SDSU Extension

iGrow Soybean

BEST MANAGEMENT PRACTICES

Chapter 13: Estimating the Soybean Plant Population and Seed Emergence Rate

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The efficiency of the seeding process can be determined by measuring the plant population and seed emergence. Seed emergence is used to calculate the seeding rate (Chapter 10) and assess the effective of planting system. These calculations require that the row spacing and plants per acre be estimated. The purpose of this chapter is to discuss guidelines for measuring seed emergence and the live population.

Calculating apparent seed emergence

Plant emergence information provides critical information to assess the effectiveness of the planting operation. The percent apparent emergence and seeding rate are equal to:

$$\text{Apparent emergence} = 100\% \times \left(1 - \frac{\text{Seeding rate - live plant population}}{\text{Seeding rate}}\right)$$

$$\text{Seeding rate} = \frac{\text{Live plant population}}{\frac{\%\text{ germ.}}{100} \times \frac{\%\text{ pure seed}}{100} \times \frac{\%\text{ emergence}}{100}}$$

In the first equation, the apparent emergence value is a function of the % germination, % pure live seed, and % emergence (Chapter 9). Information on germination and live seed purity are provided by the seller, while the % emergence can be calculated (Problem 13.1). This example shows that apparent emergence and emergence can be very different. The emergence can be influenced by many factors including seedbed preparation, crusting, and diseases.

Problem 13.1. Calcuate the % emergence if the % germination is 96%, percent pure seed is 99%, the seeding rate was 150,000 seed/acre, and measured population was 125,000 plants (at V2)/acre.

$$\text{Seeding rate} = \frac{\text{Desired plant population}}{\frac{\%\ \text{germ.}}{100} \times \frac{\%\ \text{pure seed}}{100} \times \frac{\%\ \text{emergence}}{100}}$$

$$150{,}000\,/\,acre = \frac{125{,}000\,/\,acre}{0.96 \times 0.99 \times \frac{\%\ \text{emergence}}{100}}$$

$$\frac{\%\ \text{emergence}}{100} = \frac{125{,}000/acre}{0.96 \times 0.99 \times 150{,}000/acre} = 87.7\%\ \text{emergence}$$

The apparent emergence was 80% [100 x (1-(150,000-125,000)/150,000)]. The emergence and apparent emergence values are very different and can lead to different interpretations. Low emergence can result from poor seed viability, soil crusting, or a number of factors

Calculating plant population

The simplest way to estimate the actual plant population, in a rowed crop, is to measure the number of plants in 1/1000 of an acre. Because large soybean plants are bushy, our preference is to accomplish stand counts a week or two after emergence. Figure 13.1 shows the relationship between distances, in a single row, as a function of row spacing required for 1/1000 of an acre. The population is determined by counting the number of plants in that length of row and then multiplying that population by 1000. We recommend that you measure plant populations at a minimum of ten separate locations within a field or to be more precise, ten locations within a landscape position or predetermined grid area. An example is shown in Problem 13.2.

Problem 13.2. To begin the procedure, one must use a measuring tape or rod to determin to row width. If your row width is 30 inches (as indicated in cell K5), to account for 1/1000 of an arce requires that you count the number of plants in a row that is 17 feet (cell K6) and 5.1 inches (cell K7) long.

If 124 soybean plants are within a row that is 17 feet and 5.1 inches long by 30 inches wide, then the population is 124,000 plants/acre (124 × 1000).

What is the apparent emergence rate if the seeding rate was 130,000/acre?

$$\text{Apparent emergence} = \mathbf{100}\% \times \left(\mathbf{1} - \frac{\text{planted seed population - live seed population}}{\text{planted population}}\right)$$

$$\text{Apparent emergence} = \mathbf{100}\% \times \left(\mathbf{1} - \frac{\mathbf{130{,}000}\,/\,acre - \mathbf{124{,}000}\,/\,acre}{\mathbf{130{,}000}\,/\,acre}\right) \approx \mathbf{96}\%$$

then 96% os the seeds germinated and emerged from the soil:

(100% × [1-(130,000 - 124,000)/130,000]).

	A	B	C	D	E	F	G	H	I	J	K
3			distance as a function of row width for 1/1000 acre								
4					Row width (inches)						
5		6	7	8	10	14	15	20	21	28	30
6	feet	87	74	65	52	37	34	26	24	18	17
7	inches	1.4	8.1	4.1	3.3	4.0	10.2	1.6	10.7	8.0	5.1

Figure 13.1. For different row spacing, distance in feet and inches for 1/1000 of an acre. (Modified from Clay et al., 2011)

	A	B
4		
5		6
6	feet	=INT(43.56*12/B5)
7	inches	=12*(43.56*12/B5-B6)

Figure 13.2. The Excel formulas used to create Figure 13.1. To create the spread sheet type in cell B6 and B7 the equations shown below. After these are typed in, copy them fill in equations in the C through K columns. (Modified from Clay et al., 2011)

As a second example, if you drilled soybeans into 8-inch rows (cell D5), you would count the soybean plants in 65 feet (cell D6), 4.1 inches (cell D7) of row. If you counted 191 emerged soybean plants in the 65 feet, 4.1 inches of a single row of 8-inch rowed beans, your field's population is 191,000 plants/acre.

The formulas used to create Figure 13.1 are shown in Figure 13.2. Note that the INT (integer) function in cell B6 keeps only the integer part of the calculation. If it is your desire to determine the length of row per 1/1000 of an acre for a row width not shown, you would develop a spreadsheet with formulas shown in Figure 13.2. Then you would replace the number in cell B5 (or any cell from B5 to K5) with the row width of interest. Your results may show more digits to the right of the decimal in cells B7:K7. We have formatted the cells B7:K7 to display one digit to the right of the decimal.

For soybeans planted in twin rows, (as an example, a row spacing of 21 inch, 7 inch, 21 inch, 7 inch) the average spacing [(7+21)/2] is 14 inches, so if you count only a single row, use 37 feet 4 inch, (the results for 14-inch spacing). If you count all plants in both of the twin rows (7 inches apart), use the results for the 28-inch (i.e., 21+7) spacing (18 feet, 8 inches of row).

References and additional information

Clay, D.E., S.A. Clay, C.G. Carlson, and S. Murrell. 2011. Mathematics and Calculations for Agronomists and Soil Scientists. International Plant Nutrition Institute.

Lee, C., and J. Herbek. 2005. Estimating soybean yield. University of Kentucky Cooperative Extension Service. AGR-188. Available at http://www.ca.uky.edu/agc/pubs/agr/agr188/agr188.pdf

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