CALCULATING SEEDING RATES AND GRAIN DRILL CALIBRATION

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Spring planting season is fast approaching and one of the most important tasks a farmer can do to help ensure successful stand establishment is calibrating the grain drill before heading to the field. A well maintained and properly calibrated drill can improve stands and increase yields while lowering seed costs. The seeding rate chart provided by the drill manufacturer is a good starting point in obtaining desired seeding rates, but actual results will vary depending upon a number of variables including, mechanical condition of the drill, variety and seed lot, seed size, and the addition of seed treatments and or inoculants. The seeding rate can be set in the shop, while the drill is in a stationary position by simulating the seeding of a given area and using basic mathematical calculations. In order to carry out the calibration process, the following items will be required: a hydraulic jack, measuring tape, a scale that measures in grams, bags or cups that can be used for seed collection, permanent marker or duct tape, and a calculator.

The first step is to determine your seeding rate. Seeding in terms of volume or weight per acre without consideration of seed size can result in plant populations that are too high or too low. Seed size can vary from one crop to another, between varieties of the same crop and from year to year. Therefore, you should calculate your seeding rates based on a target plant population, the seed size of the lot you are sowing, and percent germination of the seed lot. With this information the appropriate seeding rate can be calculated using one of the formulas shown below or by referring to *Table 2 Seeding Rate Chart for Cereals.*

$$Seeding\ Rate\ \ (lbs/ac)\ = \frac{plant\ population\ (s/m^2) \times TKW\ (g)}{germination\ (\%)} \times 0.89$$

$$Seeding\ Rate\ \ (lbs/ac) = \frac{seeds/ac}{seeds/lb} \times \frac{100}{germination\ (\%)}$$

Sample Calculation

Barley with a thousand kernel weight (TKW) of 46 grams and a germination of 90% is being planted at a target population of 400 seeds/m^2. Using the formula, we calculate the seeding rate at 182 lbs/acre.

$$Seeding\ Rate = \frac{400\ \times 46}{90} \times 0.89$$

A second example, this time using soybeans planted at a target population of 160,000 seeds per acre. The seed size is 2,155 seeds per pound and the seed lot has a germination of 95%. Using the formula the seeding rate would be 78 lbs/acre.

$$Seeding\ Rate = \frac{160{,}000}{2{,}155} \times \frac{100}{95}$$

Table 1. Recommended Plant Populations

	Target Plant Population	
Crop	**Plants/m^2**	**Plants/ac (x 1,000)**
Barley	350 – 400	1,400 – 1,600
Wheat	375 – 450	1,500 – 1,800
Oats	325 - 375	1,300 – 1,500
Soybeans	32 - 42	130 - 170
Peas	75 – 125	303 - 506

Now that we have determined our seeding rates, we can begin the process of calibrating the drill.

DRILL CALIBRATION STEPS

1. ***Engage the drive mechanism***
Start by lowering the drill into field position. Remove the seed tubes from the disc openers and make sure they are all clean and clear of obstructions. Compressed air works well in accomplishing this.

2. ***Determine the drill width***
The drill width is determined by measuring the distance in feet between the rows and multiplying by the total number of rows. In this example we have a drill with 24 disk openers at a row spacing of 7.5 inches. The drill width is (24 x 0.625 ft) 15 feet.

3. ***Determine the circumference of the drive wheel***
Using a hydraulic jack, elevate the drive wheel so that it can be freely turned by hand. Measure the circumference of the wheel using a fiberglass measuring tape. In this example the drive wheel has a circumference of 104 inches or (104 ÷ 12) 8.67 feet. Another way to determine the circumference would be to measure the diameter of the wheel and multiply by π (3.142).

Figure 1. *Hydraulic floor jack used to elevate the drive wheel.*

4. ***Determine the strip length***
The strip length is calculated by multiplying the circumference of the drive wheel by the total number of rotations you plan on spinning the wheel. It is recommended to travel a minimum of 100 feet during the test. Mark the tire using a permanent marker or piece of duct tape so the wheel rotations can be easily counted. In this example we will turn the wheel 12 rotations, therefore our strip length is (8.67 x 12) 104 feet.

5. ***Load seed and prime the drill***
Fill the drill with enough seed to completely cover the flutes and to complete the test. Spin the drive wheel until seed is flowing out of each row.

6. ***Attach bags or place cups under the seed tubes to catch the seed.***
Use plastic Ziploc® bags or some other sort of container to catch the seed from each of the hoses during the test. A tarp can also be placed under the drill for seed collection.

7. ***Perform the test***
Set the seed metering mechanism according to the manufactures' recommended setting for the crop

Figure 2. Ziploc® *bags attached to seed cups for seed collection.*

being sown and the target seeding rate. Be sure to also adjust the seed cups for the appropriate type and size of seed being dispensed. In our first example we will be seeding barley at our target rate that was previously determined at 182 lbs/acre. The formula used to check the seeding rate is shown below:

$$Seeding\ Rate\ (lbs/ac)\ =\ \frac{43{,}560 \times (lbs\ of\ seed\ collected)}{drill\ width(ft) \times strip\ length(ft)}$$

Rotate the drive wheel the pre-determined number of times, in this case 12 rotations. Remove the bags and pour the seed into a small container. Using the scale, weigh the seed making sure to tare the empty weight of the container so that only the seed is being weighed. Enter the values into the formula and calculate the seeding rate.

Sample Calculation

After rotating the drive wheel 12 turns, a total of 2,733 grams of seed was collected from the 24 rows. To convert grams to pounds divide by 454. Using the formula, the seeding rate at the current setting is calculated to be 168 lbs/ac.

$$Seeding\ Rate = \frac{43{,}560 \times (2{,}733 \div 454)}{15 \times 104}$$

The calibration process is trial and error. In this scenario, we are below our target rate of 182 lbs/ac, therefore we need to open the seed delivery mechanism and repeat the process again until the seeding rate falls within plus or minus 2-3% of our target rate.

If it is desirable to only test a few rows, we can calculate the quantity of seed per row that needs to be dispensed in order to achieve the target rate. To do this, follow these three simple steps:

1. *Drive wheel circumference (ft) × row spacing (ft) × number of tire rotations*
2. *Answer from step 1 × target seeding rate ÷ 43,560 = lbs of seed per row*
3. *Answer from step 2 × 454 = grams of seed needed per row*

Sample Calculation

Using the information from our barley example, we would need to catch 123 grams per row in order to achieve the target seeding rate. If all 24 rows are tested, we need to catch 2,952 (123 × 24) grams of seed for a seeding rate of 182 lbs per acre.

Grams of seed per row = (8.67 × 0.625 × 12 × 182 ÷ 43,560) × 454 = 123 grams

To verify this is correct, let’s enter the values into the formula:

$$Seeding\ Rate = \frac{43{,}560 \times (2{,}952\ \div 454)}{15 \times 104} = 182\ lbs/ac$$

In our soybean example, we will block off every second row of the drill in order to achieve a row spacing of 15 (1.25 feet) inches and will only be collecting seed from six rows. The quantity of seed needed is calculated as follows:

Grams of seed per row = (8.67 × 1.25 × 12 × 78 ÷ 43,560) × 454 = 106 grams

In our 12 wheel rotations, 106 grams for each row tested will need to be dispensed or in this case 636 (106 × 6) grams of seed are needed to achieve our target seeding rate of 78 lbs/ac. Now we perform the testing procedure as many times as necessary while adjusting the seed delivery mechanism until the appropriate weight of seed collected has been achieved or within plus or minus 2-3% of the target.

Once the correct seeding rate has been achieved, re-install the seed tubes and the calibration is complete. Actual seeding rates in the field may vary slightly due to soil conditions, travel speed and overlapping so be sure to monitor the rates as planting progresses. By completing this exercise and achieving accurate seeding rates you will be setting your crop up for success, while controlling your input costs. An Excel spreadsheet that will automatically perform the calculations is available for download on the Atlantic Grains Council website (https://atlanticgrainscouncil.ca/), as well as step by step calibration worksheets that can be printed.

Table 2. Seeding Rate Chart for Cereals

1000 KERNEL WEIGHT (g)	NUMBER OF SEEDS PER LB.	TARGET SEEDING RATE PER ACRE							
		325 s/m^2 (1.3 M s/ac)	350 s/m^2 (1.4 M s/ac)	375 s/m^2 (1.5M s/ac)	400 s/m^2 (1.6 M s/ac)	425 s/m^2 (1.7 M s/ac)	450 s/m^2 (1.8 M s/ac)	475 s/m^2 (1.9 M s/ac)	500 s/m^2 (2.0 M s/ac)
		LBS PER ACRE[1]							
28	16,200	90	97	104	111	118	125	132	138
30	15,120	96	104	111	119	126	134	141	148
32	14,175	103	111	119	127	134	142	150	158
34	13,341	109	118	126	134	143	151	160	168
36	12,600	116	125	134	142	151	160	169	178
38	11,973	122	132	141	150	160	169	178	188
40	11,340	129	138	148	158	168	178	188	198
42	10,800	135	145	156	166	177	187	197	208
44	10,309	141	152	163	174	185	196	207	218
46	9,861	148	159	171	182	193	205	216	227
48	9,450	154	166	178	190	202	214	225	237
50	9,072	161	173	185	198	210	223	235	247
52	8,723	167	180	193	206	219	231	244	257
54	8,400	174	187	200	214	227	240	254	267
56	8,100	180	194	208	222	235	249	263	277
58	7,821	186	201	215	229	244	258	272	287

[1] *The seeding rates in this table assume a germination of 95% and seed mortality of 5%*