Land-Grant Press™ by CLEMSON EXTENSION

Calibrating Sprayers: 128th of an Acre Method

Justin Ballew - Clemson Extension, Horticulture Program Team

Introduction

Proper calibration of sprayers is an often-overlooked chore by many farms and green industry professionals. It can be a tricky task; however, few things are more important for properly and safely applying pesticides. Proper calibration is essential in avoiding several issues, including control failures, phytotoxicity, chemical resistance development, and wasted material, time, and money. All sprayers should be calibrated before use. Specifically, they should be calibrated anytime output is adjusted. Additionally, if the sprayer has been idle for a while (e.g., over the winter), calibration should be checked before using it again.

Types of Spray Applications

Broadcast applications are applied uniformly across the surface of a field (figure 1). Spray nozzles are spaced evenly and close enough that spray coverage from each nozzle overlaps with the nozzle next to it. Broadcast applications are the most common type and are used when 100% coverage of a field or lawn is desired. Banded applications are applied in strips or bands rather than uniformly (figure 2). Nozzles are either spaced further apart or every other one is turned off so there is no spray overlap. Banded applications are commonly used for applying herbicides to row middles or concentrating fertilizers or fungicides in a seedbed. This method of application reduces the amount of product that needs to be applied when compared to a broadcast application. For help calculating the amount of product required to mix for a banded application, see the "Worksheet for Calculating Treated Acres for Banded Application" at the end of this publication.

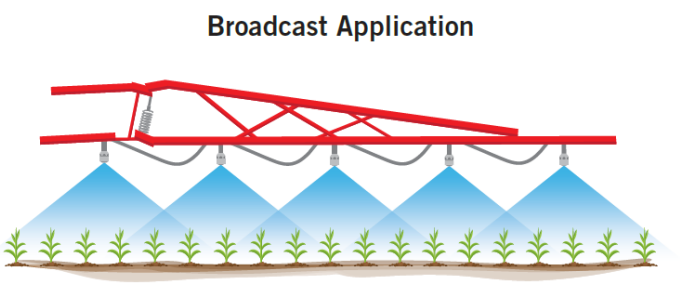

Figure 1. In a broadcast application, spray overlaps from each nozzle covering 100% of the planted area. Image credit: Bek Diamond, Clemson University (2020).

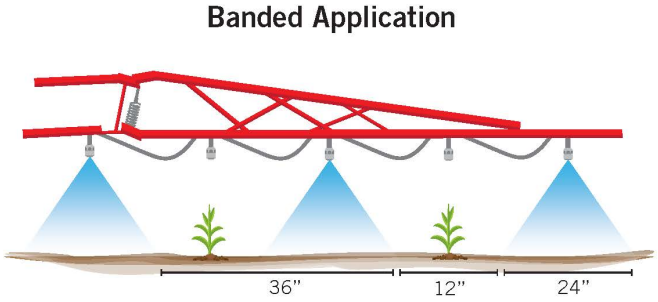

Figure 2. In a banded application, the spray is applied in bands that do not overlap. There is a treated and untreated area. Image credit: Bek Diamond, Clemson University (2020).

When applying certain materials to crops such as tomatoes or strawberries, spray applications from sprayers with multiple nozzles per row may be required. This allows a chemical to be applied from two or three different angles at once (the top and/or two sides), ensuring maximum spray coverage. Fungicides and miticides are commonly applied this way, especially with low growing crops that have dense canopies (figure 3) or those that are trellised (figure 4). This method is sometimes referred to as a targeted application or a directed spray.

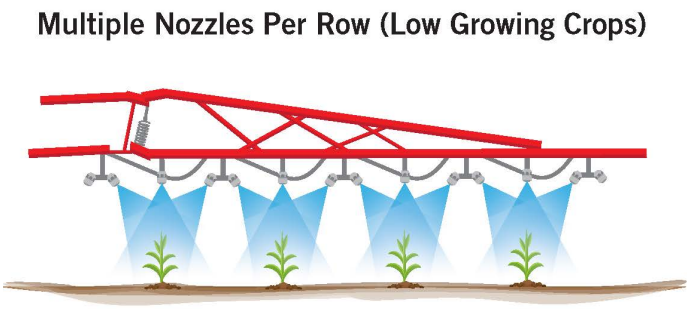

Figure 3. In a directed application with multiple nozzles on a low growing crop, the nozzles are angled to direct the spray into the crop canopy from multiple directions. Image credit: Bek Diamond, Clemson University (2020).

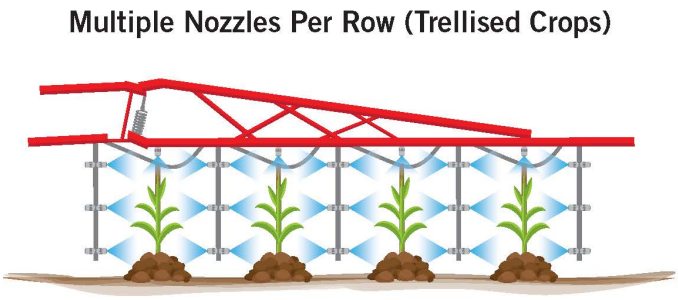

Figure 4. In a directed application with multiple nozzles on a trellised crop, the maximum coverage is achieved by spraying from multiple directions (the top and/or two sides). Image credit: Bek Diamond, Clemson University (2020).

How to Adjust Output

When preparing a sprayer to apply a new material, adjusting the output, or gallons per acre (GPA), is often necessary. There are three ways to adjust a sprayer's output: adjusting the spray pressure, adjusting the ground speed of the tractor/sprayer, and changing the nozzles.

Adjusting the spray pressure (PSI) up or down is a good way to make minor adjustments when the output is off by just a few GPA. The pressure would have to be quadrupled to double the output of a sprayer. Therefore, it is best to make significant adjustments another way.

Adjusting the speed of the tractor/sprayer is one way to make more significant adjustments to spray output. To double the output, decrease the speed by half (e.g., 10 mph to 5 mph), inversely, double the speed to reduce the output by half. Increasing the speed to reduce the output may not always be advisable as drift is more likely at higher speeds, and spray coverage may be reduced. Decreasing the speed by half will double the time it takes to make an application.

Changing nozzles is a good way to make significant output adjustments without changing tractor/sprayer speed. To increase or decrease the output, simply switch to a nozzle with a different orifice size (figure 5). To double the output, double the size of the orifice (e.g. 8002 to 8004) and vice versa to reduce the output by half.

Figure 5. Flat fan nozzles of varying orifice size. The last two digits of the number printed on the nozzle tell the nozzle output. For example, an 8004 nozzle has an output of 0.4 gallons per minute at 40 PSI. Photo credit: Justin Ballew, Clemson University (2020).

Materials Needed for Calibration

In addition to the sprayer, gather the following materials (figure 6):

- Cones or flags
- Measuring tape or wheel
- Ruler
- Measuring cups
- Stopwatch or stopwatch app on a smartphone

Always calibrate with clean water only.

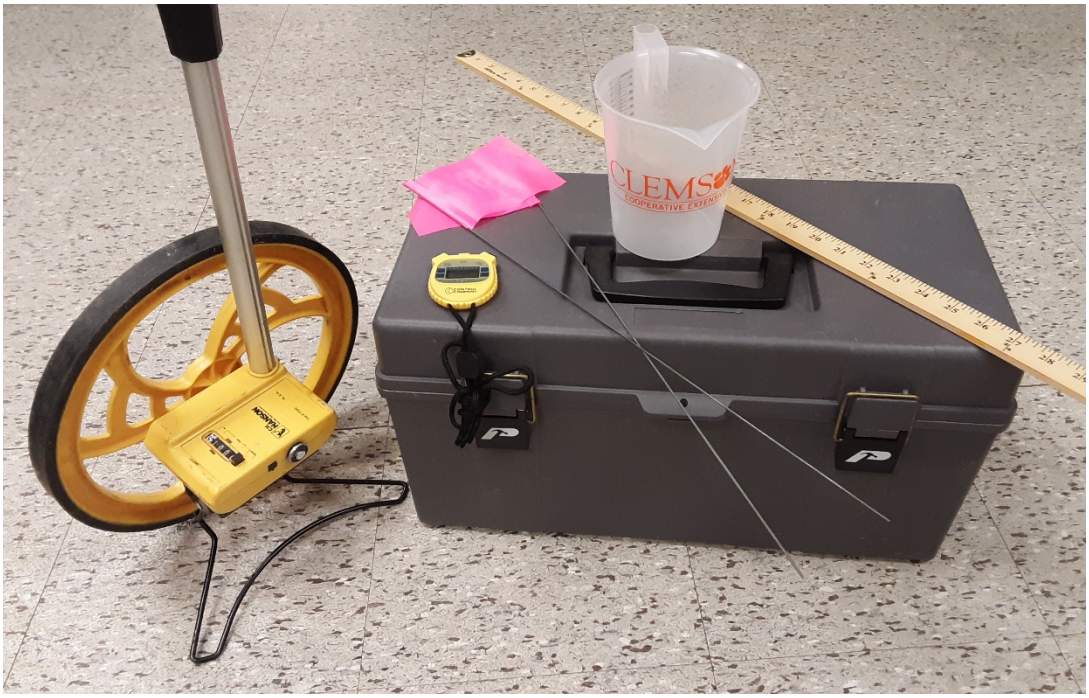

Figure 6. Materials needed for calibration include flags or cones, a stopwatch, measuring cups, a measuring wheel or tape, and a ruler. Photo credit: Justin Ballew, Clemson University (2020).

Procedure for Calibrating Sprayers

While there are several methods of calibrating sprayers, the "128th of an acre" method is one of the simplest. There are 128 fluid ounces in a gallon. Therefore, the number of fluid ounces applied to 128th of an acre (or 340 square feet) is equivalent to GPA. The procedure below outlines the steps for calibrating using this method.[1,2]

1. Using the measurements in table 1, determine the distance needed to drive the sprayer to cover 340 feet.[2]
    a. **Broadcast applications:** Measure the distance between nozzles and use that distance.
    b. **Banded applications:** Use the desired band width.
    c. **Sprayers with multiple nozzles per row:** Use the row spacing.

Table 1. Measurements to determine the distance to drive the sprayer.

Spacing in Inches (for a, b, c)	Distance (feet)
6	681
8	511
10	408
12	340
14	292
16	255
18	227
20	204
24	170
30	136
36	113
38	107
40	102
48	85
60	68
72	57

2. Measure the time (in seconds) it takes to drive the test distance determined in step 1. Spray equipment should be hooked up and running at the desired gear setting or RPM. Drive the test distance at least three times and calculate the average time.
3. Park the tractor and while maintaining the same gear setting or RPM used in step 2, use a measuring cup to collect the spray from one nozzle for the amount of time it took to drive the test distance.
    a. **Broadcast applications:** Collect the spray from a single nozzle.
    b. **Banded applications:** Collect the spray from all nozzles used on one band.
    c. **Sprayers with multiple nozzles per row:** Collect the spray from all nozzles used on one row.

4. Measure the fluid ounces of spray collected in step 3. This is equivalent to gallons per acre (GPA). For example, if 15 ounces is collected, the sprayer output is 15 GPA. If the output is not within 5% of the desired application rate,[3] repeat step 3 after adjusting the PSI or changing the nozzles. Repeat steps 2 and 3 if the tractor/sprayer speed is adjusted.

Tips for Calibrating

- Check before calibrating to ensure nozzles, screens, gaskets, and filters are in good working order and free of any debris.
- Turn the sprayer on and visually evaluate the output of the nozzles before calibrating. Clean or replace any nozzles that have an irregular spray pattern.
- Collect and measure spray from each nozzle for the same amount of time. Replace any nozzles that vary more than 10% from the average output of all the nozzles.
- Always spray at the same ground speed the tractor/sprayer was calibrated for.
- Boom height should be as consistent as possible. Traveling over uneven terrain can cause variations in boom height and inconsistent spray patterns.
- Read and follow all pesticide labels in their entirety. Remember, the label is the law.

References Cited

1. Sumner PE, MJ Bader. Calibration method for sprayers and other liquid applicators. Athens (GA): University of Georgia Extension; 2012. Circular 683.
2. Butler W. 128th acre calibration. Raleigh (NC): North Carolina Extension; 2000. AG-601-2.
3. Ozkan E, Smith K. Calibrating boom sprayers for forestry herbicide application. Columbus (OH): Ohio State University Extension; 2018. FABE-529. https://ohioline.osu.edu/factsheet/fabe-529.

Citation

Ballew J. Calibrating sprayers: 128th of an acre method. Clemson (SC): Land-Grant Press by Clemson Extension; 2020. LGP 1036. http://lgpress.clemson.edu/publication/calibrating-sprayers-128th-of-an-acre-method.

CLEMSON COOPERATIVE EXTENSION

Calibrating Sprayers: 128th of an Acre Method

Justin Ballew - Clemson Extension, Horticulture Program Team

Worksheet for Calculating Treated Acres for Banded Applications

For banded applications, materials should be measured and mixed for treated acres rather than the total acreage of the field. This formula will determine treated acres.

Sample Problem:

A banded application will be made to a ___30___ acre field.

The row spacing is __36___inches and the band width is going to be ___12__ inches.

Calculate the number of treated acres in the field.

_____30_____ x (_____12____ ÷ _____36_____) = _____10_____acres

Field acres | Band width (inches) | Row width (inches) | Treated acres

Fill in the Blanks with Your Own Information:

A banded application will be made to a _____ acre field.

The row spacing is _____inches and the band width is going to be _____ inches.

Calculate the number of treated acres in the field.

_____ x (_____ ÷ _____) = _____acres

Field acres | Band width (inches) | Row width (inches) | Treated acres