Sprayer Calibration

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Calibration helps ensure good pest control. It also helps prevent crop damage from pesticides, high pesticide residues, and environmental contamination. Calibrate all application equipment to ensure a pesticide will be applied accurately and uniformly at the recommended rate. Calibration involves preparing the equipment so it is working properly, measuring the delivery rate, adjusting the equipment to change the delivery rate, and calculating how much pesticide to add to the sprayer tank. Calibrate equipment regularly (at least once per year) to make sure the output is not changing. Also calibrate equipment when it is new and when making changes that affect the delivery rate. Proper calibration will minimize, if not eliminate, left-over mixed pesticides in the sprayer tank which can be very difficult to properly dispose of.

There are four basic procedures to be carried out when calibrating sprayers. Details on these procedures are given below. (Also refer to the "Pesticide Applicator Course for Agricultural Producers".)

Use the "Calibration Worksheets - Mushrooms" in this section to follow these four procedures when applying pesticides to your crop.

1. Set-up
2. Measuring delivery rate
3. Adjusting delivery rate (if different from recommended rate)
4. Calculating how much pesticide to add to the spray tank

Set-Up

During sprayer set-up check that the sprayer nozzles and spray pressure are correct for the applied pesticide and the crop conditions. Check the equipment to ensure all parts are in good condition and working properly (see the sprayer's operating manual). The sprayer must apply the pesticide uniformly across the width of the watering boom and over the whole bed area.

You must choose which nozzles to use and nozzle pressure before you can move on to the second step in calibration, "Measuring Delivery Rate".

The last page of the "Calibration Worksheet" gives formulas for checking the speed of your tractor gears.

Selecting Spray Volume

Drench Appliation

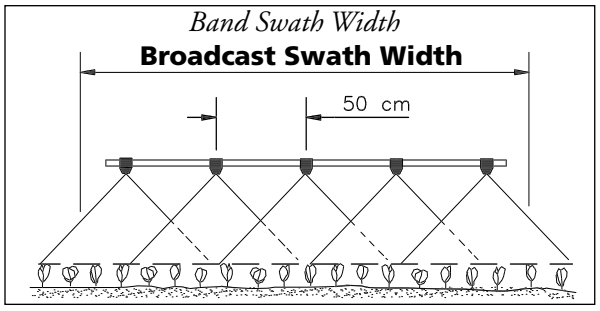
Before calibrating your sprayer, you should determine how much spray mixture should be sprayed in the given area. The recommended amount of spray mixture (spray volume) is usually found on the pesticide label.

Selecting Nozzle Pressure

Many nozzle manufacturers have chosen to report nozzle outputs with pressures in "bars" not kilopascals (kPa). The bar unit is equal to 100 kPa. Pesticide labels report pressures in kPa. Use a pressure gauge on the sprayer marked in both psi and kPa (or bar) so both units can be read directly from the gauge. The maximum pressure on the pressure gauge should be twice the maximum spray pressure used to protect the gauge from damage and allow it to be read accurately.

Determine Sprayer Swath Width

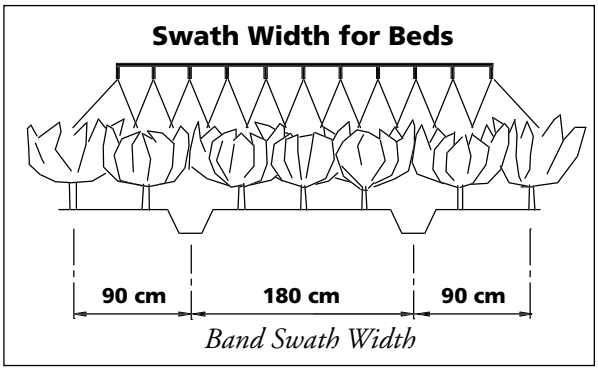
Swath width is the width of treated area over which spray droplets are distributed in one pass of the applicator (see figures below). In a broadcast spray, it is the nozzle spacing multiplied by the number of nozzles, and for band treatments it is the sum of the treated band widths. For crops grown in beds, sprayer swath width is the bed spacing (from center to center of wheel tracks) multiplied by the number of beds.



Broadcast swath width

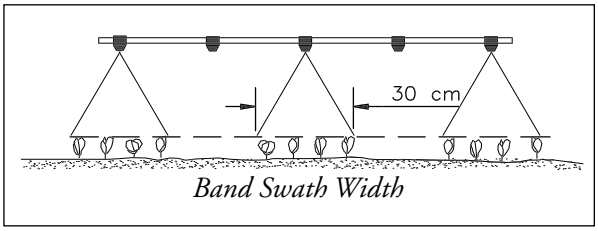
= # of nozzles x spacing
= 5 nozzles x 50 cm
= 250 cm
= 2.5 m

Swath width is usually measured in meters or feet. The swath width is used in sprayer calibration to calculate the sprayer's delivery rate. As the sprayer swath width is based on the treated area, the delivery rate will also be based on the treated area when band spraying herbicides.



Broadcast swath width
= # of beds x bed width
*= 2 * x 180 cm*
= 360 cm
= 3.6 m

**Note: no. of beds = 1/2 bed + 1 bed + 1/2 bed*
= 2 beds



Band swath width
= # of bands x band width
= 3 bands x 30 cm
= 90 cm
= 0.9 m

Measuring Delivery Rate

There are two basic methods used to measure sprayer delivery rates — the test area method and the timed output method.

a) The test area method uses fewer calculations, however, it can take longer to carry out. If an entire production room (growing area) is used as the test area, the measured discharge of water is the delivery rate per production room and no calculations are required. The most common problem with the test area method is measuring the amount of spray water discharged.

b) The timed output method requires more calculations. By using both the test area and timed output method, the accuracy of your sprayer calibration can be checked.

Adjusting Delivery Rate

If the measured delivery rate of the sprayer is different than the spray volume listed on the pesticide label or recommended in the production guide, it can be adjusted in three ways:

1. Nozzle size should be changed if large changes in delivery rate are needed. Check with the nozzle supplier or agricultural advisor. Obtain a catalogue listing nozzles and nozzle outputs in litres per minute (L/min). Some of these are given in Tables 9.1 and 9.2.
2. Forward speed changes will adjust the delivery rate. Slower speeds increase the amount sprayed and faster speeds reduce the amount.
3. Spray pressure should be set for the correct droplet size. Changing pressure is recommended only for very small changes in delivery rates. Otherwise the droplet size will change and cause drift or runoff problems. Since pressure must be increased four times to double the delivery rate, this is not a good way to adjust delivery rate.

After making the adjustments, measure the delivery rate again.

Calculating How Much Pesticide to Add to the Spray Tank

When the sprayer delivery rate is known, then calculate how many square feet can be sprayed by a full tank and how much pesticide to add to the spray tank. Be very careful to accurately measure the area to be covered by the last tank to minimize left over spray mixture in the tank when you are finished spraying.

Calibrating Hand Operated Sprayers

Sprayer Set-up

Hand-operated sprayers should be checked to make sure there are no leaks, especially where the hose enters the tank and around the trigger valve. The nozzle should deliver a uniform spray pattern. Many nozzles can be adjusted to produce the desired droplet size. Adjust the nozzle to produce a coarse spray (larger droplets) for herbicides and medium to fine spray (smaller droplets) for insecticide and fungicide applications.

For uniform spray application it is important to maintain constant spray pressure and coordinate the walking speed with uniform back and forth movements of the nozzle. The back and forth movements determine the swath width.

Most pesticide labels give instructions as a specific amount of pesticide per unit area (e.g., apply 2.4 L/ha). Some pesticides like **Roundup** give directions to dilute an amount of pesticide in water and apply with thorough and complete coverage (e.g., **Roundup** –1 L of product in 100 L of water).

Application Rate Given as a Dilution with Water

When the application rate is given as a dilution rate, then the amount of pesticide to mix in a full tank can be calculated directly.

Example:

A label recommends mixing 1 L of pesticide in 100 L of water and applying to foliage with thorough coverage. A 12-litre backpack will be used.

Answer:

The amount of pesticide to add to the tank can be calculated with the following formula:

Amount of pesticide = label rate (product amount÷water volume) × sprayer volume

Amount of pesticide = 1 L product ÷ 100 L water × 12 L tank = 0.12 L product/tank

If only a partial tank full (e.g. 8 L) of pesticide mix is required, use that figure as the "sprayer volume" input in the formula.

Also estimate how much spray mixture is needed so tank mix is not left over. Do this by applying water to a measured test area and determine the total mix needed. Use the same procedures that follow for pesticide application rates given as an amount of pesticide per unit area.

Boom Irrigation Sprayer

Application Rate Given as Amount of Pesticide per Square Foot

Measuring delivery rate of the hand-operated sprayer follows the same basic steps as with the tractor mounted boom sprayer but on a smaller scale. Remember during set-up of the sprayer that a steady walking speed and swath width must be used.

1. Mark out a measured length of test strip at least 60 feet long.
2. Fill the tank about half full with water and record the volume or level of water. Pump the tank to the pressure level that will be used.
3. Carefully spray the measured test strip while maintaining a steady forward speed and pumping action. Repeat enough runs over the test area until at least 10% of a full tank has been sprayed.
4. Measure the volume of water sprayed in the test strip by refilling the tank to the starting level.

Follow these steps to determine the application rate:

(a) Calculate the test area:

Test area (ft^2) = strip length (ft) × swath width (ft) × # runs

(b) Calculate the delivery rate:

Delivery rate (gal/ft^2) = water sprayed (gal) ÷ test area (ft^2)

Adjust the delivery rate as necessary by changing the walking or application speed.

(c) Calculate the amount of area sprayed by a full tank:

Area sprayed (by full tank) = tank volume (gal) ÷ delivery rate (gal/ft^2)

(d) Calculate how much pesticide to add to the spray tank:

Amount of pesticide to add to tank = application rate × area sprayed by one tank

Scratch pad for math calculations