

Calibrating an ATV sprayer for broadcast applications

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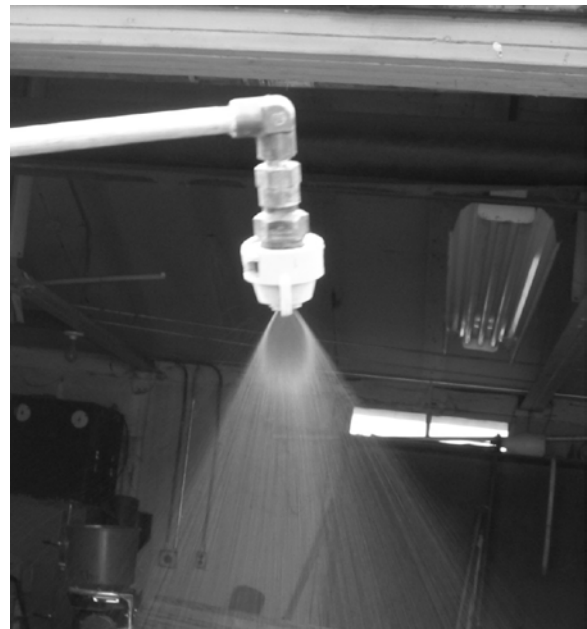
Sprayer calibration saves money and chemicals, and protects crops and the environment. There are only a few steps:

1. Choose your spray pressure and measure the spray output.
2. Figure out your working speed, then the total area you can treat per minute.
3. Calculate your spray volume and the total acreage you can treat with each tank.

Choose your spray pressure.

- During calibration, use clean equipment and plain water in the spray tank.
- For flat-fan nozzles, choose a line pressure that produces a nice solid fan. I usually use TeeJet XR nozzles, which can handle 15 to 60 p.s.i. 8002 to 8004 nozzles are a good size for these applications, depending on the nozzle spacing.

Lower pressures let you minimize the gallons per acre you apply, and they also help to reduce drift.



Measure the spray output (gallons per minute).

- Spray into cups or buckets, timing yourself. Usually 30 seconds is plenty.
- Measure how much came out of each nozzle and check for differences. A nozzle that puts out much less than the others might be partly plugged up or have some junk on the screen.



- Figure the total output in gallons per minute.
 - o Add all the nozzles' output together.
 - o Figure the total output for one minute. (For example, if you timed yourself for 30 seconds (1/2 minute), multiply your output by 2.)
 - o Convert the total output to gallons per minute. For example, if you measured the output in ounces, divide your output by 128 (128 ounces in a gallon). If your output is in milliliters, divide by 3785. This gives you gallons per minute.

Let's say we have a 12-nozzle boom and each nozzle puts out 21 oz in 30 seconds. Added all together, the boom puts out $21 \times 12 = 252$ oz in 30 sec, or 504 oz in one minute. 504 oz divided by 128 = 3.94 gallons per minute.

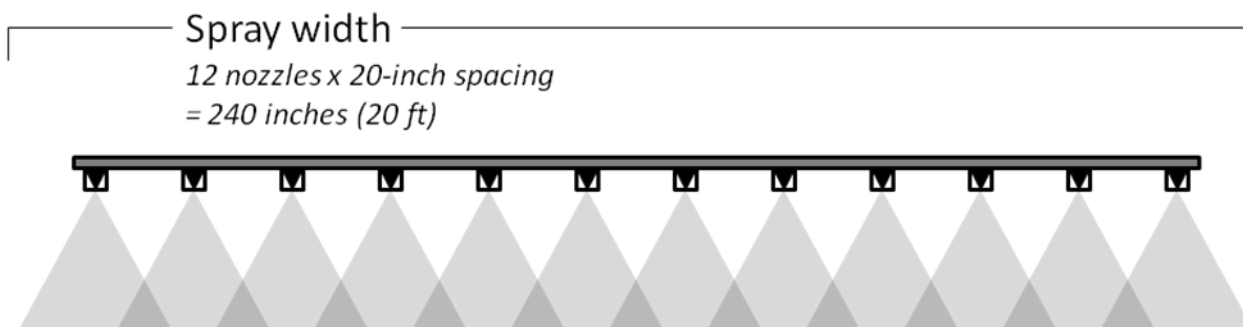
Figure out a good working speed (feet per minute).

- Using the whole spray rig, drive across the field and figure out a speed that is easy to maintain. You're aiming for around 5 mph.
 - With an ATV on bumpy ground, it's usually easiest to keep a steady speed with a low gear and high RPMs.
- Measure out a known length of the field you're going to treat (at least 200 to 400 ft).
- Once you have a good speed, time yourself driving from one end of the marked field to the other. Convert that time into feet per minute.
 - For example, 200 ft in 25 sec = $200/25 = 8$ ft/sec = 480 ft/minute.*
 - One number I use for quick estimates is 88 ft/minute = 1 mile per hour. So 480 ft/minute would be about 5.5 miles per hour, which is a good speed.
 - OR – just drive for a full minute and measure the distance covered.

Determine the rate of spray cover (square feet per minute).

- Multiply the feet-per-minute speed by the spray width. This gives the total square feet covered in each minute.
- The *spray width* is wider than the actual boom, because the nozzles at the ends spray wide.

$$\text{Spray width} = (\text{number of nozzles}) \times (\text{nozzle spacing})$$



- From the examples above, a 20-ft spray at 480 ft/minute covers $20 \times 480 = 9600$ square feet per minute.

Figure out the spray volume (gallons per acre).

- First, divide the area per minute by the area of one acre (43,560 ft²). This will give the fraction of an acre covered in one minute.
In our example, 9600 sq ft per minute / 43,560 = 0.22 acres in one minute.
- Divide the gallons per minute output by the acres per minute. This will give the spray volume in gallons per acre.
In our example, 3.94 gal per minute / 0.22 acres per minute = 18 gal per acre.
- 10 to 20 gallons per acre is a good range for most ground applications. (Some agricultural operations use more, but then they have to refill the tank more often.)

Figure out the area you can cover with each spray tank, then the amount of chemical for each spray tank.

- To get the total coverage for the spray tank, divide the tank capacity by the gallons per acre.
For example, a 50-gal tank at 18 gal per acre can treat $50/18 = 2.8$ acres.
- To determine the amount of chemical for each tank, multiply the tank coverage by the amount of chemical per acre.
For example, 5 oz Milestone per acre \times 2.8 acres = 14 oz.

Last but not least – keep track of where you have treated.

- Set out flags or sandbags on opposite sides of the field, spaced out at your spray width. Or use a spray dye. You may need to pull the flags after you make each pass.

Broadcast treatments with a backpack sprayer & boom

Guy Kyser, Weed Science Program, UC Davis

Calibrating a small boom sprayer for making broadcast treatments is similar to using a vehicle boom sprayer. The main difference is that with a vehicle sprayer, it's easiest to start by picking a good speed first, then figure out the spray volume. With a backpack, it's easier to decide on a spray volume first, then set your walking pace.

Choose your spray pressure.

- With a backpack, spray pressures will be in the 20-40 psi range.
- 8002 nozzles are good for backpack boom treatments.

Measure your output (gallons per minute).

Choose your spray volume (gallons per acre).

- 10 to 20 gallons per acre is a good range for most ground applications. (Some agricultural operations use more, but then they have to refill the tank more often.)
- Calculate how many minutes your sprayer will take to put out those gallons.

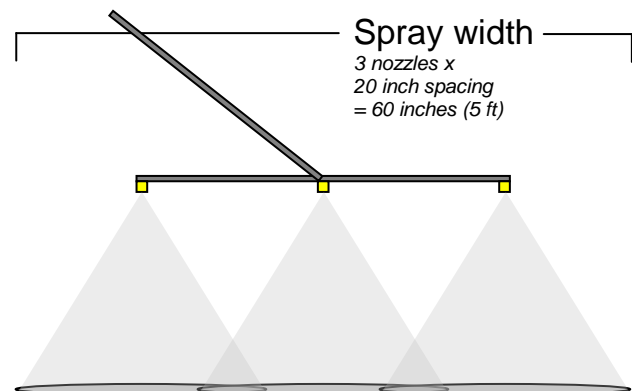
Figure out your speed using a “one-acre strip”.

- A “one-acre strip” is a long, skinny acre. This is the distance your sprayer has to go to treat one acre. This depends on your spray width.

- An acre is 43,560 ft². Divide this by the spray width to get the length of the one-acre strip. For this 3-nozzle boom, $(43,560 \text{ ft}^2 \div 5 \text{ ft}) = 8712 \text{ ft}$.

- Finally, figure out your speed. Speed = (length of the one-acre strip) \div (number of minutes to put out desired gallons per acre)

- To maintain a walking speed in the field, use a metronome or practice your pace over a known distance.



Using a spray gun for broadcast applications

Rob Wilson (UCCE Farm Advisor) and Guy Kyser (UC Davis)

Using a spray gun to cover an area evenly is more difficult than using a boom. However, spray guns are very useful for some situations, e.g., roadsides and fencelines. Spray gun equipment is usually mounted on ATVs or pickup trucks. For example, the Modoc County agricultural commissioner's office sends out teams of ATV spray gun operators to search for weeds along the back roads.

In his own area, Rob Wilson (farm advisor, Lassen County) found huge variations from one applicator to another in spray treatments. He suggests that every applicator in a team should go through the following calibration. Remember, use clean equipment and plain water for calibration.

To calibrate a spray gun for broadcast treatments,

- Measure out and mark a known area. A good size would be $1/100^{\text{th}}$ of an acre, i.e., 436 square feet – say a strip 10 ft by 44 ft.
- Walk this strip and spray it to cover, using the same pace and the same arm motions you normally use. Keep track of your time. Note that every applicator is going to have a different style and a different pace, so each one should calibrate his / herself.
- Now spray into a bucket for the same amount of time that it took to cover that strip. Measure how much water came out.

Now you know the amount of spray solution used to cover $1/100$ acre. With that information, you can figure out how many acres one tank can cover, therefore how much chemical to put in the tank.

For example, if it takes $1/2$ gallon to spray that strip, then the operator is putting out 50 gallons per acre ($1/2 \times 100 = 50$). A 20-gallon spray tank on an ATV will cover $20/50 (= 0.4)$ of an acre, and if the operator wants to put out 2 quarts of Roundup per acre the tank should have 0.4×2 quarts of Roundup, or about 26 ounces.

Spray-to-wet spot treatments

Guy Kyser, Weed Science Program, UC Davis

Spray-to-wet spot treatments can be done with a CO₂ backpack sprayer or a Solo-type handpump sprayer. Usually these applications are made with a single, relatively large nozzle (8004 or bigger) on a handheld wand, or with a spray gun. This is the kind of treatment usually performed when a team goes out to spray big weeds. However, you can waste a lot of time, herbicide, and money in spray-to-wet applications. Most of the problems come from spraying too much chemical.

Problems with overspraying

- Increased time and labor costs – both by taking more time to treat individual plants, and by requiring more refills
- Increased herbicide costs
- Reduced effectiveness – can “kill” the top of the plant before the chemical gets to the roots
- Effects on desirable plants or the environment if excess herbicide runs off

In spray-to-wet treatments, *don't overapply*. Spray the plant until the leaves are shiny, not until herbicide is pouring off the plant.

Calibration?

In field research, we calibrate spot treatments based on the foliar area of individual plants. In real life, this may not be necessary. Instead, you can do a “personal calibration”: do careful spray-to-wet treatments on a few plants and get used to the time it takes to treat each plant, the kind of arm motion and walking pace it requires, and the appearance of the plant when the treatment is done.

Personal calibration is a useful exercise for a weed team to go through before hitting the slopes. This can get everyone spraying at the same rate, multiplying the potential savings.

Spot treatment rates

Spot treatments are usually applied as a percent herbicide mix (e.g., 1% *Roundup*). Herbicide labels often give a different maximum rate per acre for spot treatments compared to broadcast applications, and they may tell you how much of the area you're allowed to treat. For example, *Milestone* has a maximum broadcast rate of 7 oz/A, but spot treatments can be made at 14 oz/acre, as long as less than half the field area is treated. *Roundup Weathermax* has a maximum rate of 2 qt/acre in most spot treatments – but if you treat less than 10% of the area, you can use more than 2 qt/acre. It's all on the labels, but sometimes you have to read carefully.

Spray volumes

Different sized plants take different amounts of spray solution for a spray-to-wet treatment. A shrub-sized plant (artichoke, pampasgrass) might take 100 to 200 gallons per acre. A small tree might take 400 gallons per acre because it is taller and has more leaves to wet.

The gallon-per-acre rate is based on how much spray solution you apply in a given area. For example, an artichoke plant 4 feet in diameter takes up about 12 square feet (0.0003 acres). At 100 gallons per acre, it would take only 0.03 gallons (about 4 ounces) of spray solution to treat this plant.

If you were treating this plant at 100 gallons per acre of 1% *Roundup Weathermax*, you'd be using 1 gallon per acre of *Roundup*, which is legal as long as you treat less than 10% of the field area. If you were applying 0.1% *Milestone*, you'd be using 1/10 of a gallon (12.8 oz) of *Milestone* per acre, which is legal as long as you treat less than half the field area.

As discussed earlier, it's not necessary to go to this level of detail in calibrating most spray-to-wet applications. Caution, though – in treating very large plants (high spray volumes) or plants which cover a large part of the field, you might be at risk of exceeding legal application rates. However, these aren't the kinds of situations in which most managers use spot treatments.

Low-volume treatments

Treatment times and number of tank refills can be cut in half by using low-volume applications instead of spray-to-wet treatments. It's basically the same procedure, but uses half the volume of spray solution with a higher concentration of herbicide. It takes a little more practice in the beginning but can result in major labor cost savings.

- Find some target plants and practice making spray-to-wet treatments as above, timing yourself on each plant.
- Now practice making the application in half the time. This will take faster motion with the spraying arm, and you may have to jog around the plant. If you can make the application in half the time, then you are putting on one-half the spray volume.
- For application, double the herbicide concentration in the spray solution. For example, if you would normally use 1% *Roundup Weathermax*, you will now use 2%. Now you are putting on half the spray volume with double the herbicide concentration, ending up at the same rate.