Reduce Seed Cost by Properly Calibrating Your Drill

Calibration of drills is important to ensure stand success. Forage seed cost has increased in the last decade and represents a large percentage of the cost of establishing a new pasture or hay field. This should have forage producers thinking more seriously about properly calibrating their drills.

Calibrating equipment by trial and error as you plant several acres can be costly in many ways. Planting lower seeding rates than required can result in thin stands and higher weed competition. On the other hand, higher seeding rates could translate to better establishment (not necessarily in higher yield) and higher seeding cost. Forage species and seed lots can vary in their ability to flow through the drill because of seed size and seeding rates. It is important to calibrate the drill even if the same variety is being seeded—because the year and seed lot have changed.

One of the recommendations when calibrating a drill is to follow the manufacture's recommendations to obtain an accurate seeding rate, but the reference chart is not always accurate. Although the charts can be a good starting point, remember that variations in ground speed; seed cleaning method; seed size, shape, density, weight, and purity; and seed coatings or treatments can create a discrepancy between the chart recommendation and the actual seeding rate. These discrepancies can range from 25 to 50 percent. Drills should be calibrated under field conditions whenever possible, and calibration becomes more important as the cost of the seed increases.

When calibrating a drill, you must know these two things: the seeding rate and the area to be covered. The seeding rate is the amount of seed divided by the area covered. Seeding rate is usually expressed in pounds of seed per acre. To determine the effective seeding area, measure the width that the seed is actually being dropped by the specific drill type you are using. For grain-type drills, measure the distance between the disk openers and then multiply the width by the number of disk openers plus one.

Determining the Distance for Calibration

You also need to determine the distance for calibrating the equipment. The distance for calibration can vary depending on the type of drill being used. It is usually more desirable to use a fraction of an acre to calculate the seeding rate because you can multiply the amount of seed collected by a constant factor. The most common distances used are 1/10, 1/25, 1/50, or 1/100 acre (**Table 1**). To calculate the area covered by an arbitrary distance, use the following equation:

$$\boldsymbol{Area\ covered} = \frac{[drill\ width\ (ft)\ x\ travel\ distance\ (ft)\ ]}{43{,}560\ (\frac{sq\ ft}{acre})}$$

Table 1. Calculated distance that must be traveled when using fractions of an acre as a guide to estimate area covered.

Acre fraction	Calculate distance to travel	Multiplier factor
1/10	distance = 4,356 sq ft/seeding width (ft)	10
1/25	distance = 1,724 sq ft/seeding width (ft)	25
1/50	distance = 871 sq ft/seeding width (ft)	50
1/100	distance = 436 sq ft/seeding width (ft)	100

Determining the Seeding Rate

During the calibration process, seed needs to be collected to make the necessary adjustments. Keep in mind that the seed must be collected when traveling at the same speed you actually will travel to seed the field. It might be a good idea to do the calibration in the field to be planted to account for any variation in field conditions. Before starting the calibration process, it will be helpful to have either small containers to catch the seed or a large tarp or plastic sheet; a container to weigh the seed; a scale; a calculator; and a stopwatch. There are four calibration methods for determining the rate of seed being applied per acre.

Collect seed from driving the drill over a distance. In the drill, seed tubes can be disconnected and a container or bag can be attached at the end of the tube to collect the seed during the established distance from each seed opening. Once the seed is collected, weigh the amount of seed to obtain a seed weight, and divide it by the travel distance. Necessary information for this seeding rate calculation includes effective drill width (number of drill rows times distance between rows), distance traveled, and weight of seed collected. For example, a drill has an effective seeding width of 12 feet. In 200 feet, it drops 1.23 pounds of annual ryegrass. What is the seeding rate?

$$\boldsymbol{Area\ covered} = \frac{12\ ft\ x\ 200\ ft}{43{,}560\ (\frac{sq\ ft}{acre})} = 0.055\ acre$$

$$\boldsymbol{Seeding\ rate} = 1.23\ lb \div 0.055\ acre = 22.4\ lb/acre$$

Weigh residual seed. This method is also known as the difference method. The drill should be completely empty and clean before using this method. You can place a known amount of seed in the drill and travel a known distance at the same speed. Then, weigh the remaining amount of seed in the drill bin or box. The amount of seed planted will be equal to the initial amount of seed minus the amount of seed left. Although the seed left in the bin can be removed using a shop vacuum, it is important to make sure that the vacuum is empty and clean before starting the removal process and that all the remaining seed is collected. When weighing the seed, always tare the scale to zero for weighing the container, or subtract the weight of the weighing container. For example, 5 pounds of bahiagrass are placed in an 8-foot drill. After traveling 300 feet, it is determined that 2.75 pounds of seed remain in the box. What is the seeding rate?

$$\boldsymbol{Area\ covered} = \frac{8\ ft\ x\ 300\ ft}{43{,}560\ (\frac{sq\ ft}{acre})} = 0.055\ acre$$

$$\boldsymbol{Seeding\ rate} = (5\ lb - 2.75\ lb) \div 0.055\ acre = 40.9\ lb/acre$$

Turn the wheel and collect seed. Another method of calibrating is having the drill in a stationary position and turning the drive wheel on the drill. In this case, the drive wheel on the drill can be jacked up off the ground and turned a given number of times (revolutions) to obtain the desired coverage area. Once the number of turns is determined, pour seed in the drill box, put bags in the tubes, rotate the drive wheel based on the number of revolutions determined, collect seed from the tubes, and weigh the seed. For example, a drill has a wheel diameter of 2.1 feet and an effective seeding width of 8 feet. How many times does the drive wheel need to be turned to seed 0.10 acre? Let's assume that 1.25 pounds of bermudagrass were collected from the tubes.

$$\boldsymbol{Wheel\ circumference} = 2.1\ ft\ x\ 3.1416 = 6.6\ ft$$

$$\boldsymbol{Wheel\ turns} = \left[43{,}560\ sd\frac{ft}{acre} \times (0.10\ acre)\right] \div (6.6\ ft \times 8\ ft) = \ 82.5\ turns$$

$$\boldsymbol{Seeding\ rate} = 1.25\ lb\ \div 0.10\ acre = 12.5\ lb/acre$$

Count seeds per foot row. When using this method for calibrating the drill, the producer must know the number of seed per pound and the recommended seeding rate per acre in pounds. One of the disadvantages of this method is that the number of seeds per pound can vary within a species, variety, or seed lot. Seeds per pound may also vary, depending upon year and seed source (certified versus common). When using this method to calibrate your drill, use a hard surface, tarp, or canvas to drop the seed and easily count the number of seeds. Pull the tractor over the sample area at field speed while seed drops from each row. Record the number of seeds per foot in each row. Count several rows and calculate an average. Use this information to determine the seeding density. **Table 2** provides an estimated seed density at various row widths and seeding rates. For example, let's assume that you are planting bahiagrass that has 210,000 seeds per pound, the drill row width is 7 inches, and you counted an average of 11.7 seeds per foot row (**Table 2**). **Table 3** provides an approximate number of seed per pound for different forage species. The seed density will be:

$$\boldsymbol{Seed\ density} = \left(\frac{seed}{ft} \times 12\right)\ \div row\ width\ (inches)$$

$$\boldsymbol{Seed\ density} = (17.7\ seeds\ per\ ft\ row\ x\ 12)\ \div 7\ inches = 30\ seeds\ per\ sq\ ft$$

$$\boldsymbol{Total\ seed\ per\ acre} = seed\ density \times 43{,}560\ sq\ ft\ per\ acre$$

$$\boldsymbol{Total\ seed\ per\ acre} = 30 \times 43{,}560 = \ 1{,}306{,}800\ seeds\ per\ acre$$

$$\boldsymbol{Seeding\ rate}\ \left(\frac{lb}{ac}\right) = total\ seed\ per\ acre\ \ \div number\ of\ seeds\ per\ pound$$

$$\boldsymbol{Seeding\ rate}\ \left(\frac{lb}{ac}\right) = 1{,}306{,}800\ \ \div 210{,}000 = 6.2\ lb/ac$$

Calibrating a Broadcast Seeder

When calibrating a broadcast seeder, the spreading width and the driving speed should be determined first. Before starting the calibration and for safety reasons, it is important to remain clear of the spreaders and spinner during the process. To determine the spreading width, select a location that is protected from the wind and lay a clean, wide tarp behind the tractor. Add a small amount of seed to the spreader and set the gate opening to the desired setting. Keeping the unit in place, turn on the spreader for at least 10 to 20 seconds at the RPM and spinner speed to be used in the field when broadcasting; measure the outer layer where the seeds land on the tarp. To determine uniformity of the spreading pattern, lay several small containers on the tarp to catch the seed (**Figure 1**). To avoid seed bouncing out of the container, add some cloth or paper towels to the containers.

After measuring the spreading width, calculate the distance needed to cover 0.10 acre. For example, if the spreading with is 25 feet, what is the distance needed to cover 0.10 acre?

$$Travel\ distance = \left[\left(43{,}560\ sq\frac{ft}{ac}\right) \div spreading\ width\ (ft)\right] \times acre$$

$$Travel\ distance = \left[\left(43{,}560\ sq\frac{ft}{ac}\right) \div 25\ ft\right] \times 0.10\ acre\ \ = 174\ ft$$

The second step in this process is to determine the driving speed. Using the distance calculated in step a, drive at the intended spreading speed for planting and record the time needed to cover that distance. Drive the same distance and speed you will use when actually spreading seed to get an average speed. For example, let's assume that the driver took an average of 20 seconds to drive 174 feet. The average speed is then 6 miles per hour (1 ft/s = 0.681818 mph).

Once the speed has been determined, return to the area where the tarp or plastic is located. Making sure that the tarp is clean, add seed to the spreader and turn the spreader on for the same length of time needed to drive the distance calculated in step a (in this example, 20 seconds). Collect the seed in the tarp, pour it into the container, and weigh the seed to calculate the seeding rate. It is important to make

Table 2. Seed per foot row needed to achieve densities with drills with different row widths.						
	Seed density (seeds per square foot)					
	15	20	30	40	50	60
Drill row width (inches)	Seeds per running foot of row					
6	7.5	10.0	15.0	20.0	25.5	30.0
7	8.8	11.7	17.5	23.3	29.2	35.0
8	10.0	13.3	20.0	26.6	33.3	40.0
9	11.2	15.0	22.5	30.0	37.5	45.0
10	12.5	16.7	25.0	33.3	41.7	50.0

Table 3. Approximate number of seeds per pound and recommended seeding rates for different forage grasses and legumes commonly grown in Mississippi.		
Forage species	Approximate number of seed per pound (1,000)	Recommended bulk seeding rate (lb/ac)
Grasses		
Annual ryegrass	224	20 – 30
Bahiagrass	210	15 – 20
Bermudagrass (hulled)	2,071	5 – 10
Browntop millet	140	25 – 30
Forage sorghum	24	15 – 20
Oats	15	90 – 120
Pearl millet	82	25 – 30
Rye	18	90 – 120
Tall fescue	227	15 – 20
Wheat	11	90 – 120
Legumes		
Alfalfa	227	20 – 25
Arrowleaf clover	400	5 – 10
Ball clover	1,000	2 – 3
Cowpea	4	100 – 120
Crimson clover	150	20 – 30
Hairy vetch	16	20 – 25
Persian clover	642	5 – 8
Red clover	272	12 – 15
White clover	768	2 – 3

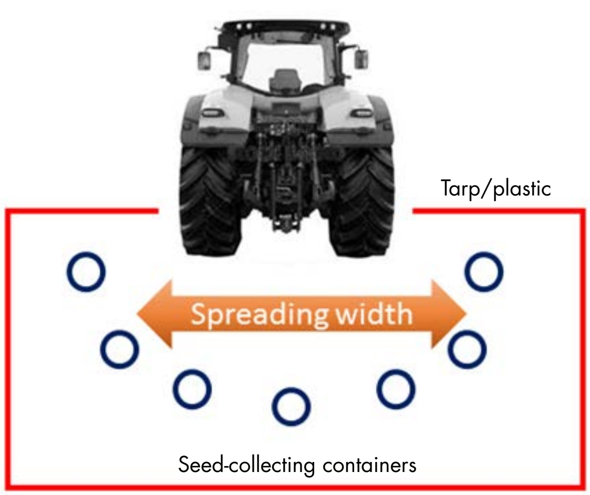

Figure 1. Configuration to determine the spreading pattern when calibrating a broadcast seeder.

sure that no seed is spilled from the tarp or the container. If the desired seeding rate is not achieved, adjust the spreader gate opening or driving speed and repeat the process of collecting the seed. For example, if the average time to cover 0.10 is 20 seconds and the amount of seed collected during that time is 2.5 pounds, the seed rate should be:

$$\boldsymbol{Pounds\ of\ seed\ spread\ per\ acre\ (lb)} = seed\ weight\ (lb)\ x\ multiplier\ factor\ (table\ 1)$$

$$\boldsymbol{Pounds\ of\ seed\ spread\ per\ acre\ (lb)} = 2.5\ lb\ x\ 10 = 25\ lb\ per\ acre$$

$$Pounds\ of\ seed\ spread\ per\ acre\ (oz) = [seed\ weight\ (oz)\ x\ multiplier\ factor\ (table\ 1)] \div 16\ oz\ per\ lb$$

$$Pounds\ of\ seed\ spread\ per\ acre\ (grams) = [seed\ weight\ (g)\ x\ multiplier\ factor\ (table\ 1)] \div 454.4\ g\ per\ lb$$

Once the drill is properly calibrated using one of the methods described above, it is important to keep in mind that the calculated seeding rates are for bulk seed. Your local county MSU Extension office has information on seeding rates for your area. These seeding rates can be modified depending on planting date, soil type, type of establishment (till, no-till, or broadcast), soil fertility levels, and other factors. To ensure that the recommended plant population is met, the seeding rate should be adjusted to pure live seed (PLS, the percentage of the bulk seed weight that is viable and should germinate when planted at the recommended seeding depth). Pure live seed is calculated based on the purity and germination of the seed lot and variety. Keep in mind that PLS may vary among seed lots of the same seed variety or species; always ask for this information from your seed salesperson if it is not on the seed label. For example, bahiagrass is recommended to plant at 20 pounds per acre, but the seed label indicates 95 percent purity and 75 percent germination. How much seed should you plant?

$$PLS = \%\ germination \times \%\ purity$$

$$PLS = 0.95\ x\ 0.75 = 0.7125$$

$$Seeding\ rate\ (PLS) = 20\frac{lb}{ac} \div 0.7125 = 28\ lb/ac$$

Calibrating the Drill Seeding Depth

Determining the planting depth is as important as determining the seeding rate. Small seeds such as clovers should not be planted deeper than ¼ inch. Planting small seeds too deep can result in poor emergence and thin stands. Plant some test strips after calibrating your drill. Unless seeds are color-coated, they can be hard to see on the ground. To determine seeding depth, spray paint a small batch of seed yellow or orange and let them completely dry. Place these seeds in the seed box immediately above each seed box opening before pouring the rest of the seed. This will allow you to see the seed placement in the first rows and adjust the seeding depth accordingly.

After calibrating the drill, it will be a good idea to keep track of the seeding rate after planting a few acres. Most of the new drills on the market are equipped with an acre meter that can be used to monitor seeding rates. Keep track of the amount of seed that you have used and divide the amount of seed planted by the acres planted. Actual seeding rates may vary somewhat due to groundcover, soil conditions, overlapping between passes, and driving speed. This is why it is recommended you do calibrations in the field to be planted. Additionally, it is useful to check actual seeding rates by maintaining records of seed used and acres drilled over the years. Whether you are planting grasses, legumes, or mixes, calibrating a seed drill before planting is beneficial. There are also calibration apps that can help you determine the appropriate settings for your drill. For example, Kuhn SA has developed a calibration assistant that can be downloaded from the Google or Apple app stores (http://www.kuhn.com/com_en/mobile-applications-seeders-calibration-assistant.html).

Conversion Factors

43,560 = number of square feet in 1 acre
16 = number of ounces in 1 pound
454.4 = number of grams in 1 pound
1 ft/s = 0.681818 mph
60 = number of seconds in 1 minute

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