Trial Type: Management
Growing Season: 2023-2025

Project Objective: Study on plant populations with the objectives of (1) characterize optimum seeding rates in soybeans at the field scale level, and (2) gain insight into which soil and crop attributes explain yield response to seeding.

Project Insights:

1. The most profitable seeding rates based on current sale price and seed costs are 110K and 80K.
2. Planting a target rate of 80K seeds/ac yielded statistically less than higher target seeding rates. However, that yield loss was rarely large enough to offset the additional seed cost.
3. At current prices, choosing the optimal seeding rate for your field showed an average increase in profit per acre of $14.55.
4. For replanting, consider that at the lowest target rate of 80K, the average V2 stand count was 68,000 plants per acre, and yield was comparable to our higher planting rates.
5. Planting equipment frequently under-seeded at 170K target seeding rates.

Economic Analysis

An analysis of the most economical seeding rates at varying seed costs and sale prices is seen below (Figure 1). The analysis was performed on all 52 trials for 2023-2025. Average yield values for the years were used as the baseline yield values when calculating the most economical planting rate. The rates that are most economical at current prices are 110K and 80K. Even though these rates yielded lower on average, the losses in yield are not great enough to overcome the additional costs of seed when planting at rates of 140K and 170K. Profitability wise, to justify planting at least 140K, sale prices would need to increase to at least $15 and seed costs would need to decrease to at least $50.

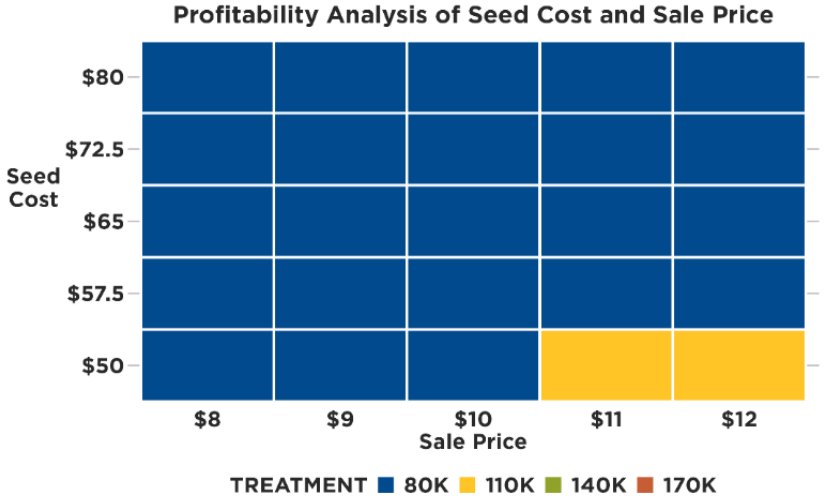

Figure 1 This matrix displays the most economical seeding rates at varying sale prices and varying seed costs. Estimates of economic outcomes were based upon the average yields for each seeding rate for 2023-2025. Seed cost is based upon a rate of 140,000 seeds/unit.

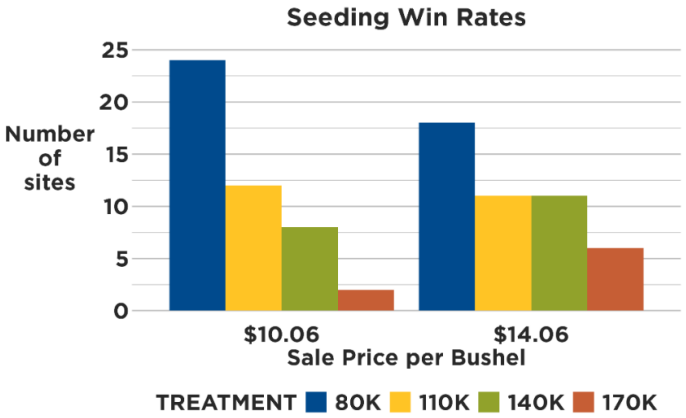

Figure 2 Total number of sites where each rate was the most economical. The 2025 sale price of $10.06 and the 2023 sale price of $14.06 were used as recent years price examples. A price of $65 per 140,000 seeds was used for seed costs.

To further explore the economics of seeding rate for these trials, the graph above displays the number of locations where each rate was the most profitable (Figure 2). If sale price is increased, the 110K and 140K rates become more competitive economically with 80K, but the 80K rate still wins at a majority of locations. The 170K rate rarely wins due to the minimal yield increase observed at the rate and the increased cost of seed compared to the other rates. There are some instances where the rates other than 80K win but those instances are harder to come by and less likely to occur.

Project Results

Below is a map of the distribution of where trials were located across the state (Figure 3). From 2023-2025, 52 trial locations were successfully implemented.

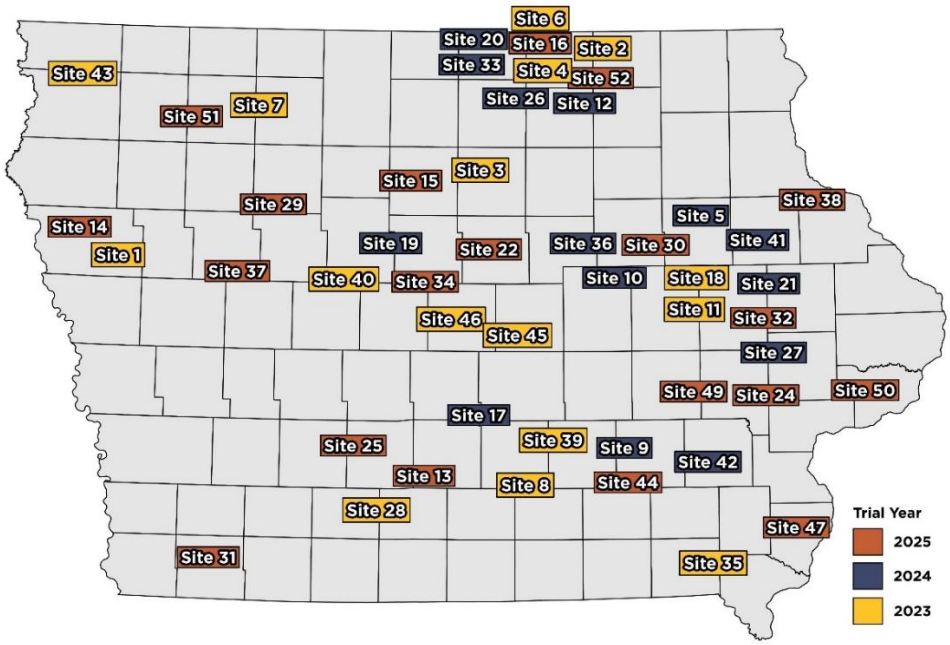

Figure 3 Trial locations for 2023, 2024, and 2025.

The following graph shows the yield response for all 52 trials from 2023-2025 (Figure 4). In the combined analysis, planting 80K seeds per acre yielded significantly less when compared to all other seeding rates.

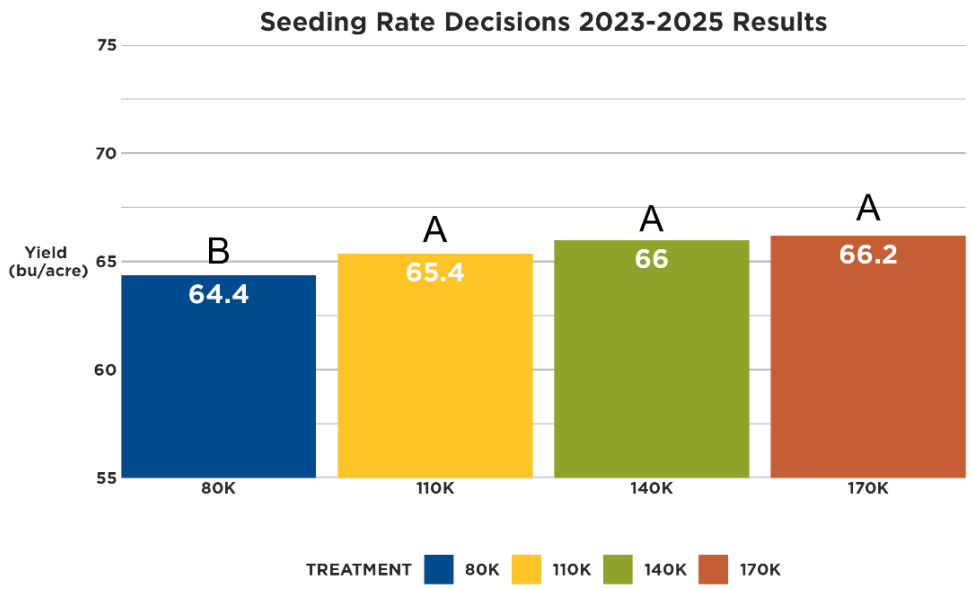

Figure 4 Yield results from the 52 trial sites in 2023-2025. Letters indicate yield groups. Different letters between two treatments indicate statistical significance difference between yields.

Planting Timing and Row Width

Planting timing and row width have varying impacts on soybean yield in our trial results. Planting soybeans in April compared to May provided a bump in yield (Figure 5). Seeding rate does not have a large impact on yield differences for either month. Higher seeding rates showed a small yield advantage in both months. Planting earlier, regardless of seeding rate, showed a yield advantage.

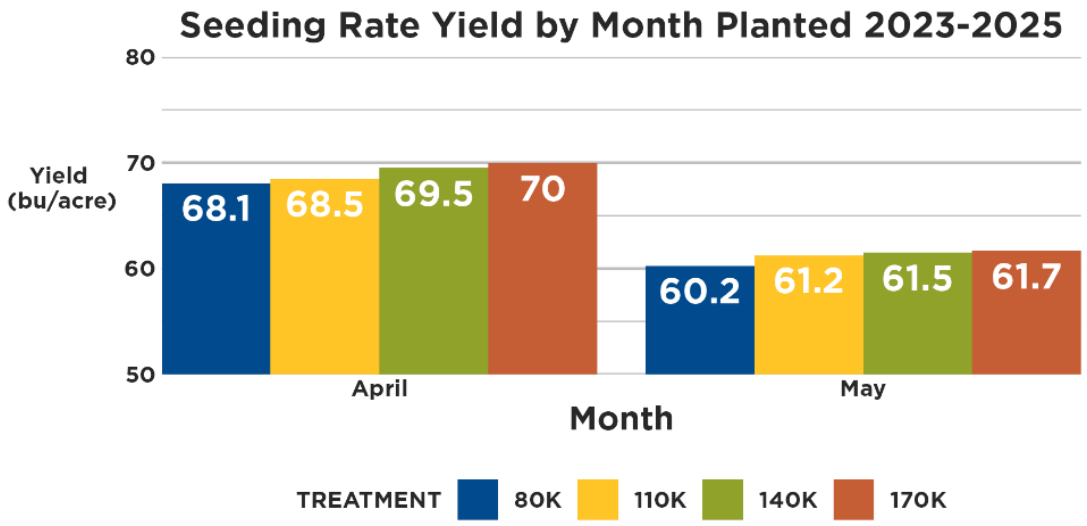

Figure 5 Comparison of seeding rate yield by month the trial was planted. No statistically significant differences were observed between treatment yields.

Comparing 15-inch row width soybeans to 30-inch row width showed small differences in yield (Figure 6). Planting at a 30-inch row width resulted in yield that progressively increased with higher seeding rates. The yield difference observed between 80K and 170K for 30-inch rows was statistically significant. All other treatment comparisons for the 30-inch rows were not statistically significant. Yield differences for the 15-inch rows were not statistically significant and were more consistent between seeding rates than the 30-inch rows. The difference between the highest yielding 15-inch treatment (140K) and the lowest yielding 15-inch treatment (80K) was only 1.3 bu/acre. Higher planting rates were more crucial to higher yield in the 30-inch rows than in the 15-inch rows.

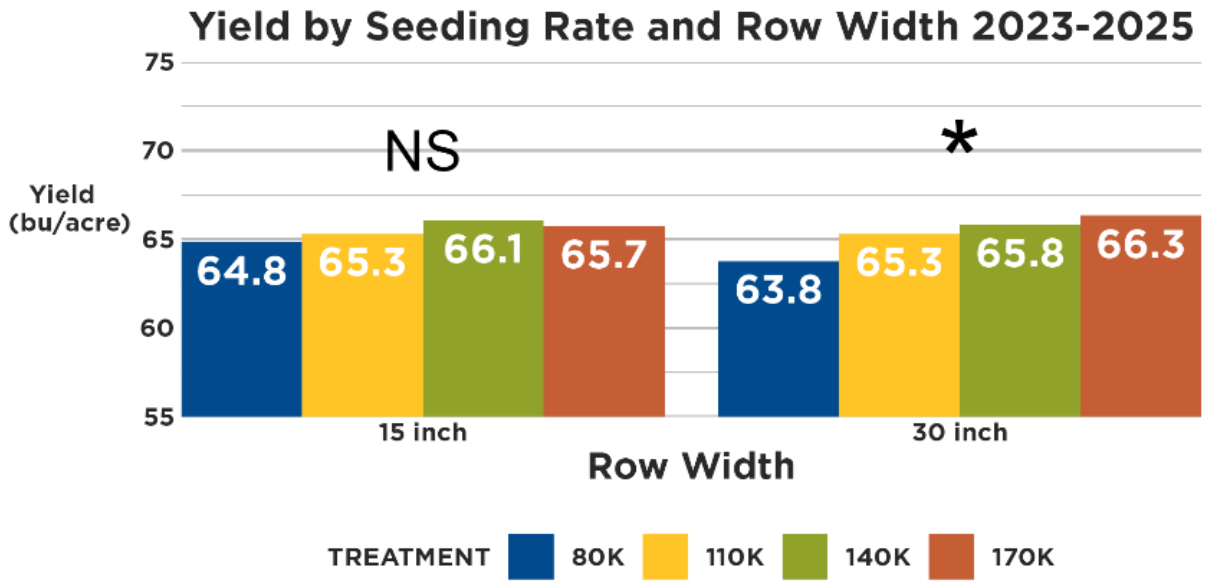

*Figure 6 Comparison of seeding rate yield by row width. NS indicates no statistical significance between treatments and * indicates statistical significance.*

Planter Performance

Target seeding rates compared with the actual planted rates are seen below (Figure 7). Applied seeding rates were averaged and then subtracted by the target seeding rate at that location. Negative values indicate instances of under seeding, and positive values indicate over seeding. During this research trial, planter performance was the most accurate at lower seeding rates, and there was significant under seeding occurring at the highest rate of 170k per acre. We did not observe any significant difference between the planting performance when considering 15-inch row spacing versus 30-inch row spacing. If planting at higher rates, it is recommended to reduce your speed to plant at the desired rate.

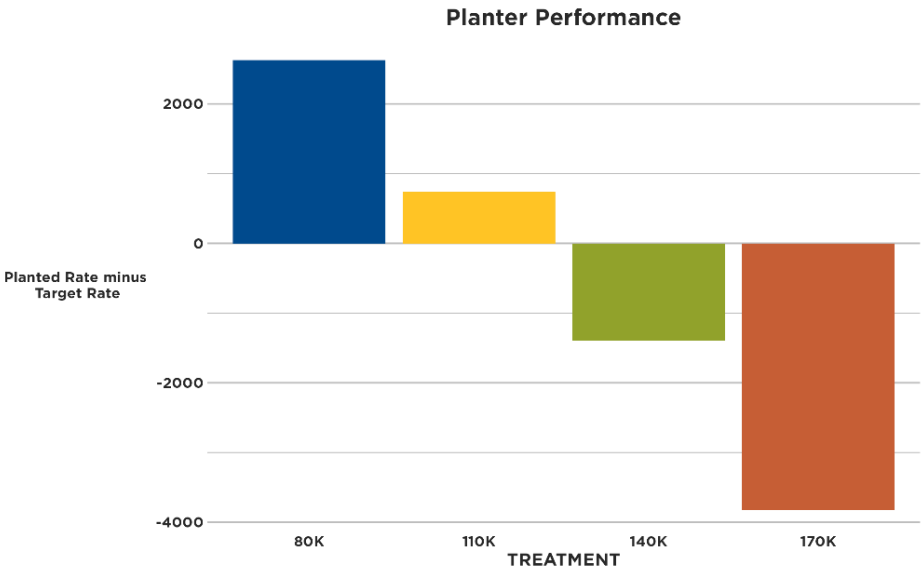

Figure 7 Comparison of planting equipment performance at each seeding rate. At higher rates of seeding planting equipment tended to under seed as compared to the lower rates.

The results comparing stand count populations with target seeding rates are seen below (Figure 8). Stand counts were collected early in the growing season in each treatment pass. Assuming a 90% germination rate of 80K, 110K, 140K, and 170K, we would have expected stand counts of 72K, 99K, 126K, and 153K plants per acre. As target seeding rates increased, the difference between the target rate and stand count increased. A good example of this is that at the 80K target rate, the average stand count was 68,151 plants per acre, and at the 170K target rate, the average stand count was 134,983 plants per acre. These differences were likely influenced by the planting equipment keeping pace at the lower seeding rates compared to at the higher seeding rates.

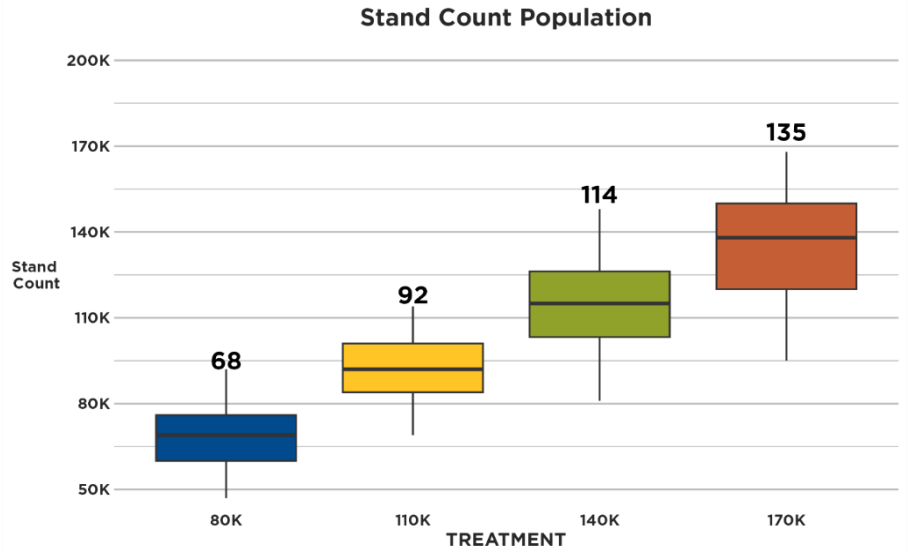

Figure 8 Comparison of stand count population at each seeding rate. The higher the rate of seeding the greater the difference between the target seeding rate and the stand count population. Stand count population (y-axis) is expressed as population/1000. Mean values are labeled above each target rate.