text{gpm per nozzle} = \frac{60 \times 5 \times 18}{5,940} = 0.909 \text{ gpm}$$

6. TO DETERMINE OPERATING SPEED IN MILES PER HOUR (MPH):

$$\text{MPH} = \frac{0.682 \times \text{distance in feet}}{\text{number of seconds}}$$

- A. Measure off a distance, preferably 300-500 feet. Put a marker at each end.
- B. Drive the tractor between the two markers and clock the time required to travel the distance.
- C. Multiply the distance in feet by 0.682 and divide by the number of seconds to obtain speed in mph.

7. TO CALCULATE CAPACITY OF SPRAY TANK IN GALLONS:

NOTE: All dimensions are in inches.

A. Cylindrical tank - Gallons = length x diameter<sup>2</sup> x 0.0034

B. Rectangular tank - Gallons = length x diameter x width x 0.004329

C. Elliptical tank - Gallons = length x short diameter x long diameter x 0.0034

Arthur W. Selders  
Extension Specialist  
Agricultural Engineering

IS-PM-7.0:570:1189

Programs and activities offered by the West Virginia University Cooperative Extension Service are available to all persons without regard to race, color, sex, national origin, or handicap.

Cooperative Extension Work in Agriculture and Home Economics, West Virginia University and the United States Department of Agriculture, Cooperating. Rachel B. Tompkins, Director, Morgantown, West Virginia. Published in Furtherance of Acts of Congress of May 8 and June 30, 1914.