SDSU Extension

iGrow Corn

BEST MANAGEMENT PRACTICES

Chapter: 34

Estimating Corn Seedling Emergence and Variability

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Figure 34.1. Emerged corn seeds (Howard F. Schwartz, Colorado State University, Bugwood.org

The ability to nurture the planted seed to a mature plant depends on many factors, including the seed germination rate and seedling emergence. Both of these factors depend the effectiveness of the seeding process. Seedling emergence is used to calculate the seeding rate and to assess the effectiveness of the planting system. These calculations require that the row spacing and plants per row be estimated. The purpose of this chapter is to discuss guidelines for determining the seeding rate and measuring seed emergence.

Calculating the Corn Seeding Rate

An important consideration in achieving the yield goal requires that the appropriate number of seeds be planted in the soil. A very coarse rule of thumb is to seed 10% more seeds than your target population. However, this rate can be fine-tuned by considering the seed germination rate and the number of germinated seeds that survive to harvest. Information on germination is provided by the seed dealer and found on the seed bag or box label. Expected survival, which is impacted by diseases, insects, weather events, and seedbed characteristics, is harder to estimate. The survival of germinated seeds to harvest can be calculated by measuring seed emergence and the harvested plant population.

Seeding Rate

The seeding rate is calculated with the equations:

$$\text{Seedling rage (seeds/acre)} = \frac{\text{Desired population at harvest (plants/acre)}}{\frac{\text{\% emergence of planted seeds}}{100}}$$

In this equation, the % emergence of planted seeds can be estimated based on seed germination rate and prior records. Common estimated values for % emergence of planted seeds range from 90% to 95%, and it can be calculated using the equation:

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$$\frac{\text{\% seed emergence of planted seeds}}{100} = \frac{\text{\% germinated seeds}}{100} \bullet \frac{\text{\% emergence of germinated seeds}}{100}$$

The % germinated seeds can be estimated using the germination rate provided by the seed seller and the % of germinated seeds that emerged from the soil (Fig 34.1). Unfortunately, the % of germinated seeds that emerged from the soil is not known and therefore it must be estimated. This value is important because it can reveal planter problems. Sample calculations for these values are provided in Examples 34.1, 34.2, and 34.3.

Seed Emergence

Calculating the % seed emergence requires a measurement of the plant population (Fig. 34.1). The percent seed emergence is influenced by many factors, including seedbed preparation, crusting, and diseases, and it is calculated with the equation:

$$\text{\% Seed emergence} = 100\% \bullet \frac{\text{Plant population after emergence}}{\text{Seeding rate}}$$

Calculating Plant Population

The plant population in a cornfield is determining by counting the number of plants in 1/1000 of an acre (Table 34.1). Based on data in Table 34.1, for a 30-inch row, the length of the row for 1/1000 of an acre is 17 feet and 5.1 inches.

Table 34.1 The distance along a row representing 1/1000 of an acre. On the row, the number of plants should be counted. The plant population is 1000 times the number of plants in 1/1000 of an acre.

Distance	Row width (inches)									
	6	**7**	**8**	**10**	**14**	**15**	**20**	**21**	**28**	**30**
Feet	87	74	65	52	37	34	26	24	18	17
Inches	1.4	7.1	4.1	3.3	4	10.2	1.6	10.7	8	5.1

Determining Stand Uniformity

Corn plants that are too close can act as a weed to the adjacent plant. The newest of planters, if accurately calibrated, have the capacity to reduce this variability to near zero. Stand uniformity can be determined by calculating the standard deviation of the distances between adjacent corn plants. The field variability can be determined by placing a 20-foot tape measure next to a row of corn plants, as shown in Figure 34.2.

Record the location of each plant within the row in inches. Use a tape measure that documents inches rather than feet and inches. Repeat the process at 4 or 5 separate locations within the field. Type these numbers into a spreadsheet and use the spreadsheet to calcualate the distance, the average distance, and standard deviation of the distances (Table 34.2).

Optimum yields are obtained by minimizing the spacing variability. The standard deviation provides an index of the ability of the seeder to plant a uniform stand (Note that there may also be agronomic problems, such as clods or a crust that reduces seedling emergence). Most agronomists believe that yield is optimized by a standard spacing distance (low standard deviation) between the plants. Research suggests

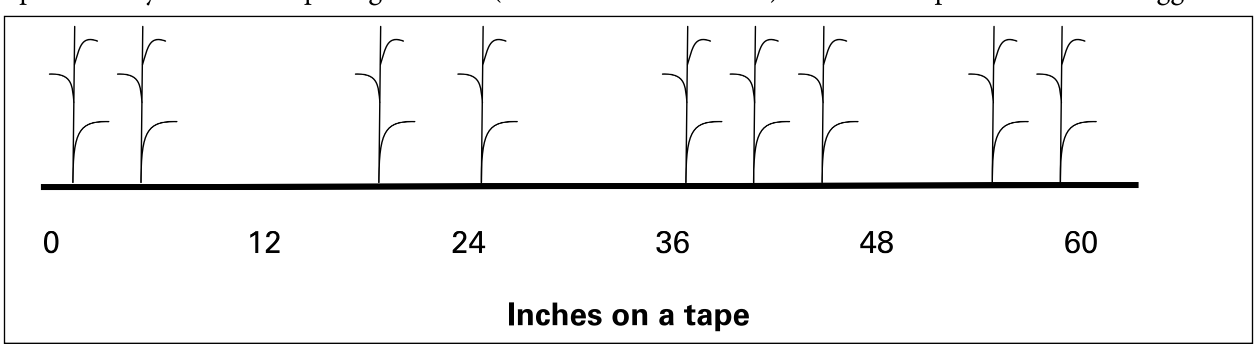

Figure 34.2 The number of corn plants along a transect within a single row. In this example, corn plants are located at 2, 5, 19, 25, 37, 42, 46, 55, and 57 inches.

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Example 34.1 Determine the emergence of germinated seeds (EGS). If the seed container label germination rate is 90%, the seeding rate is 35,000 seeds/acre, and the post-emergence counted plant population is 30,000 plants per acre, what is the % emergence of germinated seeds?

$$\%EGS = \frac{\frac{\%\text{seed emergence}}{100}}{\frac{\%\text{seed germination rate}}{100}} = \frac{\frac{30{,}000 \text{ plts/acre}}{35{,}000 \text{ plts/acre}}}{0.90} = 0.952$$

This calculation suggests that 95.2% of the germinated seeds emerged from the soil.

Example 34.2 If the seedling plant population is 32,000 plants/acre and the plant population at harvest is 31,000 plants/acre what is the survival of seedlings to harvest

$$\%\text{ survival} = \frac{31{,}000}{32{,}000} = 96.9\%$$

Example 34.3. If the % germination is 96%, the expected survival of germinated seed to harvest is 92.2%, and the target plant population is 34,000 seed/acre what is the seeding rate?

$$\text{Seeding rate} = \frac{\text{Target population at harvest}}{\frac{\%\text{seed germination rate}}{100} \bullet \frac{30{,}000 \text{ plts/acre}}{35{,}000 \text{ plts/acre}}}$$

$$\text{Seeding rate} = \frac{34{,}000/\text{acre}}{0.96 \bullet 0.922} = 38{,}413 \text{ plants/a}$$

Example 34.4 Determine the seed emergence rate if the seeding rate is 38,000 plants/acre.

Measure the row width, and if your row width is 30 inches, count the number of plants in a row that is 17 feet and 5.1 inches long. If 35 corn plants are contained in the row, then your plant population is 35,000 plants/acre (35×1000).

$$\text{Seed emergence} = 100\% \bullet \frac{35{,}000}{38{,}000} = 92.1\%$$

In a second example, you plant corn in 15-inch rows, what is the length of row to produce 1/1000th of an acre? Based on data in Table 34.1, count the number of plants in a row that is 34 feet and 10.2 inches long.

Table 34.2 Sample spreadsheet showing how to calculate plants/acre and yield losses due to variable seeding. The tables below show the locations on a tape measure. In the table on the right, the equations behind the values in column B are shown. The value in column C is the row spacing.

	A	B	C
	Measured location of each corn plant	Spacing distance between each pair of plants	
1	0		30
2	2	2	
3	17	15	
4	33	16	
5	38	5	
6	39	1	
7	44	5	
8	52	8	
9	55	3	
10	60	5	
11	66	6	
12	Average	6.6	
13	Standard deviation	5.12	
14	Bu/acre in estimated yield loss	12.5	
15	Plants/acre	30,750	

A	B
	Equations
	=A2-A1
	=A3-A2
	=A4-A3
	=A5-A4
	=A6-A5
	=A7-A6
	=A8-A7
	=A9-A8
	=A10-A9
	=A11-A10
	=average(B2:B11)
	=stdev(B2:b11)
	=(B13-2)*4
	=(1/(C1*B12))*144*43,560

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that a standard deviation of 2 inches is excellent. There is about a 4 bu/acre yield loss per inch for standard deviations greater than 2 inches.

Table 34.3 Definition of terms used in this chapter.

Key Terms	Definition
Seed germination	The germination rate of the seed. Specified by the seller.
Seedling emergence	The emergence of the seedlings from the soil.
Seeding rate	The number of seeds/acre planted in the soil.
Plant population	The plant population following emergence.
% emergence of germinated seeds	Difficult to measure, can be estimated based on the seed germination rate.
Standard deviation of the stand uniformity	The standard deviations (variability) in the distances between adjacent corn plants.

References and Additional Information

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