Basic Sprayer Calibration

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What is Calibration?

Calibration means testing your spray equipment with water and measuring how much it can apply on a given area when walking at a given speed using a given pressure and keeping the nozzle at a given height so one is able to know:

- How much water is needed
- How much chemical is needed
- How many sprayer full tanks will be needed
- How much chemical to add per full tank

Why calibrate?

- Pesticides are increasingly expensive. PMPs can't afford to waste material.
- Improve the efficacy of the pesticide applied (better pest control).
- Reduce the chance for pest resistance development by applying the correct rate.
- Reduce off-target spray deposition (drift, run-off). Increasing regulatory scrutiny.
- Protect the environment, workers.
- Save time and money by reducing unnecessary spray.

When should you calibrate?

- Beginning of the season
- Anytime something changes that can affect the application (output rate, travel speed, nozzles, product, person making the application)

Tools needed for calibration

- Stopwatch/timer
- Measuring tape, flags, flagging tape, stakes
- Calculator, notepad for recording
- Calibrated container, pressure gauge, flow meter for liquid applications
- Small scale, tarp, funnels or cups for granular applications

Getting started

- Read the label to determine application rates
- Determine size of area to be treated
- Be sure equipment is clean
- Wear personal protective equipment (PPE)
- Use clean water
- Choose the correct type of equipment based on formulation type and application site

Calibration of Hand Held Sprayers

The procedure for calibrating a hand-held or backpack sprayer is simple. Just follow these steps:

- Measure out an 18.5 x 18.5 foot strip in the area similar to the one you will be spraying.
- Add water to your tank and in a uniform manner, spray this area with water and record the amount of seconds it takes. Do this 2 or 3 times making sure that you keep your pattern and pressure constant. Take the average.
- Measure the amount of water delivered to this strip by spraying into a bucket for the same amount of time as in step #2. Also keep your pressure the same as when you sprayed the strip.
- The amount of water collected in fluid ounces equals the output or **GPA**. (Ounces = GPA)

This method works because of the relationship between a square that is 128^{th} of an acre (18.5 ft x 18.5 ft = 342.25 ft^2) and the fact that there are 128 ounces in a gallon.

$$\text{Application rate (gal/acre)} = \frac{\text{Flow rate (gal/min)}}{\text{Land rate (ac/min)}}$$

This fundamental relationship works for all sprayers!

$$\text{Application rate (gal/ac)} = \frac{\text{Flow rate (gal/min)}}{\text{Land rate (ac/min)}}$$

<u>Flow rate</u> is dependent on nozzle selection and pressure.

$$\textbf{Application rate (gal/ac)} = \frac{\textbf{Flow rate (gal/min)}}{\textbf{Land rate (ac/min)}}$$

Land rate is dependent on speed of travel and the swath width covered by the nozzle or set of nozzles.

This is the area that the nozzle or set of nozzles is covering per minute.

$$\textbf{Application rate (gal/ac)} = \frac{\textbf{Flow rate (gal/min)}}{\textbf{Land rate (ac/min)}}$$

There are 3 ways to obtain the flow rate of a given nozzle, some more accurate than others:

1) Look for the stamp on the nozzle body, indicating the flow rate for that nozzle at a particular pressure, typically 40 psi (only valid for 40 psi)

2) Check the manufacturer's catalog which typically gives flow rates for a given nozzle at a range of pressures. (only valid for new nozzles at certain psi)

3) Measure it!

Application rate (gal/ac)= $\frac{\textbf{Flow rate (gal/min)}}{\textbf{Land rate (ac/min)}}$

<u>Flow rate</u> is dependent on nozzle size selection and operating pressure.

For flat fan nozzles, the nozzle nomenclature, stamped onto the nozzle body, tells you the manufacturer's intended flow rate at a given pressure (typically 40 psi).

For example, **11004** *should* deliver 0.4 gal/min at standard pressure (40 psi), at an angle of 110° when the boom is at optimum spray height for that nozzle- typically 18-20 inches.

Even if you have the manufacturer's listed rate from the catalog, it's still a good idea to measure the *actual* flow rate from the nozzle (*why might these differ*?)

Why the *actual* flow rate may differ from the manufacturer's specs.

- Different operating pressure.
- Worn or broken nozzle. It is rare for nozzles to be brand new. (How often should a nozzle be replaced?)
- Drop in pressure from extended hose length.

Tools you will need to measure flow rate

Conversion factors

$$\textbf{Application rate (gal/ac)} = \frac{\textbf{Flow rate (gal/min)}}{\textbf{Land rate (ac/min)}}$$

Application rate is most often expressed in **gallons per acre.**

In order to calculate this, we convert our flow rate, often recorded in ounces per second to gallons per minute;

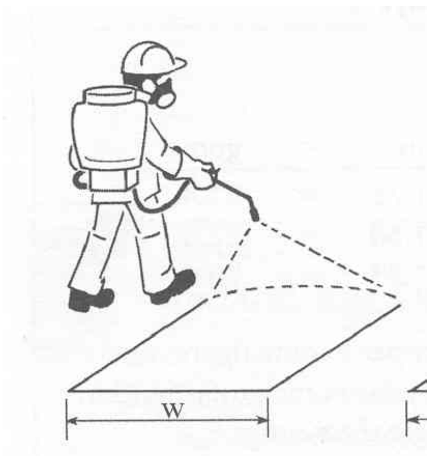
and our land rate, often recorded in feet per second multiplied by feet in swath width, to acres per minute.

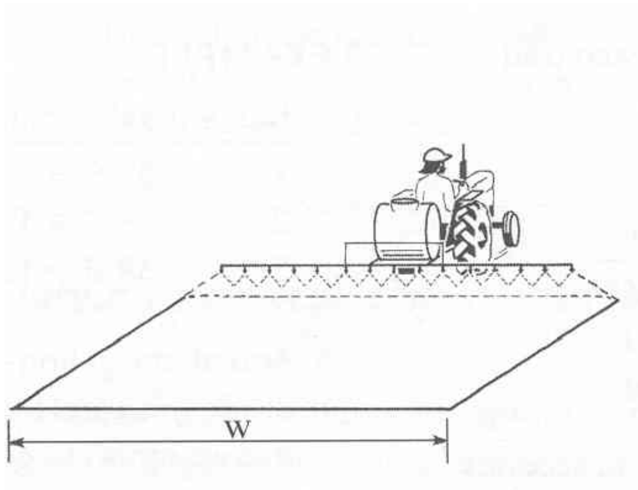
Land Rate: AREA covered in time

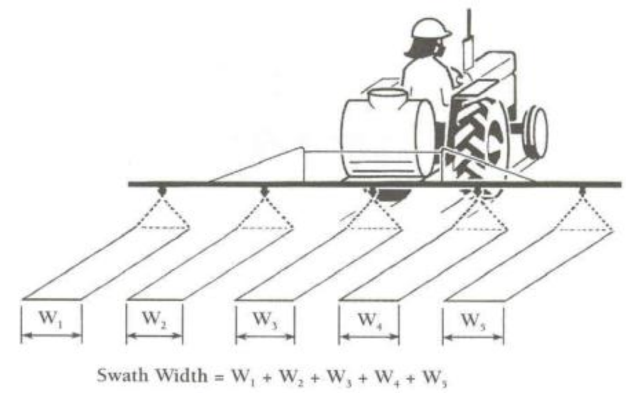
- not just walking speed
- *area* covered per unit time (ft^2/min)

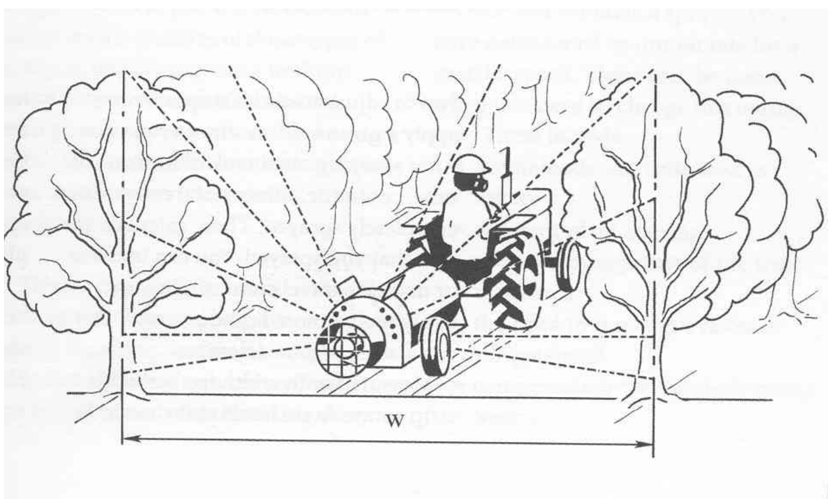
- **speed (ft/min) x swath width (ft)**
- convert ft^2/min to acres/min

Swath measurements









Measuring speed

To measure speed:

- Tank should be about ½ full.
- Terrain should be typical for the spray job.
- Measure time (convert to feet per minute) to travel at least 100 feet.
- Wear/carry same gear you would typically use during an application.
- Time multiple runs and take an average.

Accurate calibration doesn’t guarantee effective:

- Spray coverage
- Pest control
- Drift control

Calculation Practice

Example 1

Solutions:

What is the total amount of diluted product needed?

One gallon is needed per 1,000 ft^2 and we will be spraying only 500 ft^2, so we can set up the math like this:

$$\left(\frac{1\ gal\ of\ diluted\ product}{1{,}000\ ft^2\ applied\ area}\right)\times 500\ ft^2\ applied\ area = 0.5\ gal\ of\ diluted\ product$$

How much Suspend SC is needed for the spray solution?

The rate is 0.25 fl oz per 1,000 ft^2 and we'll spraying 500 ft^2, so the math is

$$\left(\frac{0.25\ fl.oz.concentrate}{1{,}000\ ft^2\ applied\ area}\right)\times 500\ ft^2\ applied\ area = 0.125\ fl.oz.concentrate$$

How much a.i. (deltamethrin) is in the mixture?

The label says that Suspend SC is 0.42 lb deltamethrin per gallon. So the math to calculate this is:

$$\left(\frac{0.42\ lb.deltamethrin}{1\ gal\ concentrate}\right)\times 0.125\ fl.oz.concentrate \times \left(\frac{1\ gal}{128\ fl.oz.}\right) = 0.0004\ lb.of\ a.i.$$

To convert this from lbs to oz.:

$$\left(\frac{16\ oz.}{1\ lb.}\right)\times 0.0004\ lb.deltamethrin = 0.006\ oz.\ of\ a.i.$$

Example 2

Solutions:

<u>What is the total amount of diluted product needed?</u>

The rate is 1 gal per 1,000 ft^2 and we want to spray 250 ft^2, so set up:

$$\left(\frac{1\ gal\ diluted\ product}{1{,}000\ ft^2}\right)\times 250\ ft^2 = 0.25\ gal\ diluted\ product$$

and if we want to know how many fl. oz. that is, since there is 128 fl oz per gal, then:

$$\left(\frac{128\ fl.oz.}{1\ gal}\right)\times 0.25\ gal\ diluted\ product = 32\ fl.oz\ diluted\ product$$

<u>How much Suspend SC is needed for the spray solution?</u>

The rate is 0.75 fl oz per 1,000 ft^2 and we want to spray 250 ft^2, so we can set up the math like this:

$$\left(\frac{0.75\ fl.oz.concentrate}{1{,}000\ ft^2}\right)\times 250\ ft^2 = 0.1875\ fl.oz.concentrate$$

Example 2 (con't)

How much a.i. is in the mixture?

The label says that Suspend SC is 0.42 lb deltamethrin per gallon. So the math to calculate this is:

$$\left(\frac{0.42\ lb.deltamethrin}{1\ gal}\right)\times 0.1875\ fl.oz\ concentrate\times\left(\frac{1\ gal}{128\ fl.oz.}\right) = 0.0006\ lb.deltamethrin$$

To convert pounds. to ounces:

$$\left(\frac{16\ oz.}{1\ lb.}\right)\times 0.0006\ lb.deltamethrin = 0.01\ oz.deltamethrin$$

Example 3

Solutions:

What is the total amount of diluted product needed?

1 gal is needed per 1,000 ft^2 and we're spraying 350 ft^2, so:

$$\left(\frac{1\ gal\ diluted\ product}{1{,}000\ ft^2}\right)\times 350 ft^2 = 0.35\ gal\ diluted\ product$$

or since there is 128 fl oz per gal, then:

$$\left(\frac{128\ fl.oz.}{1\ gal}\right)\times 0.35\ gal\ diluted\ product = 45\ fl.oz.diluted\ product$$

How much Talstar P is needed for the spray solution?

The rate is 0.75 oz per 1,000 ft^2 and we want to spray 350 ft^2, so we can set up the math like this:

$$\left(\frac{0.75\ fl.oz.concentrate}{1{,}000\ ft^2}\right)\times 350\ ft^2 = 0.26\ fl.oz.concentrate$$

Example 3 (con't)

How much a.i. is in the mixture?

The label says that there are 2/3 (or 0.67) lb of a.i per gal. So, since we used 0.26 fl oz of Talstar P, the amount of a.i. is:

$$\left(\frac{0.67\ lb\ of\ a.i.}{1\ gal\ concentrate}\right) \times 0.26\ fl.oz\ concentrate \times \left(\frac{1\ gal}{128\ fl.oz.}\right) \times \left(\frac{16\ oz.}{1\ lb.}\right)$$
$$= 0.022\ oz.a.i.$$

Example 4

Solutions:
What is the total amount of diluted product needed?
2 gal are needed per 1,000 ft^2 and we're spraying 5,000 ft^2, so:

$$\left(\frac{2\ gal\ diluted\ product}{1{,}000\ ft^2}\right)\times 5{,}000\ ft^2 = 10\ gal\ diluted\ product$$

How much Talstar P is needed for the spray solution?
The rate is 0.67 fl oz per 1,000 ft^2 and we are spraying 5,000, so the math looks like:

$$\left(\frac{0.67\ fl.oz.concentrate}{1{,}000 ft^2}\right)\times 5{,}000\ ft^2 = 3.35\ fl.oz\ concentrate$$

How much a.i. is in the mixture?
The label says that there are 2/3 (or 0.67) lb of a.i per gal. So, since we used 0.26 fl oz of Talstar P, the amount of a.i. is:

$$\left(\frac{0.67\ lb.a.i.}{1\ gal\ concentrate}\right)\times 3.35\ fl.oz\ concentrate\times \left(\frac{1\ gal}{128\ fl.oz.}\right)\times\left(\frac{16\ oz.}{1\ lb.}\right)$$
$$= 0.28\ oz.a.i$$

Hands-on exercise