



Optimum Plant Population in Iowa

Key Facts

As a result of higher seed prices, improved planters and weed management programs, soybean growers are more aware of the importance of seeding rates and optimal plant populations at harvest. A harvest population of approximately 100,000 uniformly distributed plants per acre will maximize economic return in Iowa regardless of row spacing. There appears to be no economic advantage to harvest populations greater than, or less than, 100,000 plants per acre. Economics, however, should be considered carefully when striving for higher harvest populations since seed is expensive. Timely management, such as weed management, is more critical at low plant populations.

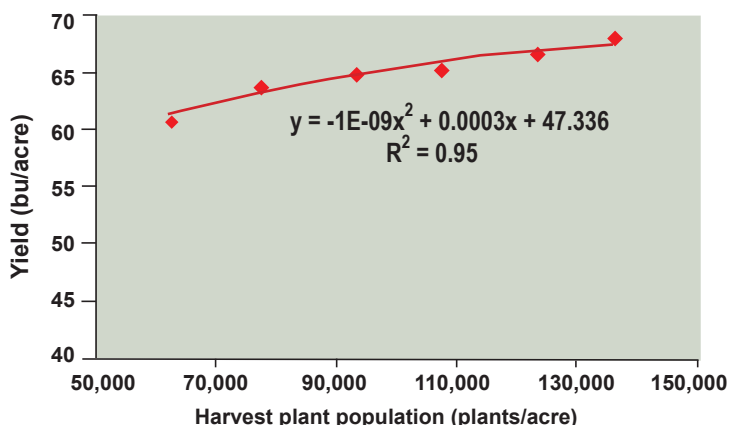
Conversations about soybean seeding rates have stimulated a great deal of interest among producers in recent years, mostly because soybean seed costs are increasing rapidly. Today, growers should be able to control their seeding rates with considerable precision because of improved planting equipment, the availability of high quality seed and effective weed management programs.

More than two dozen experiments have been conducted in Iowa since 2003. Overall, a plant population of approximately 100,000 plants uniformly distributed per acre is enough to maximize yield and economic return (Figure 1).

A plant population in excess of 100,000 plants per acre will minimize the yield per plant, while the overall yield per acre remains the same. Therefore, increasing the seeding rate to try to achieve higher yield is not a sound economic decision. However, a population less than 100,000 plants per acre can often result in significantly lower yields.

The reason plant population is not a critical yield factor for soybean is that the plant has the ability to adjust growth and development to compensate for different plant populations. The plant produces branches and more pods per plant if the plant population is low and fewer branches and pods per plant if the plant population is high.

Figure 1. Effect of plant population on soybean yield in Iowa across 13 environments from 2005-2007.

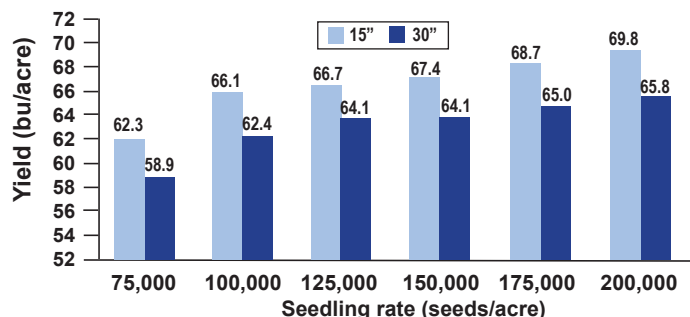


Higher seeding rates were previously justified in fields with high weed pressure. Today's weed management programs are much more effective, however, so high plant populations are unnecessary. Planting equipment has also improved significantly. The soil to seed contact achieved and the accuracy of seed placement promote stand establishment.

Row spacing

Since 2004, research has been conducted across Iowa to determine whether seeding rates should be adjusted for different row spacings (15-inch vs. 30-inch). On average producers can achieve 4.5 bu./acre more yield by planting soybean in 15-inch vs. 30-inch row spacing across all seeding rates (Figure 2). Previous recommendations were to increase

Figure 2. Seeding rate and row spacing effect on yield across 13 environments from 2005-2007.



the seeding rate when switching to narrower rows. Current data suggest that seeding rate does not need to be adjusted when changing row spacing. The data (unpublished) also show a higher mortality rate in 30-inch row spacing compared to 15-inch rows. However, producers should be aware that, when planting with a drill, higher seeding rates are necessary to achieve a uniform stand of 100,000 plants per acre at harvest when compared to a row-crop planter.

Other agronomic practices to consider

Data collected since 2003 suggest there is no yield response to seeding rate regardless of planting date. With a good weed management program, the same seeding rate can be used, whether you plant late April or early June. However, producers should consider using a drill if planting soybeans in mid-June or later to obtain quick canopy closure.

Previous data suggest that the same seeding rate can be used in tilled or no-till planting conditions if a properly weighted and adjusted drill or planter is used and soil conditions are acceptable. Because it is challenging to obtain uniform stands in no-till systems or by using a drill, frequent monitoring of equipment performance is necessary for best results.

The use of fungicide seed treatments for protection against seedling diseases is becoming more common in Iowa. A fungicide seed treatment will protect the seed during germination and emergence to minimize the risk of replanting. However, these seed treatments will rarely increase yield if a uniform stand of 100,000 plants per acre is established. Data collected in Iowa since 2005 suggest an overall improvement in stand between 5 to 10 percent with a fungicide seed treatment regardless of seeding rate, and 10 to 20 percent improvement in stand can be gained when using a fungicide/insecticide seed treatment combination. Fungicide/insecticide seed treatment combinations, however, can increase yield significantly if a field has a high population of bean leaf beetles.

Assessing plant population

Seeding rate or planting rate refers to the number of soybean seeds planted per acre to attain a certain plant population (Table 1). Plant population refers to the number of soybean plants per acre established after planting. Stand counts should be taken just prior to harvest since there will be plant-to-plant competition throughout the growing season and plants will be lost.

The difference between the seeding rate and the plant population is called the mortality rate. Mortality rates differ significantly and depend on equipment adjustment, planting depth and speed, soil type and drainage, seedbed conditions, seeding rate, planter type (row unit or drill), planting date and row spacing. Seed quality and germination rates, weather, pathogens and insects will also influence plant population.



Table 1. Soybean plant density related to row spacing and average number of plants per foot of row.

Plants per acre	Row spacing (inches)				
	30	20	15	10	7
75,000	4.3	2.9	2.2	1.5	1.0
100,000	5.8	3.6	2.9	2.0	1.4
125,000	7.2	4.8	3.6	2.4	1.7
150,000	8.6	5.7	4.3	2.9	2.0
175,000	10.1	6.7	5.1	3.3	2.3
200,000	11.5	7.7	5.7	3.8	2.7

Summary

A final population of 100,000 uniformly spaced plants per acre is recommended for fields throughout Iowa. Many factors affect the relationship between seeding rate and final stand, including the accuracy of the planting equipment, seed quality, weed management programs and the producer's management skills. Fortunately, establishing precise plant populations is not critical because the soybean plant readily adapts to a thinner stand.

On average, producers can achieve 4.5 bu./acre more yield by planting soybean in 15 inch vs. 30 inch row spacing across all seeding rates. A 5 to 10 percent improvement in stand can be achieved with a fungicide seed treatment regardless of seeding rate, and 10 to 20 percent improvement in stand can be gained when using a fungicide/insecticide seed treatment combination. Fungicide/ insecticide seed treatment combinations can increase yield significantly if a field has a high population of bean leaf beetles.

For more information about soybean management, go to www.soybeanmanagement.info.

IOWA STATE UNIVERSITY University Extension

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Many materials can be made available in alternative formats for ADA clients. To file a complaint of discrimination, write USDA, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call 202-720-5964.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Jack M. Payne, director, Cooperative Extension Service, Iowa State University of Science and Technology, Ames, Iowa.