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Calibrating Granular Pesticide Applicators

Vern Hofman
Extension Agricultural Engineer

Granular formulations of pesticides for weed, insect or disease control must be applied accurately for effective and safe control. Application of less than the recommended rate may result in ineffective control while application of more than the recommended rate will increase cost per acre and may injure present or subsequent crops. Granular applicators are relatively inexpensive and simple to use, but require extreme care in calibration for precise application. Keep in mind that uniform application is extremely important for granular applicators.

Granular applicators can be calibrated in a manner similar to that used for sprayers. The amount of granules applied by applicators depends on the size of the metering opening, speed of travel, field roughness, and the flow rate of the pesticides. Flow rate of granules is affected by temperature, humidity, particle size, shape and density. Because of such variables, prediction of a certain rate at a certain setting is difficult. Variables can change from one day to the next or from one field to another. For this reason, the application rate should be checked frequently so that necessary adjustments can be made to obtain the proper application rate.

Use the operators' manual for the initial setting, and **run a check by actually catching the granules discharged from each applicator unit over a measured area**. Calibration must be done at the same speed as equipment will be operated in the field. Speed during application must remain constant since a small speed change can affect application rate by up to 50 percent.

Individual units on row crop applicators should be calibrated independently. Studies have shown that units differ greatly in application rate, even with the same setting. All units must be checked regularly if proper application is to be maintained.

CALIBRATION OF BROADCAST APPLICATORS

Calibration begins by determining the correct rate of granules to apply. Recommendations vary depending on the amount and type of pesticide being used. Rates are usually expressed as pounds of granules per broadcast acre or as ounces per 1,000 feet of row.

Recommendations are sometimes given as pesticide active ingredient per acre. Granules vary in concentration of active ingredient and the same pesticides may be available with more than one concentration. The pounds active ingredient per acre must be converted to pounds of granules per acre when using active ingredient per acre recommendations. Read the label to determine the percent active ingredient in the granules and then convert the pounds active ingredient (a.i.) per acre to pounds of granules per acre by:

$$\text{lb granules/A} = \text{lb a.i./A} \times \frac{100\%}{\%\ \text{a.i. in product}}$$

Example: A recommendation calls for 1.5 lb active ingredient per acre. Granules are available in a 10% formulation. How may pounds of granules per acre should be applied?

$$\text{lb granules/A} = 1.5\ \text{lb a.i./A} \times \frac{100\%}{10\%}$$

$$\text{lb granules/A} = \frac{1.50}{.10} = 15$$

Calibration techniques are based on determining the amount of granules dispensed when treating a known area. The procedure is to adjust the applicator setting until the required amount of granules is collected while traveling a measured distance or treating a measured area. Use the following steps:

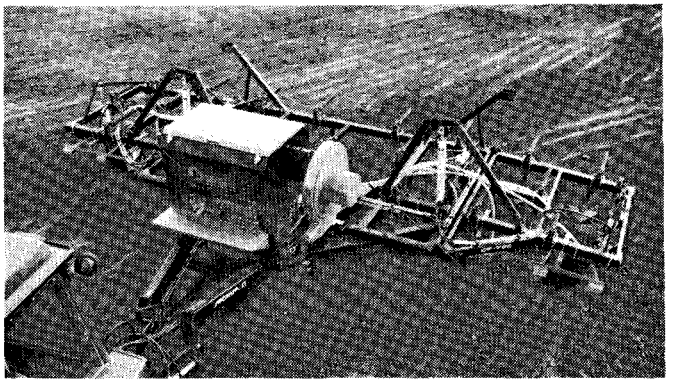

Figure 1. Broadcast granular applicators are an excellent way of applying chemicals while doing a tillage operation.

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1. Adjust the delivery openings on the applicator to the setting suggested by the manufacturer and fill the hopper with granules.
2. Operate the vehicle at the same speed that will be used in the field.
3. Operate the unit over a measured distance of several hundred feet in the field to be treated. Collect the granules from each discharge tube.
4. Accurately weigh the amount of granules delivered at each outlet and total the weights. The granules collected from each outlet should be equal or vary no more than ± 5 percent. If they do not, adjust the applicator settings and recheck until they are the same. A postal scale or food scale should be used, as a small amount of granules will be collected and an accurate weight must be determined.
5. Determine the area treated. The area treated is the applicator width (feet) times distance traveled (feet).
6. Calculate the amount of granules applied per acre as follows:

$$\text{Pounds/A (granules)} = \frac{\text{pounds granules collected} \times 43{,}560 \text{ sq. ft./A}}{\text{Applicator width (ft.)} \times \text{Distance traveled (ft.)}}$$

Example: A granular applicator treats a swath 35 feet wide. When driven over a distance of 500 feet, a total of 4.5 lb of granules is collected. The pounds per acre of granules applied is:

$$\text{lb/A} = \frac{4.5 \text{ lb} \times 43{,}560 \text{ sq. ft./A}}{35 \text{ ft.} \times 500 \text{ ft.}}$$

$$\text{Pounds/A} = 11.2$$

If desired application rate is 12.5 lb/A, the amount of granules that should be collected in the previous example is:

$$\text{Pounds granules} = \frac{12.5 \text{ lb/A} \times 35 \text{ ft.} \times 500 \text{ ft.}}{43{,}560 \text{ sq. ft./A}}$$

$$\text{Pounds granules} = 5.0$$

If the active ingredient concentration of the granule is 10%, the rate of active material applied per acre is:

$$\text{lb/A a.i.} = 12.5 \text{ lb/A granules} \times \frac{10\%}{100\%}$$

$$\text{lb/A a.i.} = 1.25$$

After the applicator has been calibrated to apply the proper amount of granules, make periodic field checks to verify that the application rate does not change from one day to the next or from one field to another. This is best done by determining the amount of granules applied to a known acreage. Also, recalibrate if the pesticide is changed since flow rate of different granules will vary considerably.

CALIBRATION OF BAND APPLICATORS

Calibration of band applicators is similar to broadcast applicator calibration. Granules are applied at the same rate as the broadcast rate from one edge of the band to the other; the difference is that the entire field is not treated. Less total product is applied to the field, and more than one acre must be driven over in the field to actually treat one acre in the band. The following formula is used to determine treated acres when the total field acres are known:

$$\text{Treated acres} = \text{Total acres} \times \frac{\text{band width (inches)}}{\text{row spacing (inches)}}$$

Example: A herbicide band granular applicator is mounted on a corn planter. The corn rows are 30 inches apart and the bands are 12 inches wide. What portion of a 100-acre cornfield is being treated?

$$\text{Treated acres} = 100 \text{ acres} \times \frac{12 \text{ inch band}}{30 \text{ inch row spacing}}$$

$$\text{Treated acres} = 40$$

In this example, 40 acres of the 100-acre field are being treated at the recommended broadcast rate. When the treated acreage is known, the formula used for calibrating broadcast applicators is used. Collect the granules from each row and weigh them separately to be sure all units are dispensing equal amounts. Then total the weights of the granules of the individual rows.

Example: An eight-row corn planter with a herbicide band applicator is used. The granules are being applied in 12-inch bands on a row spacing of 30 inches and 0.25 lb of granules (4 oz.) is collected from each row over a distance of 1000 feet. How many pounds of granules are being applied per treated acre?

$8 \text{ rows} \times 0.25 \text{ lb/row} = 2 \text{ lb granules collected}$

$8 \text{ rows} \times 12 \text{ in. bands} = 8 \text{ feet}$

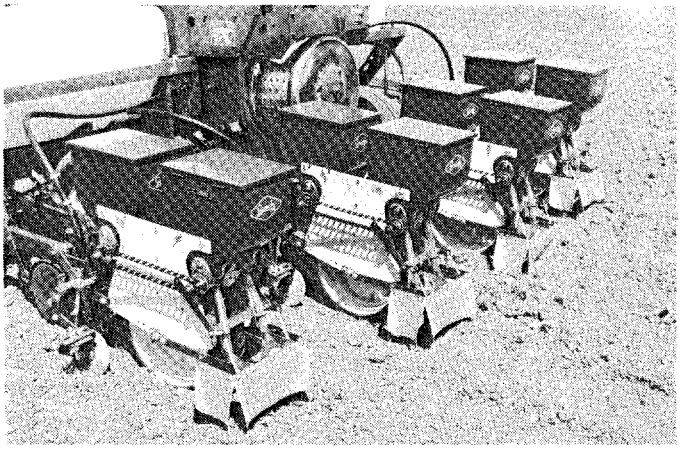

Figure 2. Band granular applicators provide an excellent means of cutting chemical cost on row crops.

Pounds per treated acre =

$$\frac{2 \text{ lb granules}/1000 \text{ ft.} \times 43{,}560 \text{ sq. ft./A}}{8 \text{ ft.} \times 1000 \text{ ft.}}$$

lb/A = 10.9

Granules is being applied in the row at the rate of 10.9 lb per acre. If the desired rate is 12 lb/A, the amount of granules that should be collected in the previous example is:

$$\text{lb granules} = \frac{12 \text{ lb/A} \times 8 \text{ ft.} \times 1000 \text{ ft.}}{43{,}560 \text{ sq. ft./A}}$$

lb granules = 2.2

If the active ingredient of the granules is 10%, the rate of active material applied per acre is:

$$\text{lb/A a.i.} = 12 \text{ lb/A granules} \times \frac{10\%}{100\%}$$

lb/A a.i. = 1.2

In the example, the total field area covered by the eight-row planter in a 1000 ft. test run is:

$$\text{Acres} = \frac{\text{length (ft.)} \times \text{width (ft.)}}{43{,}560 \text{ sq. ft./A}}$$

$$\text{Acres} = \frac{1000 \text{ ft.} \times 20 \text{ ft.}}{43{,}560 \text{ sq. ft./A}}$$

Acres = 0.46

The treated area receiving chemical at the broadcast rate is:

$$\text{Acres} = \frac{1000 \text{ ft.} \times 8 \text{ ft.}}{43{,}560 \text{ sq. ft./A}}$$

Acres = 0.18

CALIBRATING GRANULAR INSECTICIDE APPLICATORS

The application of granular insecticides is based on ounces of product per 1,000 linear feet of row, rather than pounds per broadcast acre. This application method requires an even application of pesticide per linear foot row, whether banded or placed in the furrow.

Row spacing will determine the total amount of granules needed per field when purchasing granules for in-the-row application. In addition to ounces per 1,000 feet of row, pesticide manufacturers generally list recommended pounds per acre for standard row widths on the product label. For other row spacing, the amount of granules needed per acre must be changed proportionally to maintain a uniform concentration of granules per foot of row.

Table 1 shows the feet of row per acre for several row spacings. The total feet of row per acre for any row spacing can be calculated by dividing 43,560 sq. ft. per acre by the row spacing in feet.

Table 1. Total feet of row per acre for various row spacings.

Row Spacing (in.)	Feet of Row per Acre
20	26,136
22	23,760
30	17,424
32	16,335
34	15,374
36	14,520
38	13,756
40	13,068

$$\text{Feet of row/A} = \frac{43{,}560 \text{ sq. ft./A}}{\text{row spacing in ft.}}$$

Example: A field is planted in 30-inch rows. How many feet of row is in each acre?

$$\text{Note: 30 inches} = \frac{30 \text{ inches}}{12 \text{ in./ft.}} = 2.5 \text{ ft.}$$

$$\text{Feet of row/A} = \frac{43{,}560 \text{ sq. ft./A}}{2.5 \text{ ft. row spacing}}$$

Feet of row/A = 17,424

A recommendation in ounces per 1,000 feet of row can be converted to lb/A with the following formula:

$$\text{lb/A} = \frac{\text{oz./1,000 ft. of row} \times 2722}{\text{1,000 ft. of row} \times \text{row spacing (ft.)}}$$

Note: 2722 is a constant found by dividing the number of square feet in one acre (43,560) by the ounces in one pound (16).

Example: A soil insecticide recommendation calls for 6 oz./1000 feet of row. If you are planting in 30-inch rows (30 inches = 2.5 ft.), how many lb/A of insecticide should be applied?

$$\text{lb/A} = \frac{6 \text{ oz./1,000 ft.} \times 2722}{\text{1,000 ft. of row} \times 2.5 \text{ ft. row space}}$$

lb/A = 6.5

The number of ounces per 1,000 feet of row is usually listed on the insecticide label. A recommendation in lb/A for a standard row spacing can be converted to oz./1,000 feet of row with the following formula:

Example: A soil insecticide recommendation calls for 10 lb/A when applied in 30-inch rows (30 in. = 2.5 ft.). How many oz./1,000 feet of row is required for proper calibration?

oz./1,000 ft. of row =

$$\frac{10 \text{ lb/A} \times 2.5 \text{ std. row spacing (ft.)} \times 1{,}000 \text{ ft. row}}{2722}$$

oz./1,000 ft. of row = 9.2

Granular insecticide applicators should be calibrated at the beginning of **each** planting season. Consult the insecticide label and determine the ounces of insecticide applied per 1,000 feet of row, or calculate the amount using the preceeding formula. In the field to be planted, mark off 1,000 feet. Pour insecticide into each granular hopper. A suggested calibration setting to deliver the needed number of ounces of product per 1,000 feet of row will be on the insecticide label or in the applicator operator's manual. Adjust the calibration setting on each applicator box to the suggested setting. Attach a calibration tube under each granule outlet and then operate the applicator for 1,000 feet at your standard operating speed. Next, check each calibration tube to determine if the level of insecticide in each tube is equal. Adjust the calibration settings as needed so that all applicator boxes deliver equal amounts of granules into the calibration tubes (i.e. 8 ounces of granules, if the recommened rate is 8 ounces per 1,000 feet of row. Calibration tubes may be used, if available for the pesticide).

OTHER FACTORS TO CONSIDER

For band applicators, the width of the band is determined by the design of the spreader and the height of the spreader above the surface. The height should be adjusted until the desired band width is obtained.

A flexible hose carries the granules from the hopper to the spreaders on some band applicators. The hose should have a uniform slope to provide good flow of granules from the metering unit to the spreader. Adjust the hose length to maintain an even flow.

Many chemical companies offer calibration tubes for their materials which can be attached to the distributor tube and will give a direct reading for that particular chemical. **These tubes can be used only for that particular chemical. Do not use them for any other chemical as the density of the granules varies considerably.** Also, granules of different pesticides should not be mixed together. Variable density will cause uneven settling and uneven application.

Uniform application with granular applicators is extremely important. Uniformity of application can be checked by operating the applicator across a hard-surfaced area where the application pattern can be visually observed. Be sure to do this in an area where all chemical can be cleaned up. If gaps or heavy spots are visible in the pattern, adjust the distributor to correct the problem.

WEIGHTS AND MEASURES

Weight
16 ounces = 1 pound = 453.6 grams

Length
3 feet = 1 yard = 91.44 centimeters
16.5 feet = 1 rod
5,280 feet = 1 mile = 320 rods

Area
9 square feet = 1 square yard
43,560 square feet = 1 acre = 160 square rods
640 acres = 1 square mile

Speed
88 feet/min. = 1 mph

Caution: Use care when handling pesticides. Wear rubber gloves and be careful not to breath the dust when pouring granules into the applicator box.

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