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The 1/128th of an Acre Sprayer Calibration Method [1]

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The 1/128th of an acre method for calibrating sprayers is based on the fact that the spray volume in ounces applied to an area equal to l/128th of an acre is equal to the gallons per acre rate being applied.

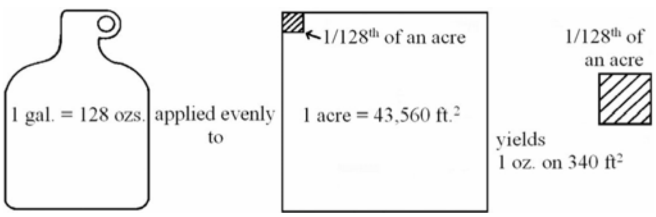

Figure 1. Why gallons per acre equals the ounces on 1/128th of an acre.

In order to make practical use of this fact to calibrate a sprayer, a grower must determine the length of a course required to spray l/128th of an acre (340 sq. ft^2). The course length would be equal to 340 sq. ft. divided by the swath width being sprayed.

Length (in feet) of 1/128th of an acre course =

$$\frac{340\ ft^2}{\text{swath width (ft)}}$$

The swath width used in the equation depends on the type of spray application. Figure 2 shows the swath widths to use for some of the more common types of spray applications. When applying a broadcast spray with a boom sprayer, as shown in (a) of Figure 2, the swath width is equal to the nozzle spacing on the boom. The swath width for a band application, as in (b) of Figure 2, is equal to the band width being applied. The band width can be easily determined by spraying some dry sand with the nozzle and measuring the band width wetted.

Note: Band applications should be applied with special nozzles that spray a uniform amount across the full width of the band. However, these nozzles must not be used for broadcast spraying, as in (a) where the patterns overlap.

Examples (c) and (d) of Figure 2 show two types of applications that can be easily calibrated with the 1/128th of an acre method using the row width as the swath width. The fact that more than one nozzle is directed at the row will be accounted for in a manner explained later in this pamphlet (see When More Than One Nozzle is Directed at the Same Swath Width).

Directed sprays using a skid to keep a constant height above the soil, as in example (d), are

1. This document is AE5, one of a series of the Agricultural and Biological Engineering Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Original publication date January 1987. Revised October 2007. Visit the EDIS Web Site at http://edis.ifas.ufl.edu.
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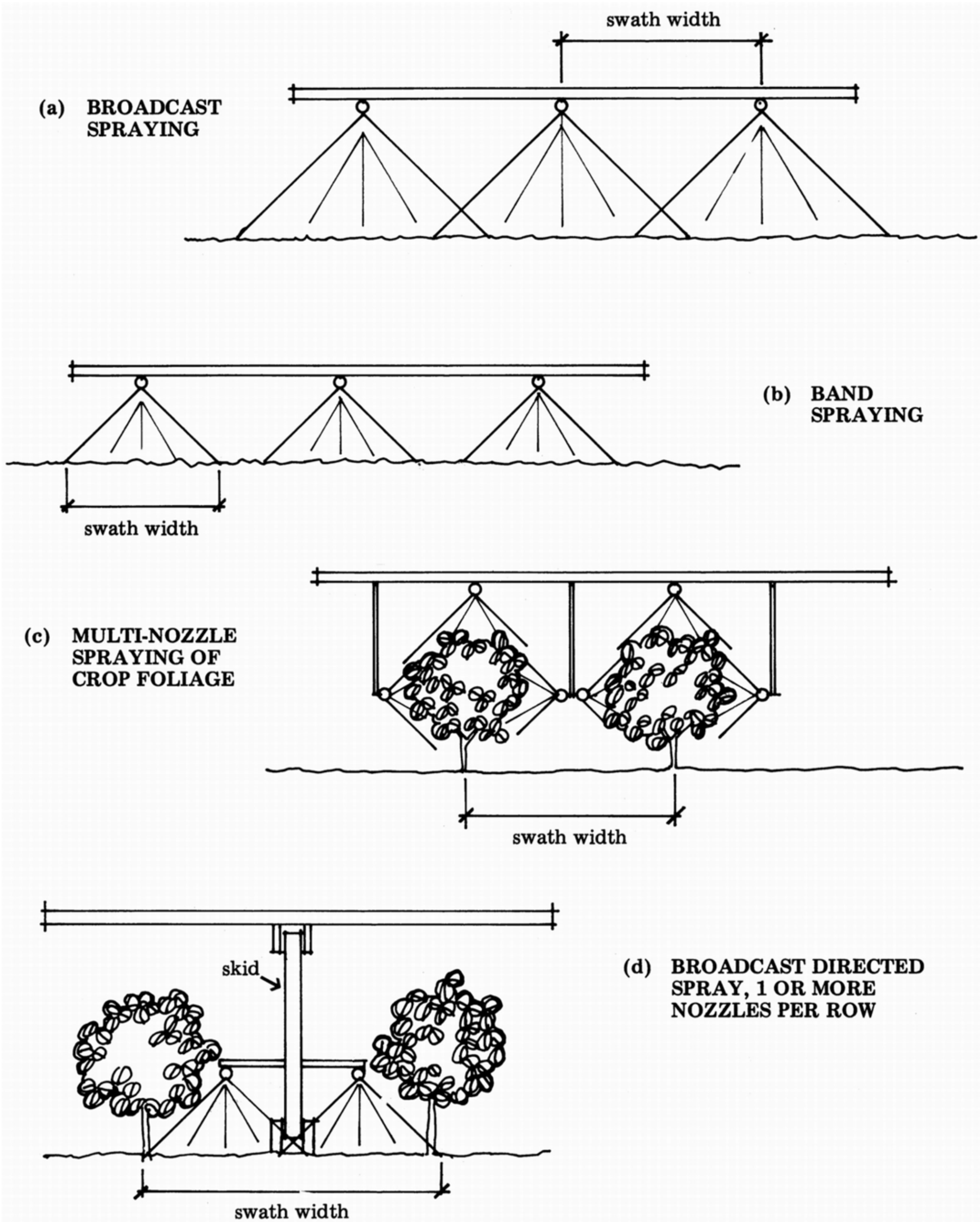

Figure 2. Swath widths for more common types of spray application.

sometimes applied in a band rather than treating all of the soil. In some instances more than one nozzle is directed at the same band in order to get thorough coverage. The band width is used as the swath width in this type of application.

Table 1 gives the length of a course which would be 1/128th of an acre for various swath widths.

Nozzle Uniformity Check

Before proceeding with an example on how to use the 1/128th of an acre calibration method, an easy way to check that all of the nozzles are putting out the same amount will be outlined. The need for this check is not unique to the 1/128th method; it is needed regardless of the calibration method used.

Table 1. Course lengths for various swath widths.

Swath widths in inches and feet		
inches	feet	
8	.67	507
10	.83	408
12	1.00	340
14	1.16	292
16	1.33	255
18	1.50	226
20	1.67	204
22	1.83	185
24	2.00	170
26	2.16	157
28	2.33	146
30	2.50	136
32	2.67	127
34	2.83	120
36	3.00	113
38	3.16	107
40	3.33	102
48	4.00	85

Herbicides demand greater attention to calibration than other pesticides and dictate a uniform flow at each nozzle. A nozzle uniformity check is an absolute must when applying herbicides, but is desirable for all pesticide applications.

A graduated cylinder that is tall relative to its diameter should be used to catch the flow from every nozzle on the boom for a period of at least 10 seconds. The amount of fluid caught from each nozzle should be recorded. After catching the fluid from all of the nozzles, add the amounts caught, and divide by the number of nozzles to get the average amount. Any nozzle that is greater than 10% above or below the average should be replaced with another nozzle, and the flow checked on the replacement(s).

Nozzle	10 Sec. of Flow (ozs.)	Nozzle	10 Sec. of Flow (ozs.)
1	8.0	7	9.0
2	8.5	8	5.0
3	10.0	9	8.0
4	8.5	10	8.5
5	8.0	11	8.5
6	8.5	12	8.0
Sum of Flows = 98.5			
Average= $\frac{98.5}{12}$ =8.2			

Ten percent of 8.2 would be 0.82. Any nozzle that was putting out more than 8.2 + 0.82 = 9.02 or less than 8.2 - 0.82 = 7.38 should be replaced. Nozzle number 3 would be replaced because of excess flow, and number 8 would be replaced because the flow was insufficient.

A baby bottle can be used to conduct the 10 second catch-test in many instances without the liquid overflowing. However, a large cylinder might be needed when relatively high gallons per acre are being applied by the sprayer. Using a larger cylinder is more desirable than cutting the duration of the catch-test because accuracy suffers when the time is reduced. If a baby bottle is used, use it exclusively for checking nozzle uniformity. Never try to clean it and use it to feed a baby.

The 1/128th of an Acre Method

Example 2: A grower is applying an herbicide broadcast with a sprayer that has nozzles spaced 20 inches apart. How would he calibrate using the 1/128th of an acre method?

1. Determine the course length from Table 1. Since the swath width for broadcast spraying is equal to the nozzle spacing--20 inches--the table gives a course length of 204 feet.

2. Stake out the 204-feet course.

3. Using the same gear and rpm that will be used when spraying, determine the time required to travel the course length.

4. Conduct a nozzle uniformity check as previously outlined.

5. With spray system pressure set at the same pressure as will be used when spraying, catch the flow from one of the nozzles for the same period of time that it took to travel the course length. It is preferable to catch the flow from a nozzle that was spraying very close to the average amount. It is sufficient to check the flow at one nozzle, because the uniformity check conducted in Step 4 ensures that the one nozzle chosen is representative of all of the nozzles.

6. The number of ounces caught in Step 5 is equal to the number of gallons per acre (GPA) being applied to the sprayed area. If 15 ounces were caught in the time it took to travel the course length, the GPA applied is 15.

7. Determine the acres sprayed with each tank of spray.

$$\text{Acres Treated per Tank} = \frac{\text{Tank Capacity (gal)}}{\text{Gallons Applied per Treated Acre}}$$

Example 2a: Assume that 15 ounces were caught in Step 5 above. This would be equal to a 15 gallon per acre application rate. How many acres would be sprayed with a 300-gallon tank of spray?

$$\text{Acres per Tank} = \frac{300 \text{ gal/tank}}{15 \text{ gal/acres}} = 20 \text{ acres/tank}$$

8. Add the amount of pesticide specified on the label for the number of acres being treated.

Example 2b: Assume that the label of a particular pesticide specifies 1 pint of formulation per acre. To spray 20 acres, the 300-gallon tank in Example 2a that would spray 20 acres would have 20 pints of formulation added. The remainder of the tank would he filled with water or other diluents.

When More than one Nozzle Is Directed at the Same Swath Width

When sprays similar to cases (c) and (d) of Figure 2 are applied, the only step of those outlined in Example 2 that would change is step 6. Instead of the number of gallons per acre rate being equal to the number of ounces caught from one nozzle, the GPA would be equal to the ounces caught from one nozzle multiplied by the number of nozzles directed at the swath.

Example 3: Assume that 3 identical nozzles are directed at a crop, as in Figure 2(c), and the crop is planted on 3 feet rows. Determine the GPA using the 1/128th of an acre method.

After completing steps 1 through 4, a catch of one nozzle for the correct time period yielded 10 ounces. The GPA would be 3 x 10 or 30 gallons per acre.

Nozzles of Different Sizes

If the nozzles directed at a row are different sizes, such as the nozzle over the row being larger than the two paired nozzles on the sides, the GPA cannot be determined by multiplying the flow from one nozzle by the number of nozzles (as in Example 3). The flow would have to be caught for the time it took to travel the course length from each of the nozzles and pooled in one container graduated in ounces. The total number of ounces would be equal to the number of gallons per acre rate.

Note: When the nozzles directed toward a row differ in size, a nozzle uniformity test should be conducted for each of the sizes.

Multi-nozzles Directed into a Band

Often growers will direct as many as 4 nozzles into a band centered on the crop, leaving the row middle to be mechanically cultivated. When this type of application is done, the swath width used for determining the 1/128th of an acre course length would be the band width. However, the number of gallons per acre being applied in the band is determined by catching the flow from one nozzle for the time it takes to travel the course length and multiplying the number of ounces by the number of nozzles directed into the band.

Applying Band Sprays

When applying a band spray, the acreage of a field that is actually treated is proportional to the ratio of the band width to row spacing. Table 2 shows the portion of the field acreage that is treated when applying a band spray on various row spacings.

Table 2. Portion of field treated when band spraying.

Row spacing (inches)	Band width (inches)		
	12	14	16
30	.40	.467	.533
32	.375	.437	.500
34	.353	.412	.471
36	.333	.389	.445
38	.316	.368	.421
40	.300	.350	.400
42	.286	.334	.381
44	.273	.318	.364
46	.261	.302	.348
48	.250	.292	.333

Table 2 is useful for determining the amount of pesticide needed in order to apply various band sprays to a given acreage. It is also useful when determining the volume of spray needed to spray a small field requiring less than a full tank of spray. The use of Table 2 is demonstrated in Examples 4, 5, and 6.

Example 4: How much chemical must be bought to apply a 12-inch band application on 100 acres of a crop planted on 40-inch rows, if the label specifies a broadcast rate of 1 quart per acre?

Table 2 shows that an application of this type (12-inch band on 40-inch rows) treats 0.30 of the field. The pesticide required would be 0.30 of what was needed if the whole field was treated broadcast. Since the label specified 1 quart per acre on a broadcast basis, it would require 100 quarts to apply a broadcast treatment to the 100-acre field, and only 0.30 as much, or 30 quarts, to apply the specified band application.

When the band swath width is used to determine the course length necessary to equal 1/128th of an acre, the number of gallons per acre established by the number of ounces caught are the gallons applied to each treated acre.

The number of acres treated per tank of mixture can be determined as shown below:

$$\text{Acres Treated per Tank} = \frac{\text{Tank Capacity (gal)}}{\text{Gallons Applied per Treated Acre}}$$

The amount of chemical to add to the tank can be determined in the following manner:

Pesticide per Tank =Acres Treated per Tank x Rate per Acre on a Broadcast Basis

Note that the broadcast rate per acre is used in determining the amount to add to the tank because the number of treated acres, not field acres, was used as the multiplier. This method should help avoid some of the confusion about band applications because the only information needed is: (1) the application rate per treated acre, which is taken directly from the nozzle catch test, and (2) the broadcast application rate specified on the label of the pesticide used.

Example 5: A grower wants to apply a 16-inch spray band over the drill in a 120-acre field of crop planted on 36-inch rows. The herbicide used is recommended at 2 quarts per acre when applied broadcast. Determine the following:

A. How much herbicide must be purchased?

The herbicide needed to apply a broadcast spray to the 120 acres would be 240 quarts since it was recommended at 2 quarts per acre on a broadcast basis. The portion of the 240 quarts needed for the band application can be determined from Table 2.

Portion of Field Treated when applying 16-inch band on 36-inch rows = .445

Herbicide Needed =.445 x Amount Needed for Broadcast Treatment

Herbicide Needed = .445 x 240 = 107 quarts

B. Using the 1/128th of an acre method, determine the amount of herbicide to add to a 100-gallon sprayer.

The course length to spray when the band width is 16 inches, in order to spray 1/128th of an acre, can be taken from Table 1.

Course Length = 255 feet

Assume that a nozzle catch test conducted for the time it takes to travel 255 feet yields 20 ounces. Twenty gallons would be applied per treated acre. The acres treated per tank can be determined by knowing the gallons per treated acre.

$$\text{Acres Treated per Tank} = \frac{\text{Tank Capacity (gal)}}{\text{Gallons Applied per Treated Acre}}$$

$$= \frac{100}{20} = 5$$

Determine the amount of chemical to add to each tank.

Amount of Chemical per Tank =Acres Treated per Tank x Herbicide Recommended per Acre on a Broadcast Basis = 5 x 2 = 10 quarts/tank

Spraying a Small Field

When a grower must treat a small field or a small portion of a big field that requires less than a full tank, it is sometimes confusing to know how much spray to mix when band spraying. The example below demonstrates how to determine what proportion of a tank is needed.

Example 6 How much spray must be mixed to treat a 5-acre field with a 14-inch band when the crop is planted on a 38-inch row spacing. A calibration test showed that the sprayer was applying 25 gallons per treated acre.

1. The portion of the 5-acre field treated is determined from Table 2 and is 0.368.

Acres Treated = .368 x 5 = 1.84

2. Since the sprayer applied 25 gallons of spray per treated acre, the required amount of spray mix would be:

Spray Mix Required= 1.84 acres x 25 gal/acre = 46 gal

The 46 gallons would have the amount of spray needed to treat 1.84 acres broadcast. The remainder of the 46 gallons would be water or other diluents.