AE-959

OCTOBER 1988

Drill Calibration for Planting Grasses and Legumes

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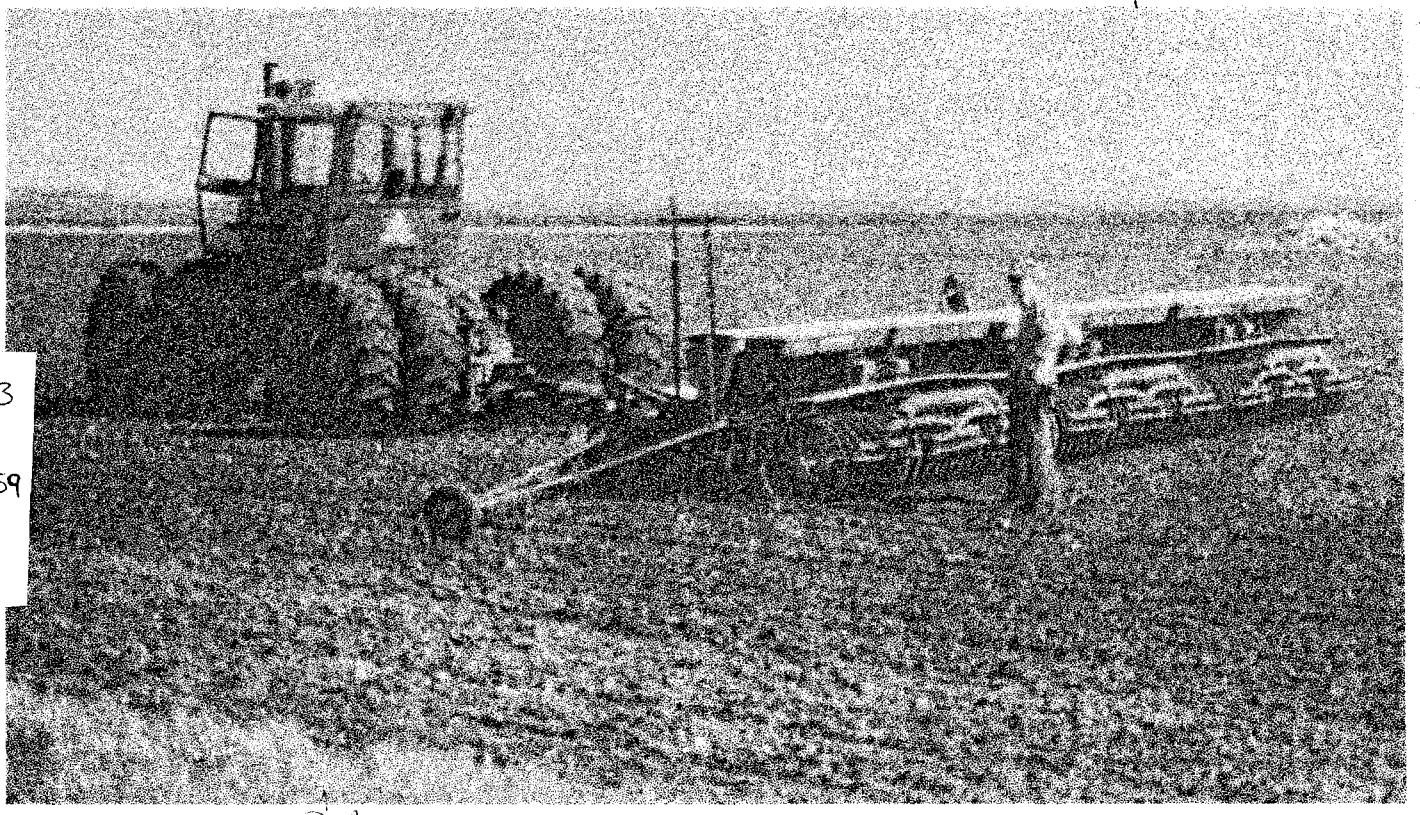

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Drill calibration is essential to maintain seed cost at the estimated level and to assure that an adequate number of live seeds are uniformly distributed in the seed row. To fully understand the concepts of drill calibration, a basic knowledge of seed mixture formulation based on pure live seed (PLS) and adjusting PLS seeding rates based on the quality of seed purchased is necessary.

Grass and legume seed mixtures are formulated based on pure live seed. Seeding rates usually are calculated to provide 20, 25 or 30 live seeds per square foot. The lower number of seeds per square foot is for drier areas, for grasses and legumes considered easy to establish and for ideal seedbed conditions and planting techniques. It is essential to provide a firm seedbed before planting. This will help prevent seeding to excessive depths.

The number of pure seeds in one pound of each grass or legume must be known to formulate a seed mixture based on PLS. Table 1 provides a listing of various grasses and legumes, approximate number of seeds per pound and the number of seeds per square foot per pound/acre planted. For example, smooth bromegrass has approximately 135,000 seeds per pound of pure seed. Each pound planted per acre provides an average of 3.1 seeds per square foot (135,000 ÷ 43,560 sq. ft./acre equals 3.1 seeds/sq. ft.). If a seeding rate of 30 PLS/sq. ft. is desired in the field, then 30 ÷ 3.1 seeds/lb. planted indicates the total pounds of smooth bromegrass required per acre or 9.7 lbs. PLS.

Forage crop seed mixtures formulated on PLS assumes every seed is live and has the potential to establish a healthy seedling. In other words, every pound of seed in the mixutre is considered to have a germination and purity of 100 pecent. Purchased seed generally has a germination and purity less than 100 percent. This requires the actual pounds of seed planted to be adjusted upward to provide the desired number of PLS per square foot in the field.

The actual pounds of purchased seed required is based on the quality of the particular seedlot purchased. The percent germination and percent purity, as listed on the seed tag, must be known for each grass or legume in the mixture. It is a two-step process.

Step 1: Determine the PLS index or seeding rate adjustment factor for each grass or legume in the mixture.

% germination x % purity = PLS index or seeding rate adjustment factor (a decimal number)

Example: Smooth bromegrass - 90% germination
90% purity

0.90 x 0.90 = .81 PLS index

Table 1. Number of seeds per pound and per square foot per pound planted for various grasses and legumes. (Assumes uniform distribution over one acre.)

Species	Number of seeds per lb.	Number of Seeds per sq. ft. per lb. planted/ac
Bluestem:		
Big	160,000	3.7
Little	260,000	6.0
Sand	110,000	2.5
Bromegrass:		
Meadow	80,000	1.8
Smooth	135,000	3.1
Canarygrass:		
Reed	530,000	12.2
Foxtail:		
Creeping	750,000	17.2
Grama:		
Blue	825,000	18.9
Sideoats	190,000	4.4
Indiangrass	175,000	4.0
Needlegrass:		
Green	180,000	4.1
Sandreed:		
Prairie	275,000	6.3
Switchgrass	390,000	8.9
Wheatgrass:		
Crested		
fairway	200,000	4.6
standard	175,000	4.0
Intermediate	88,000	2.0
Pubescent	90,000	2.1
Slender	175,000	4.0
Streambank	156,000	3.6
Tall	79,000	1.8
Thickspike	154,000	3.5
Western	110,000	2.5
Wildrye:		
Altai	100,000	2.3
Beardless	160,000	3.7
Russian	175,000	4.0
Legumes:		
Alfalfa	220,000	5.0
Sweetclover	260,000	6.0

Step 2: Determine the pounds of purchased seed required per acre for each grass or legume in the mixture.

$$\frac{\text{PLS seeding rate}}{\text{PLS index}} = \text{adjusted PLS seeding rate or lbs. purchased seed/acre}$$

Example: Smooth bromegrass (30 seeds/sq. ft.)

$$\frac{30 \text{ seeds/sq. ft.}}{3.1} = 9.7 \text{ lbs. PLS/acre}$$

$$\frac{9.7 \text{ lbs. PLS/ac}}{0.81 \text{ (Step 1)}} = 11.97 \text{ or } 12 \text{ lbs. purchased seed/acre}$$

Cost-share for seeding grass and grass-legume mixtures is available through the ASCS Agricultural Conservation Program (ACP). The cost-share is based on a minimum seeding rate to establish an acceptable stand and a maximum cost per pound PLS of adapted grasses or legumes in the seed mixture. To compute the cost per pound PLS for each grass and legume in the mixture, use the following procedure:

$$\frac{\text{Purchased seed cost/lb.}}{\text{PLS index}} = \text{cost/lb. PLS}$$

Example: Smooth bromegrass cost/lb. = $1.65

Note: PLS index is 0.81 (step 1 above)

$$\frac{\$1.65}{0.81} = \$2.04 \text{ cost/lb. PLS}$$

Extension circulars R-704, "Forage Crop Seed Mixture Formulation" and R-703, "Pure Live Seed...Seeding Rates for Grasses and Legumes" will be helpful when formulating seed mixtures and adjusting PLS seeding rates.

Drill calibration for seeding grasses and legumes can be done by two methods...(1) weighing the seed delivered by the drill over a specified area, and (2) the number of seeds delivered per foot of drill row. The "seeds delivered per foot of drill row" method is simple, easy, accurate and requires no special equipment for on-farm calibration.

DRILL CALIBRATION IS BASED ON THE ADJUSTED PLS SEEDING RATE OR THE TOTAL POUNDS OF PURE SEED REQUIRED TO DELIVER THE DESIRED NUMBER OF LIVE SEEDS PER SQUARE FOOT IN THE FIELD. If the PLS seeding rate was determined by someone other than yourself, the total number of PLS per square foot for each grass or legume in the seed mixture can be determined by using Table 1. Multiply the pounds PLS for each grass and legume to be planted times the number of seeds per square foot per pound of pure seed planted (Table 1).

lbs. PLS x No. seeds/sq. ft./lb. seed planted = seeds/sq. ft.

Example:
Smooth bromegrass -
7.7 lbs. PLS x 3.1 seeds/sq. ft./lb. = 23.9 PLS/sq. ft.
Alfalfa -
1.2 lbs. PLS x 5.0 seeds/sq. ft./lb. = 6.0 PLS/sq. ft.
23.9 plus 6.0 equals 29.9
Total 29.9 or 30 PLS/sq. ft.

The number of seeds required per foot of row for drill calibration can be determined for SINGLE SPECIES planting by using Table 2 and for MIXTURES OF TWO OR MORE GRASSES AND LEGUMES by using Table 3.

The number of seeds required per foot of row for SINGLE SPECIES seeding has been calculated for several drill row spacings and seed germination percentages in Table 2. To use this table, the percent seed germination of your purchased seedlot, number of PLS required per square foot in the field (20, 25 or 30 PLS per square foot) and your drill row spacing must be known. For example, if the drill row spacing is 6 inches, seed germination 90 percent and 30 PLS per square foot are desired in the field, then approximately 17 seeds are required per foot of row for drill calibration purposes. If the drill row spacing is 7 inches, seed germination 90 percent and 30 PLS per square foot are desired, a total of 19 seeds per foot of row are required for drill calibration.

Table 2. Apporximate number of seeds required per foot of row by drill spacing, seed germination percentage and number of PLS desired per square foot in the field for SINGLE SPECIES DRILL CALIBRATION.

Row spacing and % germination	No. PLS/square foot desired		
	20	25	30
	------No. seeds/foot of row------		
6-INCH SPACING			
100	10	12	15
90	11	14	17
80	13	16	19
70	14	18	21
7-INCH SPACING			
100	12	15	17
90	13	16	19
80	15	18	22
70	17	21	25
8-INCH SPACING			
100	13	17	20
90	15	19	22
80	17	21	25
70	19	24	29
10-INCH SPACING			
100	17	21	25
90	18	23	28
80	21	26	31
70	24	30	36
12-INCH SPACING			
100	20	25	30
90	22	28	33
80	25	31	38
70	29	36	43

The number of seeds per foot of row for MIXTURES OF TWO OR MORE GRASSES AND LEGUMES can be determined by using Table 3. List the grasses and legumes in your seed mixture in column 1, the PLS seeding rate in column 2, and the percent germination of individual species or varieties in the mix in column 3. The number of seeds per square foot per pound of pure seed planted (column 5) can be found in Table 1. The drill spacing adjustment factor (column 7) for 6, 7, 8, 10 and 12-inch spacings, is provided in Table 3 footnote. Now complete columns 4, 6 and 8 by following the instructions provided for each column. Total column 8 and round the number to the nearest whole number. This is the total number of seeds required per foot of row for your drill spacing to plant the pounds of PLS as indicated in column 2. Note: The actual PLS pounds required may vary depending on seed quality, especially test weight, as this will influence the estimated number of seeds in a pound of grass or legume seed.

GRASS DRILLS have advantages over grain drills when seeding grass and grass-legume mixtures. These drills are designed with special drill box feed mechanisms and seed agitators to prevent bridging of the seed and help maintain a constant flow of seed. In addition, depth bands on the disc openers place the seed at a shallow, uniform planting depth. Several Soil Conservation Districts throughout the state have grass drills which can be obtained on a rental basis. These drills usually will plant light, chaffy grasses without the addition of a carrier such as oats.

GRAIN DRILLS are widely used to plant grasses and legumes. These drills require greater attention by the operator to assure a uniform distribution of seed in the row. A carrier such as oats or very coarse cracked corn (not ground) may be required to prevent bridging of seed in the drill box and to allow seed to flow uniformly into the feed mechanism or the seed metering wheel.

The amount of carrier required will vary depending on the seed mixture being planted and the type of grain drill being used. Large, light, chaffy grasses will require more carrier than small-seeded grasses with smooth, heavy seed. Grain drills with the seed metering wheel exposed in the seed box will require less carrier than drills with the metering wheel mounted below the seed box in a cup. The exposed metering wheel acts as an agitator, providing a more uniform flow of seed.

The amount of carrier required on a volume basis generally will be about one part carrier to two parts grass or grass-legume mixture being planted. (Example: 1 bushel of carrier to 2 bushels of grass seed.) Use only as much carrier as required for the seed mixture to flow uniformly through the drill. The exact amount can be determined only by trial and error.

Table 3. Guidelines to determine the approximate number of seeds per foot of row for seed mixtures containing two or more grasses and legumes.

Grasses and legumes in mix (1)	lbs. PLS/acre (2)	Germination (% → decimal) (3)	lbs. pure seed/acre (4)	No. seeds/sq. ft./lb. seeded (5)	Total seeds per sq. ft. (6)	Drill adjustment factor (7)	No. seeds per foot of row (8)
Example: Smooth brome	7.7	Seed tag 0.90	Col 2 ÷ 3 8.5	(Table 1) 3.1	Col 4x5 26.4	(footnote 1) 0.50	Col 6x7 13.2
Alfalfa	1.2	0.90	1.3	5.0	6.6	0.50	3.3
Totals	8.9	xxxx	xxx	xxx	33.0	xxxx	16.5
Totals		xxxx	xxx	xxx		xxxx	

1 DRILL ADJUSTMENT FACTOR: 6-inch = .5; 7-inch = .58; 8-inch = .66; 10-inch = .83 and 12-inch = 1.0.

CAUTION: When planting grass seed mixtures, do not fill the seedbox full. Place only a small amount of seed in the drill box and stir the seed periodically, possibly after every round in the field or more frequently to PREVENT BRIDGING of the seed over the metering wheel and to prevent heavier seeds from settling out of the mixture during planting.

Two drill calibration methods are outlined. The methods used are the "TARP METHOD - DISCS UP" when the seed metering wheels can be engaged with the disc openers in the up position or the "STATIONARY METHOD," for drills on which the metering wheel cannot be engaged with the disc openers in the up position.

TARP METHOD - DISCS UP

1. Engage the metering system when the disc openers are up. This usually can be done by loosening and shifting the arm that disengages the drive when the drill is lifted.

2. Cover two or three metering orifices on each side of the orifice to be used for calibration. Masking or duct tape can be used.

3. Remove the drop tube from the disc opener under the orifice being used for calibration. The tube must hang free to drop the seeds in a row on a tarp or plastic sheet.

4. Place a small amount of grass seed mixture and carrier over the orifice being calibrated.

5. Lay a tarp or large plastic sheet on the ground to calibrate the drill. An area out of the wind is highly desirable.

6. Operate the drill a short distance to check for bridging of seed, then drive the drill over the tarp or plastic sheeting. Drive at a speed similar to that used for field planting. Speed will affect the accuracy of metering and separation of the grass seed mixture from the carrier.

7. Count the number of grass and/or legume seeds delivered per foot of row. Do not count the carrier or the inert material. Make several counts at different places along the seeded row and average the count. The number of grass and legume seeds counted should be approximately the same as the calculated number in Tables 2 or 3.

8. Repeat the process in steps 5, 6 and 7 as often as necessary, adjusting the drill and, if necessary, adding more carrier to obtain the required number of grass and legume seeds per foot of row. After one drill row has been adjusted to the proper seed rate, check several other metering wheels to be sure they are doing a uniform job. Some metering orifices may drop more or less than another. Start with a clean tarp each time.

9. Once the drill has been properly calibrated, replace the drop tube in the disc opener, remove tape from the plugged orifice opening and disengage the drive system. Your drill is now ready for the field.

10. In the field, keep a record of the amount of grass seed and carrier placed in the drill and estimate the amount of seed delivered over a particular area. After two or three rounds have been made, minor adjustments in the drill setting may be required to plant the total pounds of grass or legume seed mixture required per acre. The number of acres seeded can be determined by multiplying drill width (ft.) x distance traveled (ft.) divided by 43,560 sq. ft./acre.

STATIONARY METHOD

Grain drills that do not permit engagement of the drive system with the disc openers in the up position should be calibrated by the stationary method. This method of drill calibration disregards travel speed and settling of seed in the drill box and is not as accurate as the tarp method. It requires a count of the number of seeds over a distance of one revolution of the drive wheel. The drive wheel diameter must be measured in inches and a calculation made to determine the circumference (C) around the outside of the wheel in feet.

Example: Circumference of drive wheel in feet

$$\text{Circumference in ft.} = \frac{\text{diameter (inches)} \times 3.14}{12 \text{ (inches)}}$$

Example: Drive wheel diameter = 20 inches

$$C = \frac{20 \times 3.14}{12} = 5.23 \text{ ft.}$$

Distance traveled in one revolution of the drive wheel

Calibration Procedure

1. Cover two or three metering orifices on each side of the orifice being used for calibration. Use masking or duct tape for covering orifices.

2. Disconnect the drop tube under the metering orifice to be used for calibration.

3. Place a small amount of grass or legume seed mixture and carrier in the drill box over the orifice opening to be used for calibration. Turn the

drive wheel several revolutions to check for uniform seed metering and bridging of seed over the orifice. If bridging occurs, more carrier will be required.

4. Collect seed in a cup for one revolution of the drive wheel. Place a mark on the outer edge of the drive wheel to indicate when wheel has been turned one complete revolution.

5. Count only the grass and legume seed collected. Divide the number of seeds collected by the circumference of the drive wheel as calculated for your drill to determine the number of seeds delivered per foot of drill row.

Example: Circumference of drive wheel = 5.23 ft.

No. of seeds collected = 85

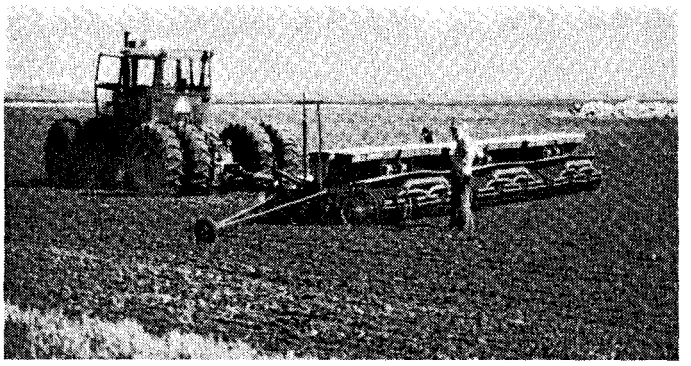
$$\frac{85}{5.23} = 16.2 \text{ seeds/row ft.}$$

Note: The number of grass and legume seeds per foot of drill row should be approximately the same as the calculated number in Tables 2 or 3.

6. Repeat the process as often as necessary, adjusting the drill metering system and, if necessary, adding more carrier to the seed mixture to obtain the required number of grass and legume seeds per foot of drill row. It is best to collect seed mix from more than one metering wheel to be sure the seeding rate is uniform from most seed units.

7. Once the drill has been properly adjusted, replace the seed drop tube and remove the tape placed over the orifice openings. Your drill is now ready for the field.

8. In the field, keep a record of the amount of grass seed mixture and carrier placed in the drill and estimate the amount of seed delivered over a particular area. After two or three rounds have been made, minor adjustments in the drill setting may be required to plant the total pounds of grass and/or legume seed mixture required per acre. The number of acres seeded can be determined by multiplying drill width (ft.) x distance traveled (ft.) divided by 43,560 sq. ft./acre.



Accurate calibration of drills is essential to provide a uniform grass and legume stand.

Summary

Over or under seeding of grasses and legumes is expensive. If more than the recommended amount of seed is used, seed cost is excessive, and if too little seed is planted, a poor stand which may require reseeding will result.

Drill calibration is essential to prevent this problem whether a grass drill or a grain drill is used. Counting the number of seeds planted per foot of drill row is an excellent means of calibration as the number of seeds per square foot is determined.

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