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**Pesticides
Fact Sheet**



BOOM SPRAYER CALIBRATION FOR PESTICIDE APPLICATIONS

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To protect your investment in agricultural pesticides, a boom sprayer should be calibrated at the start of the season and whenever application conditions change. Also, sprayer output should be periodically checked throughout the season to assure proper application rate. Although boom sprayers are calibrated in a variety of ways, each method utilizes the measurements of nozzle flow rate and equipment travel speed.

NOZZLE FLOW RATE

Nozzle flow rate is critical to the accurate application of pesticides. Nozzle flow rate is dependent on:

- ◆ **Nozzle size and style** - Different nozzles can provide different flow rates and/or patterns at the same pressure. Each nozzle on a boom sprayer (sometimes the nozzles on the ends of a boom sprayer have a different function) should be the same size and style and from the same manufacturer. Check the nozzle manufacturer's catalog for the specific size and operating pressure for each application situation.
- ◆ **Pressure** - Flow rate is related to pressure. Small adjustments in flow rate are achieved with changes in pressure. Larger changes in flow rate require a change in the travel speed and/or replacement of the nozzles.
- ◆ **Nozzle wear** - As a nozzle wears, orifice size slowly increases. The result is an increased flow rate from the worn nozzle and a reduction in pressure for other nozzles on the boom. In instances where abrasive chemicals are sprayed, excessive nozzle wear may occur within a few hours.
- ◆ **Blocked Passages** - Debris can block screens and orifices, reduce flow rates and/or alter spray patterns. Frequently a visual inspection of spray patterns will detect a blockage. Passages, screens and orifices should be cleaned periodically and visual inspections made regularly.
- ◆ **Flow properties of the carrier** - Nozzle flow rates normally reflect an application rate based on water as the carrier. In situations where carriers heavier or lighter than water are used, the flow rate is changed. Some manufacturers provide charts showing alternative nozzle selections/pressure settings for liquids such as liquid fertilizer with densities different from water.

TRAVEL SPEED

Knowing the actual speed of spray equipment is essential. Cable driven speedometers are seldom accurate at lower speeds (5 mph) and engine rpms may be a better indicator of travel speed. Digital speedometers that monitor speed with radar are available and offer much greater accuracy. Errors in travel speed are one of the most common causes of misapplication. For example: A boom sprayer (20 feet wide) is calibrated to apply 15 gallons per acre at 4 mph. If it is incorrectly operated at 5 mph, it can reduce the application rate to 10 or 11 gallons per acre. If it is incorrectly operated at 3 mph, it can increase the application rate to 19 or 20 gallons per acre. Accurately measuring the time required to travel a predetermined distance will provide true travel speed.

CALIBRATION EQUIPMENT FOR BOOM SPRAYERS

Calibrating will require a measuring tape to measure nozzle spacing and a 300-foot course, a measuring container accurately calibrated in ounces (60 oz capacity, plastic is preferred), a new/accurate pressure gauge, a stop watch or watch with second hand, a calculator and notepaper to record information.

- ◆ **Confirm spray pressure at the boom:** Normally, the pressure gauge on spray equipment is located to allow ease of access by the operator. This positions the gauge away from the boom and results in the actual boom pressure being lower than that shown on the gauge. Since hose length can influence pressure, a simple pressure check at the nozzles, with a second new/accurate pressure gauge, is a good idea. Operating pressure should be adjusted to provide correct nozzle pressures along the boom. Manufacturers' catalogues have a list of the proper pressures for each nozzle type.

- ◆ **Measure nozzle spacing:** Nozzles on the spray boom should be equally spaced. Check that the center-to-center measurement between each nozzle is the same. Nozzle spacing (measured in inches) is the “W” value in the formula below. This spacing, the manufacturer's recommended pattern overlap, height of the boom and height of the target, are all components in the spraying operation. Refer to nozzle manufacturers' guidelines to determine correct nozzle spacing, overlap and height.

- ◆ **Calculate target flow rate for each nozzle:** The following formula calculates the number of gallons per minute (GPM) that must be delivered by boom sprayer nozzles for the application rate to be correct. The formula will give an answer in gallons per minute (GPM) and the pressure setting and/or travel speed are adjusted to raise or lower this value. The operating pressure should be changed for small adjustments in GPM, while speed (miles per hour) should be changed for large adjustments in GPM.
$$\text{GPM} = \frac{\text{GPA} \times \text{MPH} \times \text{W}}{5940}$$

GPA = Gallons per acre from product label
MPH = Sprayer speed, in miles per hour
W = Spacing of nozzles on boom, in inches

- ◆ **Check all nozzles for uniform flow rate:** Measure the flow rate of each nozzle on the boom after the pressure is set. Collect the liquid output from each nozzle for 30 seconds. This volume times two will equal the nozzle flow rate in ounces per minute. Nozzles that vary from manufacturers' specifications by more than 10 percent (nozzle output is 10 percent greater or less than the rated nozzle output) should be replaced. If all the nozzles are the same age and two or more tips vary by more than 10 percent, manufacturers recommend that all nozzle tips on the boom be replaced. If all flow rates are within limits, the flow rate values for each nozzle should added together and divided by the number of

nozzles to determine the average nozzle flow rate in gallons per minute (GPM in the formula above). It is not unusual for the actual nozzle output to differ slightly from the values shown in manufacturers' catalogues.

- ◆ Confirm actual travel speed: To accurately determine travel speed this procedure must occur under actual field conditions. Mark a 300-foot course in a typical field. With the sprayer at least half full of water and the tractor traveling at normal spraying speed, drive the course from start to finish two or three times. Time each trip over the course and calculate your average time. Convert your time to miles per hour with this formula:
MILES PER HOUR = $\frac{\text{Distance in Feet} \times 60}{\text{Time in Seconds} \times 88}$

Throttle speed and/or gear selection should be changed to match the travel speed used in the GPM formula above. Both travel speed (MPH) and application rate (GPM) may need to be adjusted to fine tune the spray operation for accurate applications.

BAND SPRAYING

Band spraying reduces the amount of area and chemicals sprayed per acre, while broadcast spraying applies chemicals to the entire acre. To use the above formulas for band sprayer applications, use the band width (measured in inches) rather than nozzle spacing for the “W” value.

PRECAUTIONARY STATEMENT

All pesticides have both benefits and risks. Benefits can be maximized and risks minimized by reading and following the labeling. Pay close attention to the directions for use and the precautionary statements. The information on pesticide labels contains both instructions and limitations. Pesticide labels are legal documents and it is a violation of both federal and state laws to use a pesticide inconsistent with its labeling. The pesticide applicator is legally responsible for proper use. Always read and follow the label.

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