SDSU Extension

iGrow Soybean

BEST MANAGEMENT PRACTICES

Chapter 10:
Soybean Seeding Rate Recommendations for Narrow and Wide Rows

Robert Hall

Optimizing yield requires that an appropriate seeding rate be followed. The seeding rate depends on the desired plant population, seeding approach (drilled vs. row seeded), germination rate, and the emergence rate. The germination rates are obtained from a seed testing laboratory, while the emergence rate depends on the soil, planter, and climate conditions following planting. The purposes of this chapter are to: 1) demonstrate how to calculate the seeding rate, 2) discuss advantages and disadvantages of narrow and wide row planting systems, and 3) present selected findings from a three-year study that investigated the influence of row spacing and plant populations on soybean yields.

Determining the seeding rate

The desired population and seeding rate are two different things. The desired population is the emerged population, while the seeding rate is the rate that the planter seeds. The seeding rate is always equal to or higher than the emerged population. Determining the seeding rate starts with reviewing the seed testing information (Chapter 9). In the example shown in Problem 10.1a, the seeding rate is calculated based on the germination rate, live seed purity, and emergence rate. Problem 10.1b shows a seeding rate calculation when only germination is known. The emergence rate is related to seed vigor (Chapters 9 and 13) and should not be confused with apparent emergence rate, which represents the combined impact of germination, soil, seed purity, and the seed bed preparation technique.

Problem 10.1a. Calculating the seeding rate when germination, purity, and seeding vigor (emergence) are known.

In this example, the germination rate was 92% and seed lot is 98% pure. Seed emergence from soil also needs to be considered. In this calculation, it is assumed that 90% of the seeds emerge in a clay type soil (Sample calcuation is provided in problem 13.1). (Note: In a light-texture soil, the emergence rate estimate is often estimated to be 95%).

$$\text{desired population} = \frac{135{,}000 \text{ plants at V2}}{\text{acre}} = \left(\frac{\text{seeding rate}}{\text{acre}}\right) \times \frac{0.92 \text{ germination rate}}{\text{seed}} \times \frac{0.98 \text{ pure seeds}}{\text{seed}} \times \frac{0.90 \text{ emergence}}{\text{seed}}$$

$$\text{seeding rate} = \frac{\text{desired population}}{\frac{\%\text{ germ}}{100} \times \frac{\%\text{pureseed}}{100} \times \frac{\%\text{emergence}}{100}} = \frac{135{,}000}{0.92 \times 0.98 \times 0.90} = \frac{166{,}000 \text{ seeds}}{\text{acre}}$$

Problem 10.1b. Calculating the seeding rate when only apparent germination is known.

Data from last year shows that the apparent emergence rate was 90% (Chapter 13). The germination and purity values are assumed to be identical to last year. Determine the seeding rate for this field.

$$\text{desired population} = \frac{135{,}000 \text{ plants at V2}}{\text{acre}} = \left(\frac{\text{seeding rate}}{\text{acre}}\right) \times \frac{\text{X germination rate}}{\text{seed}} \times \frac{\text{Y pure seeds}}{\text{seed}} \times \frac{\text{Z emergence}}{\text{seed}}$$

$$\frac{0.90\text{apparent emergence}}{\text{seed}} = \frac{\text{X germination rate}}{\text{seed}} \times \frac{\text{Y pure seeds}}{\text{seed}} \times \frac{\text{Z emergence}}{\text{seed}}$$

$$\text{seeding rate} = \frac{\text{desired population}}{\frac{0.90 \text{ apparent emergence}}{\text{seed}}} = \frac{150{,}000 \text{ seeds}}{\text{acre}}$$

Narrow vs. wide rows

There has been considerable press on the advantages of narrow rows over wide rows. Research in South Dakota has been mixed and it shows that there are advantages and disadvantages to both systems (Table 10.1). Recommendations for heavy (clay soils) and light (sandy soils) are slightly different. The rates are generally higher for clay type soils than sandy soils because the apparent emergence rates are higher. Sandy soils are less likely to crust than clay soils.

Table 10.1. Advantages and disadvantage of soybean planted in narrow and wide rows and seeding recommendations for narrow and wide row systems.

NARROW ROWS

Advantages	*Disadvantages*
Grain drill can be used for planting	Higher seed population may be required heavy soils
Higher yields in some years	Potential for diseases like white mold is higher
Crop canopy is established faster	Higher risk of damage from field traffic
Canopy shade reduces weed competition damage	Increased potential for aerial applied field treatments

Seeding recommendation for 8-inch rows:

- Live plant population of 160 to 200,000 plants/acre in clay-based soils
- Live plant population of 140 to 200,000 plants/acre on sandy-based soils

WIDE ROWS

Advantages	*Disadvantages*
Increased potential for ground applied field treatments	Row crop planter used for planting
Lower seeding rates are required	More time needed for crop canopy closure
Reduced of damage from field traffic	More open canopy can increase risk of frost damage
Reduced risk of disease like white mold	

Seeding recommendation for 30-inch rows:

- Live plant population of 135 of 175,000 plants/acre on clay-based soils
- Live plant population of 120 to 175,000 plants/arce on sandy-based soils

Findings from a population rate/spacing study

In 2009 the SDSU Crop Performance Testing (CPT) Program initiated a study funded by the South Dakota Soybean Research and Promotion Council. This study, conducted in Brown County, Brookings/Volga, and Beresford, evaluated two row spacings (8 and 30 inches) and three maturity classes (MG-0, MG-I, and MG-II). Findings from the Brown County study site are shown in Figure 10.1. Findings from this study are shown to demonstrate how different results can be observed in different years. Based on the findings from these studies, the recommendations provided in Table 10.1 were developed.

The yield response to row spacing for 2009 (Fig. 10.1) was much higher than the responses in 2010 or 2011. In addition, the yield response to row spacing in 2009 differed greatly between the row space treatments. Analysis showed that the response of the 8-inch rows to plant density was nearly flat over the range of plant densities tested (75,000 to 200,000 plant/acre). In contrast, the response to plant density of the 30-inch rows increased more per 1,000 plants per acre increase in plant density than did the 8-inch rows. In 2010 and 2010 there were not significant differences between the 8-inch and 30-inch rows so the data from both row space treatments were combined to describe the yield response to increasing increments of plant density.

The large difference in the yield between the 8 and 30-inch rows in 2009 was a surprise. Keep in mind that our soybean production is on the northwestern edge of the US soybean production area and we tend to grow some MG-II, a lot of MG-I, and a few MG-0 soybeans. Our region is subject to a highly variable environment with large fluctuations in spring seeding windows, early spring and summer temperatures, early-season available sub-soil moisture, summer rainfall patterns, and length of growing season. One reason many states east of South Dakota tend to have higher and more consistent yields is because they have less variable summer moisture patterns.

In summary, in the first year (2009) of a three-year study, there was a large difference between the 8- and 30-inch rows seeding approaches. However, in 2010 and 2011, there were no significant differences between the two approaches. These results suggest that soybeans seeded in 8-inch rows produce similar or in some cases higher yields than soybean planted in 30-inch rows. In general, the narrow rows required a higher seeding density than the 30-inch row spacing. In the past, at least 200,000 seeds per acre were recommended for narrow rows and 165,000 for 20- to 30-inch rows. Even though a yield advantage to the narrower row system pops up now and then, it does not do so with any consistency.

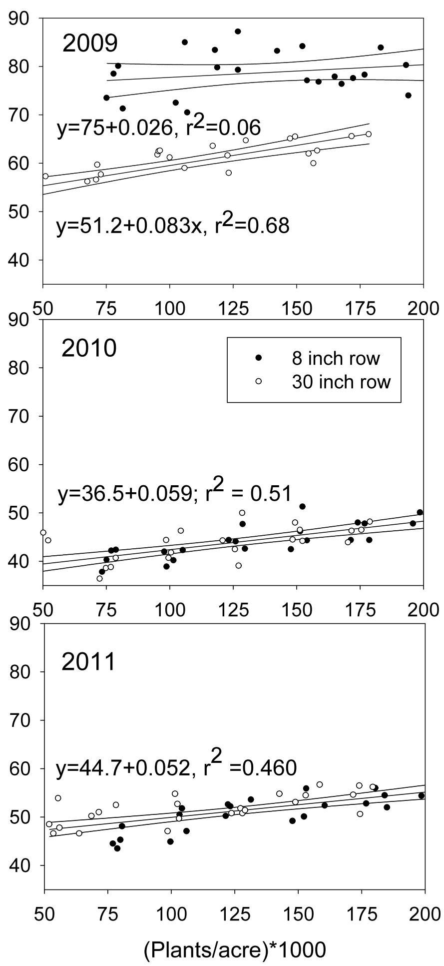

Figure 10.1. The influence of row spacing (8- and 30-inch rows) and year on the relationship between grain yield and live plant population. Included for each year is the equation for a straight line and the l associated 95% confidence limits (curved lines) for the regression line. (Source: D.E. Clay, SDSU)

References and additional information

Hall, R.G., K.K. Kirby, and S. Hawks. 2011. Develop new seeding-rate recommendations for South Dakota soybean growers. (In progress).

Naeve, S. 2008. Soybean seeding rates in Minnesota. UM Extension: Minnesota Crop eNew. Available at https://extension.umn.edu/

Robinson, A.P., and S.P. Conley. 2007. Plant populations and seeding rates for soybeans. AY-217-W. Purdue Extension. Available at http://www.extension.purdue.edu/extmedia/AY/AY-217-W.pdf

Acknowledgements

Funding for developing this chapter was provided by the South Dakota Soybean Research and Promotion Council, USDA-AFRI, SD Drought Tolerance Center, and South Dakota 2010 research program.

Hall, R. 2013. Soybean seeding rate recommendations for narrow and wide rows. In Clay, D.E., C.G. Carlson, S.A. Clay, L. Wagner, D. Deneke, and C. Hay, (eds). iGrow Soybeans: Best Management Practices for Soybean Production. South Dakota State University, SDSU Extension, Brookings,