Drop Spreader Calibration

Drop spreaders have rectangular hoppers that taper to a series of equally spaced holes arranged in a row. Most models have a rotating agitator just above the holes to ensure uniform flow of the product. The holes in the hopper can be opened and closed with a lever near the handle. The size of the openings is regulated with an adjustable lever on the back of the hopper. Granules fall straight to the ground as they flow through the holes in the bottom of the hopper. The effective swath width for drop spreaders is only as wide as the row of holes at the bottom of the spreader hopper.

Figure 1: *Image from Penn State University*

Considerations for drop spreaders:

- Drop spreaders are very effective when working in small, confined areas. They are not efficient for treating large areas because the effective swath width is only as wide as the spreader and only limited areas are being covered in a single pass.
- Wind is of minimal concern with distribution uniformity. Granules drop straight from the hopper to the ground.
- Drop spreaders are effective for applying very fine material and granules of differing sizes.
- Drop spreaders are ideal for use around impervious surfaces to keep product off of hardscapes and out of water sources.
- Drop spreaders are very accurate and no overlap of swaths is needed. However, passes must be made exactly adjacent to one another to avoid overlaps and skips. Product falls between the wheels and wheel paths should be overlapped with each pass to ensure uniform coverage. While more labor intensive, a desirable method to increase uniformity of application is to deliver half the desired rate of product and apply the product in two passes at right angles to each other.

Drop Spreader Calibration

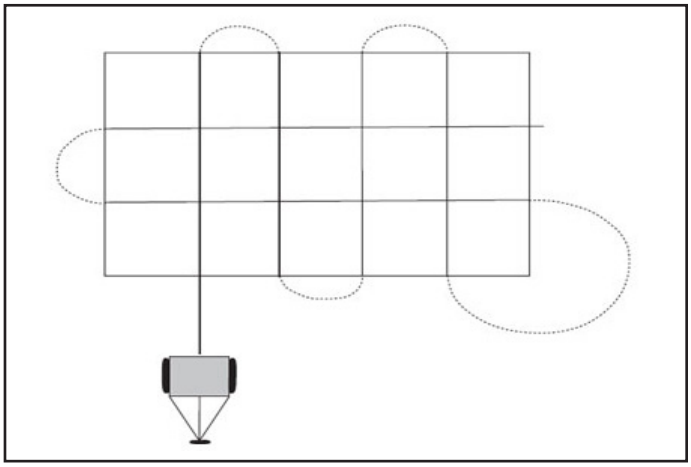


Figure 2: *Image from University of Massachusetts*

Figure 3:

The grid pattern reduces the possibility of inconsistent application. Inaccuracies can result in alternating light and dark green stripes, poor pest control, or foliar burn. If split applications are used, the spreader needs to be calibrated to deliver HALF the desired rate of fertilizer. This will be detailed further in the calibration process.

When calibrating spreaders, each spreader should be calibrated separately. Accuracy is extremely important when applying granular fertilizer or pesticide products. Variables that affect accurate product delivery include:

- Spreaders – Even if spreaders are from the same manufacturer and appear identical, they may have slightly different product delivery settings.
- Product label – Product labels often provide recommendations for spreader settings. Although the recommendation provides a useful starting point for testing spreader settings, it should not be relied upon.
- Operator ground speed – The speed operators walk varies between individuals and affects delivery of product. Application rate for a drop spreader is dependent on your walking speed. Therefore, operators should maintain a consistent walking speed throughout application.

Before applying any granular product, each spreader should be calibrated separately for each operator and product to ensure accurate and consistent distribution of product.

Drop Spreader Calibration

Calibration Process

A worksheet has been provided at the end of the document to help you move through each step and calculation to successfully calibrate your spreader.

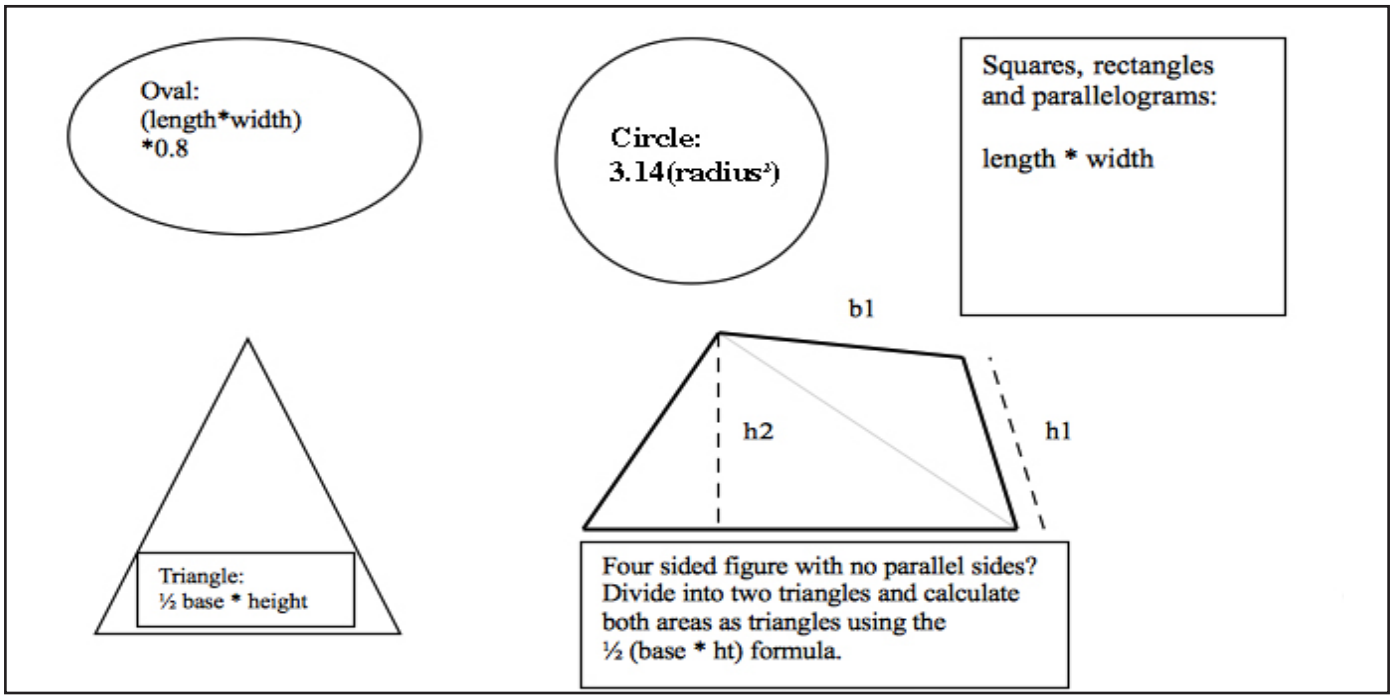
Collect materials needed to calibrate the spreader:

1) Product being applied
2) Spreader
3) Catch pan if available
4) Tape measure
5) Scale (needs to be able to weigh small amounts of product accurately, preferably in ounces)
6) Container or bucket
7) Chalk or flags
8) Calculator
9) Pencil and paper

Figure 4: *Image from Dr. Michael Goatley*

Step 1: Determine the size of the area to which product is being applied.

Calculating the square footage of various shapes found in turf and landscape management situations can be determined using the following mathematical formulas:



Drop Spreader Calibration

Step 2: Determine the amount of product needed to deliver the desired amount of nutrient.

The fertilizer grade is displayed on the product label and represents nutrient content by weight.

Example:

Specialty Turf Fertilizer
16-4-8

Total Nitrogen……..……16%
Total Phosphate……..……...…4%
Total Potash……...……8%

If you have a 100 pound bag of 16-4-8 Specialty Turf Fertilizer, 16% of the weight (or 16 lbs) is nitrogen, 4% of the weight (or 4 lbs) is phosphate (P2O5), and 8% of the weight (or 8 lbs) is potash (K2O).

Nitrogen is most commonly used when determining amount of product to apply. First determine how much nitrogen you wish to apply, and then determine the amount of nitrogen needed for a given area using the following formula:

$$\text{Pounds fertilizer per area} = \frac{\text{lbs N needed per area}}{\text{N from fertilizer formula as a decimal (i.e. the number divided by 100)}}$$

Example: Using a 16-4-8 fertilizer to supply 1 pound of N per 1000 square feet gives:

$$\text{Pounds fertilizer per area} = \frac{\text{1.0 lb N per 1000 sq ft}}{0.16}$$

$$= \text{6.25 lbs of fertilizer per 1000 sq ft}$$

In order to determine product application to a larger area, use the following equation:

$$\frac{\text{\_\_\_\_\_ lbs fertilizer}}{\text{1000 sq ft}} \times \frac{\text{? lbs fertilizer}}{\text{\_\_\_\_\_ sq ft}}$$

Drop Spreader Calibration

Example: The goal is to fertilize 10,000 sq ft. You want to apply 1 lb of N per 1000 sq ft using a 16-4-8 fertilizer.

$$\frac{\text{6.25 lbs fertilizer (16-4-8)}}{\text{1000 sq ft}} \text{ X } \frac{\text{? lbs fertilizer (16-4-8)}}{\text{10,000 sq ft}}$$

$$62{,}500 = ?1000$$

? = 62.5 lbs of fertilizer (16-4-8) to be delivered over 10,000 sq ft

This number gives you an indication for total amount of material you will need to treat the entire turf area.

Step 3: Determine the calibration area.

Drop spreaders distribute granules only as wide as the spreader's width. To determine effective swath width of the spreader, measure the distance between the wheels.

Example: Effective swath width is 2 feet.

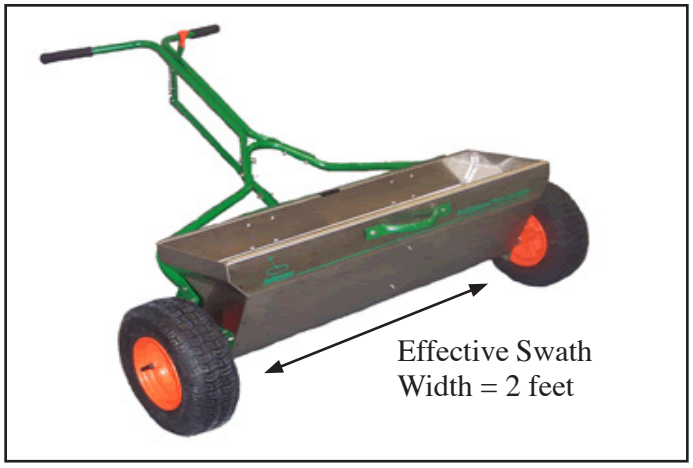


Figure 5

Measure a calibration run length of 100 feet (this length is only a suggestion – any length may be used) and mark your starting and ending points. Determine the square footage of your calibration run length using the following equation:

Drop Spreader Calibration

____ ft calibration run length X ____ ft effective swath width = ____ sq ft calibration area

Example: The effective swath width is 2 ft.

100 ft calibration run length X 2 ft effective swath width = 200 sq ft calibration area

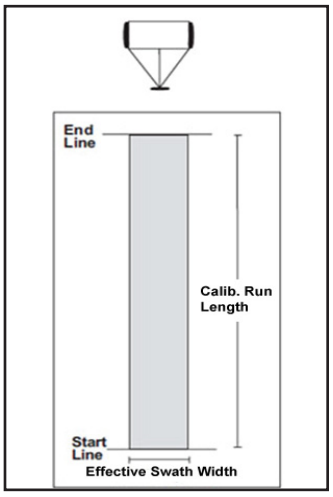


Figure 6: *Image from University of Mass.*

Step 4: Determine the desired amount to be distributed over the calibration run length.

We have already determined the amount of material to apply to 1000 sq ft and the calibration area.

In our example, we are applying 6.25 lbs fertilizer (16-4-8) per 1000 sq ft and the calibration area is 200 sq ft.

We now need to determine how much material to collect over the calibration run length so the spreader is correctly calibrated. Use the following equation:

$$\frac{\text{\_\_\_\_\_ lbs product}}{\text{1000 sq ft}} \text{ X } \frac{\text{? lbs}}{\text{\_\_\_\_\_ sq ft calibration area}}$$

Example:

$$\frac{\text{6.25 lbs 16-4-8}}{\text{1000 sq ft}} \text{ X } \frac{\text{? lbs 16-4-8}}{\text{200 sq ft}}$$

$$1250 = ?1000$$

? = 1.25 lbs of 16-4-8 fertilizer need to be collected over the 200 sq ft calibration area

Note: If the application is being split to reduce the possibility of skips and overlaps, only half, or 0.63 lbs needs to be collected over the 200 sq ft calibration area.

Drop Spreader Calibration

Step 5: Determine the appropriate spreader setting to deliver the desired amount of material.

In order to apply the correct amount of nutrient, spreader output must be determined and spreader setting must be adjusted. There are two methods to determine spreader output: through use of a catch pan, or without a catch pan.

Figure 7: Catch pan for drop spreader. *Image from Dr. Michael Goatley*

Catch pan – Catch pans attach to the bottom of the spreader to collect product as it is distributed. Once the product is discharged, the material can be collected from the pan and weighed.

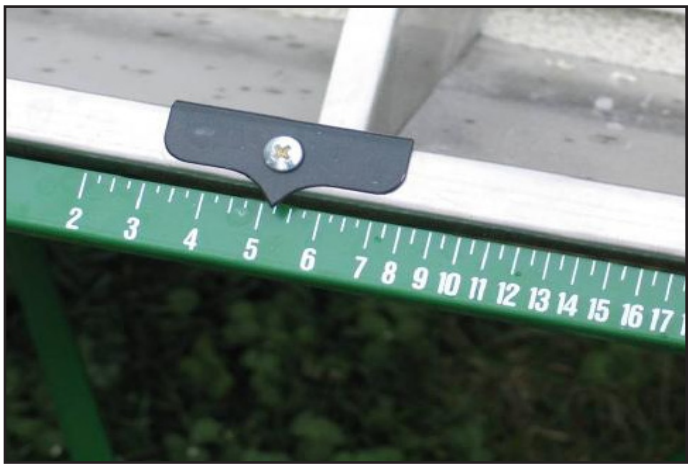


Figure 8: *Image from Dr. Michael Goatley*

Figure 9: *Image from Dr. Michael Goatley*

1) Set the spreader setting to a low to medium range. Often a product label will provide a recommended setting to use as a starting point for the calibration process. These settings are often based on a 3 mph pace. Do not rely on recommended settings as spreaders and operator speeds vary and contribute to differing applications.
2) Pour the product into the hopper.
3) Start walking at a brisk, comfortable pace with the spreader several feet in front of the starting line. When you reach the starting line, open the hopper holes and keep walking at the same pace without varying speed. Close the hopper holes as you pass over the finishing or end point. In this example, your hopper should have been open for a total of 100 feet.
4) Weigh the material collected in the catch pan (make sure you are not including the weight of the container holding the fertilizer on the scale).
5) Adjust the spreader setting up or down depending on the amount collected. Repeat the process until the desired amount of fertilizer (in our example 1.25 lbs) is collected. If splitting the application, repeat the process until half (in our example 0.63 lbs) of the fertilizer is collected.

Your spreader will be correctly calibrated to apply the desired amount of nutrient to your turfgrass area once the desired amount of fertilizer is collected and accurately weighed. The spreader is properly calibrated when the calibration rate is within ± 5% of the goal amount. (In this example, when the calibration rate falls between 1.19-1.3 lbs of fertilizer.)

Drop Spreader Calibration

No catch pan - In the absence of a catch pan, measure the weight of the product before placing it in the hopper, then measure the amount of product remaining in the hopper after the calibration run. The difference between weights before and after the calibration run reflects the amount being applied to the turf area.

If using this method, be sure that granules are being discharged in a safe area. Safe areas may include utility turf areas where fertilizer burns will not be a problem. If conducting the calibration run on a paved area, be sure to sweep the area of granules following calibration to prevent fertilizer from entering water sources. A drop cloth can also be spread on the ground to catch fertilizer material.

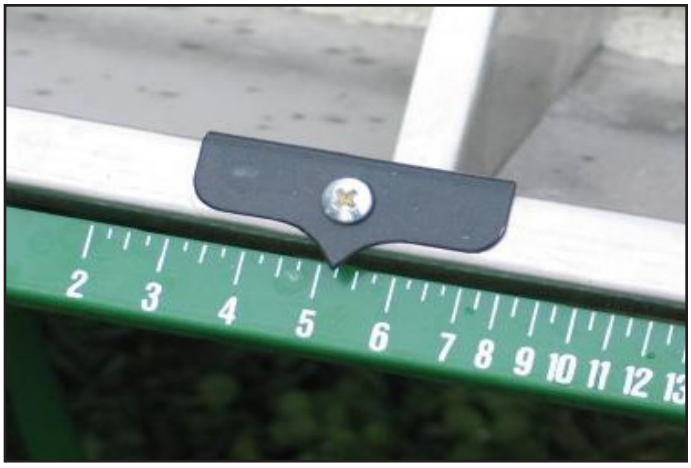


Figure 10: *Image from Dr. Michael Goatley*

Figure 11: *Image from Dr. Michael Goatley*

1) Set the spreader setting to a low to medium range. Often a product label will provide a recommended setting to use as a starting point for the calibration process. These settings are often based on a 3 mph pace. Do not rely on recommended settings as spreaders and operator speeds vary and contribute to differing applications.

2) Measure product and write down the exact weight. (Be sure not to include the weight of the container holding the fertilizer on the scale.) Pour the weighed product into the hopper.

3) Start walking at a brisk, comfortable pace with the spreader several feet in front of the starting line. When you reach the starting line, open the hopper holes and keep walking at the same pace without varying speed. Close the hopper holes as you pass over the finishing or end point.

4) Pour the product remaining in the hopper into a bucket and weigh the product. (Be sure not to include the weight of the container holding the fertilizer on the scale.) Subtract the remaining amount of product from the original weight of product. The difference in weight between the original amount and the product left in the hopper after the calibration test run is the amount that was distributed.

5) Adjust the spreader setting up or down depending on the amount collected, and repeat the process until the desired amount (in this example, 1.25 lbs) of fertilizer is distributed. If splitting the application, repeat the process until half, (in this example 0.63 lbs) of fertilizer is distributed.

Your spreader will be correctly calibrated to apply the desired amount of nutrient to your turfgrass area once the desired amount of fertilizer is distributed. The spreader is properly calibrated when the calibration rate is within ± 5% of the goal amount. (In this example, when the calibration rate falls between 1.19-1.3 lbs of fertilizer.)

Drop Spreader Calibration

Tips for Product Application

Correct and accurate application of any granular product to a turfgrass area is essential to prevent damage to the turfgrass and prevent pollution of water sources. Use the following tips for accurate and safe granular applications with your drop spreader:

- Make sure the spreader is in good operating condition. For example, make sure the tires are inflated and material does not run out of the spreader when in the off position.
- Always stay a safe distance from water sources to prevent any possible pollution.
- If granular materials land on an impervious surface, be sure to blow or sweep the material back into the turf.

If running low on product in the hopper, do not bounce or rock the spreader during application.

- Always begin walking before opening the hopper holes. Always close hopper holes at the end of a pass while still walking and before turning to begin another pass.
- If granules stick together in clumps, make sure you break them apart, or don't use the product.
- Be sure to clean your spreader thoroughly after applying granular products to prevent build up of fertilizer or pesticide particles and corrosion on spreader parts. Also, lubricate gears and other moving spreader parts before storing.

Drop Spreader Calibration Worksheet

Color-coded squares are meant to help in entering repeated numbers.

Key for Color Coding:

: total square footage of the turf area

: percentage of nitrogen in the fertilizer

: desired amount of nitrogen to apply (lbs. N / 1000 sq ft)

: amount of fertilizer needed to cover 1000 sq ft and provide desired amount of N

: effective swath width

: calibration run length (ft)

: calibration area (sq ft)

: lbs of fertilizer to be collected over the calibration run length

: amount of fertilizer needed for split application (lbs)

Step 1: Determine square footage of the area to which you would like to make a granular application.

Formula:

Area = _____ sq ft

Step 2: Measure amount of product needed to deliver the desired amount of nutrient.

Fertilizer Grade: _____ % N _____% P2O5 _____% K2O

Desired amount of Nitrogen to apply: _____ lbs N / 1000 sq ft

Amount of total fertilizer needed to apply desired amount of nitrogen to 1000 sq ft:

$$\frac{\text{\_\_\_\_\_ lbs N per 1000 sq ft}}{\text{\_\_\_\_\_ \% N (fertilizer grade)} \div 100} = \text{\_\_\_\_\_ lbs of fertilizer per 1000 sq ft}$$

Drop Spreader Calibration Worksheet

Amount of total fertilizer needed to cover entire turf area and deliver desired amount of nutrient:

Cross multiply:

$$\frac{\text{\_\_\_\_\_ lbs fertilizer}}{\text{1000 sq ft}} \quad X \quad \frac{\text{? lbs fertilizer}}{\text{\_\_\_\_\_ sq ft}}$$

? = _____ lbs of fertilizer

This number gives you an indication for total amount of material you will need to treat the entire turf area.

Step 3: Determine the calibration area.

Drop spreaders distribute granules only as wide as the spreader's width. To measure the swath width of the spreader, measure the width of the hopper.

_____ ft Effective Swath Width

Determine the calibration run length. Measure and mark the beginning and end points.

_____ ft calibration run length.

Determine the square footage of the calibration area.

_____ ft calibration run length X _____ ft effective swath width = _____ sq ft calibration area

Step 4: Determine the desired amount to be distributed over the calibration run length.

Measure and mark the beginning and end points for the calibration run length.

_____ ft calibration run length.

_____ sq ft calibration area

Cross multiply:

$$\frac{\text{\_\_\_\_\_ lbs fertilizer}}{\text{1000 sq ft}} \quad X \quad \frac{\text{? lbs fertilizer}}{\text{\_\_\_\_\_ sq ft}}$$

? = _____ lbs of fertilizer

When calibrating the spreader, the goal is to collect _____ lbs of fertilizer over _____ sq ft.

Drop Spreader Calibration Worksheet

Step 4a: Calibrating the spreader to apply fertilizer 2 directions.

If you prefer to eliminate potential for skips, overlaps, foliar burn, or other undesirables, the application can be split in half and applied in 2 directions.

_____ lbs of fertilizer ÷ 2 = _____ lbs fertilizer.

When calibrating the spreader, _____ lbs of fertilizer should be collected over _____ sq ft to apply the desired amount of nutrient in 2 directions.

Step 5: Set the spreader to deliver the desired amount of material.

In order to apply the correct amount of nutrient, spreader output must be determined and spreader setting must be adjusted. We already know how much total fertilizer we want to apply to 1000 sq ft and our calibration run length has been set. Over the course of the calibration run length, we need to collect _____ of fertilizer. If splitting the application, we need to collect _____ lbs of fertilizer.

Set the spreader setting to a low to medium range. Often a product label will provide a recommended setting to use as a point for the calibration process. These settings are often based on a 3 mph pace. Do not rely on recommended settings as spreaders and operator speed vary and contribute to differing applications.

Determine if you are using a catch pan.

Catch pan

If using a collection system, material collected needs to be weighed after each calibration run. Adjust the spreader setting up or down depending on the amount collected. Repeat the process until ±5% of the goal weight is collected.

Run Number	**Weight of Material Collected** **Goal Weight: lbs**
Run 1	
Run 2	
Run 3	
Run 4	
Run 5	
Run 6	
Run 7	

Drop Spreader Calibration Worksheet

No catch pan

If calibrating without a collection system, conduct the calibration on a utility turfgrass area that is out of sight. If conducting on an impervious surface, take care to clean up all of the dispersed fertilizer materiel so it does not runoff into water sources, or a drop cloth can be used to collect dispersed granules.

If a collection system is not being used, material needs to be weighed **before and after** the calibration run. The difference between weights before and after the calibration run reflects the amount being applied to the turf area. Adjust the spreader setting up or down depending on the amount collected. Repeat the process until ±5% of the goal weight is collected.

Run Number	**Weight of Material Before Calibration Run**	**Weight of Material After Calibration Run**	**Amount Distributed Goal weight to be distributed: lbs**
Run 1			
Run 2			
Run 3			
Run 4			
Run 5			
Run 6			
Run 7			

Drop Spreader Calibration Worksheet

Resources
Penn State University - http://cropsoil.psu.edu/turf/extension/factsheets/calibrating-spreader
University of Missouri – http://extension.missouri.edu/p/G6751
University of Massachusetts - http://extension.umass.edu/turf/fact-sheets/drop-spreader-calibration-procedures
Urban Nutrient Management Handbook – Michael Goatley, Jr., Steven Hodges
STMA Information Outreach Committee