

Calibrating Dry Broadcast Fertilizer Applicators

Proper selection of application equipment along with the calibration and evaluation of its performance are essential for satisfactory results. Even the best equipment requires calibration checks, especially when changing from one type of material or blends to another, when changing application rates, and when altering speeds or other operating conditions.

Calibration

Calibration checks of bulk fertilizer equipment should show the type of spread pattern, including the degree of uniformity obtained across the swath, the effective swath width, and the rate of application. To be effective, the system used to check calibration should be accurate, easily understood by the operator, and simple to perform.

One practical method of calibrating fertilizer and lime spreaders requires the following items:

1. Nine to 15 collection trays or pans with a grid baffle placed in the bottom.
2. Same number of test tubes.
3. Test tube rack.
4. Funnel.
5. Ten feet or more measuring tape. A 100-foot measuring tape works best.

The size of the trays and test tubes should be in proportion to the rates of application being checked. All trays must be of identical size and shape. They should be shallow (1" to 2½" deep) with a collecting area of 1.25 to 3 square feet each. The following table can be used to determine the rate of application from any size of collecting tray.

Materials collected grams per sq. ft.	Rate of application lbs. per acre
1	96.0
5	480.2
10	960.3
15	1440.5
20	1920.7
25	2400.8

For applications up to approximately 1,100 lbs per acre, 15 test tubes that are ½" inside diameter and 4½" are used. The 15 trays are usually placed as shown in Figure 1. All trays are placed at five foot intervals except for trays 7 and 9 which are placed six feet from the center tray, 8, the center (Figure 1). The trays must have grid baffles to prevent fertilizer from bouncing out. Trays must be as level as possible when collecting material.

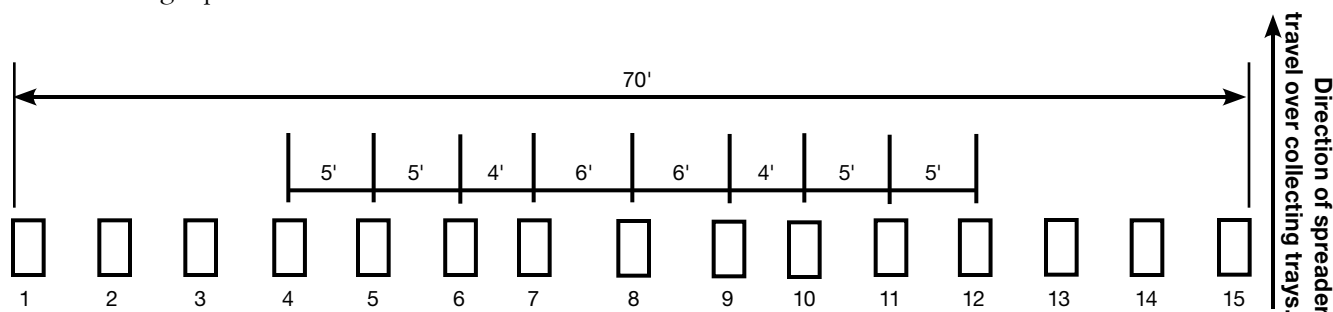


Figure 1. Field layout of collecting trays showing extra clearance on each side of the center tray for tractor and/or spreader wheels. All trays are placed at 5-foot intervals except for trays 7 and 9 that are placed 6 feet from the center tray, 8.

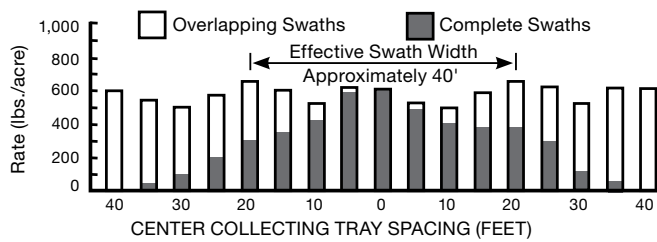


Figure 2. The spread pattern is determined by collecting the material in trays and pouring it into test tubes. Material overlap, as shown, results when swath spacing equals the effective swath width. This is a typical pattern one might expect from a double-spinner fertilizer truck. This does not depict an ideal pattern.

The spacing interval between trays can be changed, depending on swath width. The spreader is adjusted for a given rate of application and operated at normal field speed in a direction perpendicular to the line of trays while straddling the middle tray. Material collected in each tray is then poured into the corresponding test tube in the rack.

The amount of material in the test tubes provides a quick, visible evaluation of the spread pattern (Figures 2 and 3). If the spread pattern is uniform across the swath, as on the left side of Figure 3, and the proper swath width is used, the material will be deposited uniformly on the land.

The effective swath width can be found by locating the point on the right and left side of the swath where the tubes are filled to about one-half the height found in the center tubes. The distance between these points is the effective swath width and should be used as the swath spacing (Figure 2).

If the material weight is 65 lb/ft³ and you have any of the acceptable patterns on the left side of Figure 3, the first 1/2" material in the center tube represents a rate of approximately 100 lbs./acre. Each additional 3/8" of material after the first 1/2" represents an additional 100 lbs per acre. This is assuming the material in each tube is collected from an area of 1.37 square feet (collection pans 11.75" x 16.75") and test tubes of inside diameter of 1/2" are used. Fertilizers vary in moisture content and in size and particle density. These variations will cause slight errors in the indicated rates of application, but this method provides a close approximation.

Where application rates are more than 1,100 lbs per acre, larger test tubes are used with the same collecting trays. These test tubes have an inside diameter of 7/8" and are 8" to 10" tall. The first 1/16" of material in these tubes represent approximately 500 lbs per acre, and each additional 1/2" depth indicates about 500 lbs per acre. The larger test tubes are suggested

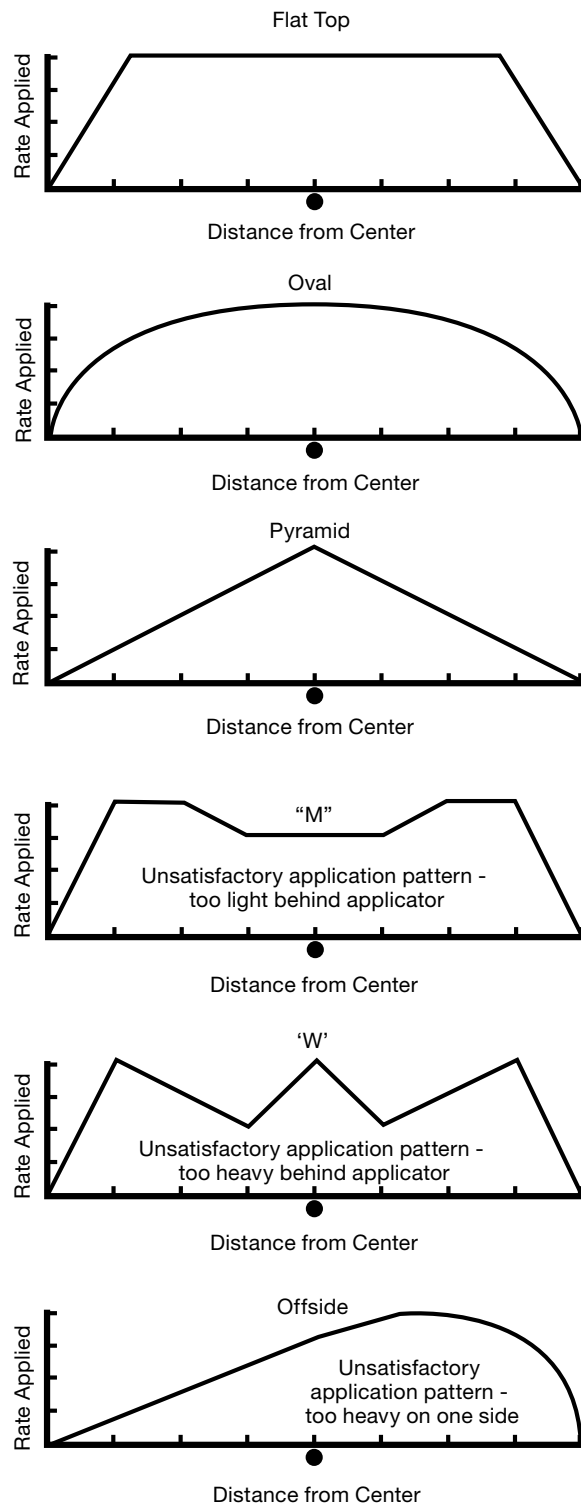


Figure 3. Typical dual spinner-disc spreader distribution patterns. Any of the first three patterns is acceptable with the remaining requiring spreader adjustments or hardware replacement to generate an acceptable pattern.

for evaluating spread patterns for rates of application between 1,000 and 6,000 lbs per acre, such as in the application of lime.

Adjustment In Spread Pattern

Once a spread pattern is evaluated, determine what, if any, adjustments can be made to improve the pattern. If the pattern is unacceptable, determine the problem. First and foremost, make sure all hardware is in good working order prior to calibration. Replace worn spinners, spinner blades, or other hardware that might affect material conveyance and distribution.

Spread patterns for a dual spinner-disc, dry fertilizer applicator can be classified into six different types (Figure 3). The flat top, oval, and pyramid patterns are the most desirable because they lend themselves to uniform overlapping of the swaths. The most common undesirable patterns are the M, W, and offside (skewed or lopsided) patterns. You can improve the M pattern by making one or more of the following adjustments (Figure 4).

1. Move the delivery chute toward the applicator to change the point of material delivery closer to the outer edge of the spinners.
2. Move the spinner blade tips in the opposite direction of spinner rotation.
3. Increase the spinner speed. A spinner speed of 550 to 600 rpm (revolutions per minute) is recommended. Higher spinner speeds could shatter granules that can lead to segregation and uneven distribution due to particle size.

The W pattern may result from applicator conditions similar to those causing the M pattern but has a heavy deposit at the center in addition to concentrations on both the right and left sides. The heavy concentration may be caused by an improperly adjusted delivery chute or leaks that permit material to fall immediately behind the applicator, such as leaks from a worn back plate. Also, wet material which sticks to the conveyor belt or chain can fall in the center, causing a heavy application immediately behind the spreader. Find the reason for heavy application at the center and correct it. The W pattern will then become an M pattern. One or more changes as described above should alter the M pattern to an acceptable flat top, oval, or pyramid pattern.

Lopsided pattern, either right or left, may result from twin spinner applicators because of uneven delivery of fertilizer material to the spinners. An improperly adjusted flow divide is usually the cause. Operations on steep slopes can also produce heavier flow to the downhill side if an effective flow divider is not included in the system. This problem can be overcome, to some extent, by proper overlap between swaths and a circular pattern application.

Single spinner solid applicators can also produce a lopsided pattern when the delivery of the material to the spinner is not positioned properly. If the right half of the pattern from a clockwise rotating spinner is heavier than the left half, any of the following adjustments will improve the pattern by delaying the release of fertilizer from the spinner (Figure 5).

1. Adjust the delivery chute to deliver closer to the center of the spinner.
2. Move spinner blade tips in the direction of the spinner rotation.
3. Replace worn and bent spinners and spinner blades.
4. Remove buildup of fertilizer and lime on spinners and spinner blades.
5. Correct the lack of proper flow dividers and delivery chutes for directing material on spinners.
6. Adjust frozen mechanisms.
7. Replace corroded and rusty hoppers and components.

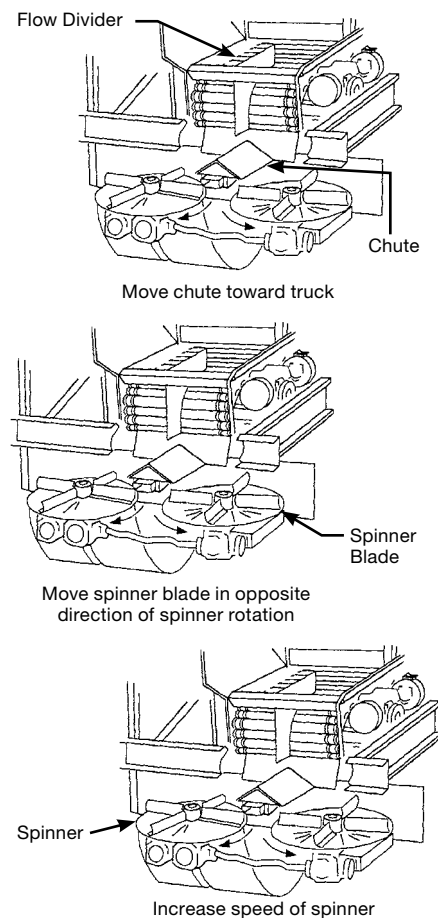


Figure 4. Dual spinner solid fertilizer applicator showing adjustments for corrections of an M distribution pattern, characterized by low delivery in the center and high delivery on the edge of the swath.

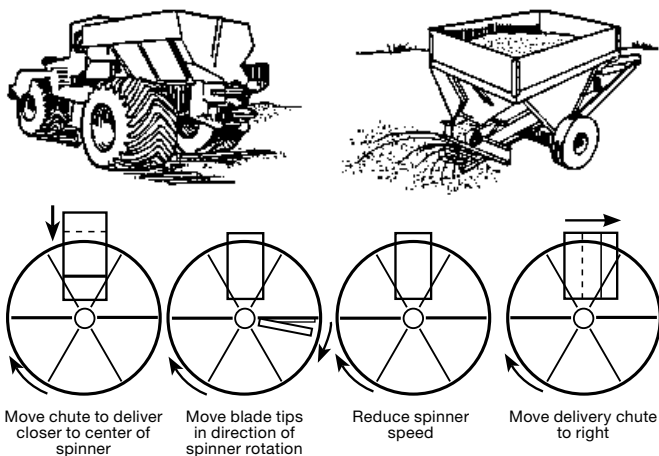


Figure 5. Four adjustments to correct “heavy right” distribution patterns from a single spinner (fan) solid fertilizer applicator. These four corrections allow material to ride the spinner further and deposit toward the left side. Corrections for “heavy left” patterns are opposite.

Accurate Spreading Requirements

- 1. Accurate Metering.** Make sure graduations are present on the sheargate to help determine application rates for various effective swath widths. Keep a notebook showing settings from calibration tests, using various materials in the trucks for ready reference. Good notes on spreader setup (e.g., gate height, spinner speed, etc.) can be used in subsequent years to set up the spreader for different materials prior to calibration.
- 2. Proper Delivery of Material to the Spinner or Boom Units.** An adequate flow divider and adjustable delivery chute (Figure 4) are necessary for uniform application, especially on hillsides and in other adverse field conditions.
- 3. Uniform Distribution Across Swath.** Spinner speed, blade pitch, and delivery chute position are critical. With auger boom distributors, adjust slide position and auger speed for uniform spreading at various application rates.

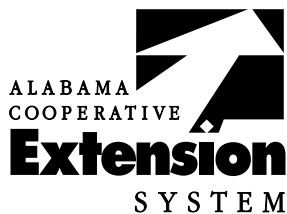
- 4. Skilled and Conscientious Operators.** Accurate spacing of swaths is essential and requires careful driving. Swath spacing should be the same as the effective swath width. A constant ground speed is important for a uniform application with many spreaders. In addition to driving, make sure that operators study the operator’s manual for their particular machine and know how to calibrate the spreader for various materials and rates of application. They should pay particular attention to cleaning, adjusting, maintaining, and repairing their spreaders. Modern guidance systems such as lightbars can greatly enhance fertilizer and lime application by allowing the operator to maintain parallel adjacent passes.

Check spread patterns and make the necessary adjustments when changing the material or the rates of application. Remember, a heavy application of wet lime requires entirely different adjustments from a light application of high-analysis, free-flowing, blended material.

When practical, drive spreaders around fields in a perimeter or circular pattern to minimize the effect of variations in spread patterns.

Granular or prilled material of uniform particle size will give the most even application. It is best to select materials for blends that are approximately the same particle size and shape and have approximately the same density and moisture content (this prevents segregation of materials in the spreading operation). Vertical baffles in gravity bins are effective in preventing segregation.

- Remember, even with proper adjustment, it is difficult to maintain a completely uniform and accurate application rate of granular fertilizer and lime if wind speeds exceed 15 mph.



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John Fulton, *Extension Specialist*, and Professor, Biosystems Engineering and **Charles Ogburn**, *Extension Agricultural Engineer (Retired)*, both with Auburn University. Uniform and accurate application of fertilizer, lime, pesticides, and other soil amendments is essential for profitable crop returns and is required by state and federal laws and regulatory agencies.

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