Trial Type: Management
Growing Season: 2023

Project Objective: Project on plant populations to understand the optimum seeding rates in soybeans to maximize yield and return on investment.

Seeding Rate Decision Insights:

1. Across 23 locations in 2023, planting a target rate of 110,000 seeds/ac (110K), 140,000 seeds/ac (140K) or 170,000 seed/ac (170K) all produced statistically similar yield results, while the 80,000 seeds/ac (80k) yielded consistently significantly less.
2. The greatest return on investment between these 4 treatments based on the seed cost were the treatments with 110K or 140K.
3. In these trials there was evidence to suggest a seeding rate of 80K caused a loss in yield and the lowest return on investment when compared to 110K, 140K and 170K.
4. Planting equipment frequently under-seeded on average at seeding rates of 140K and 170K.

Yield Response and Partial Economic Return

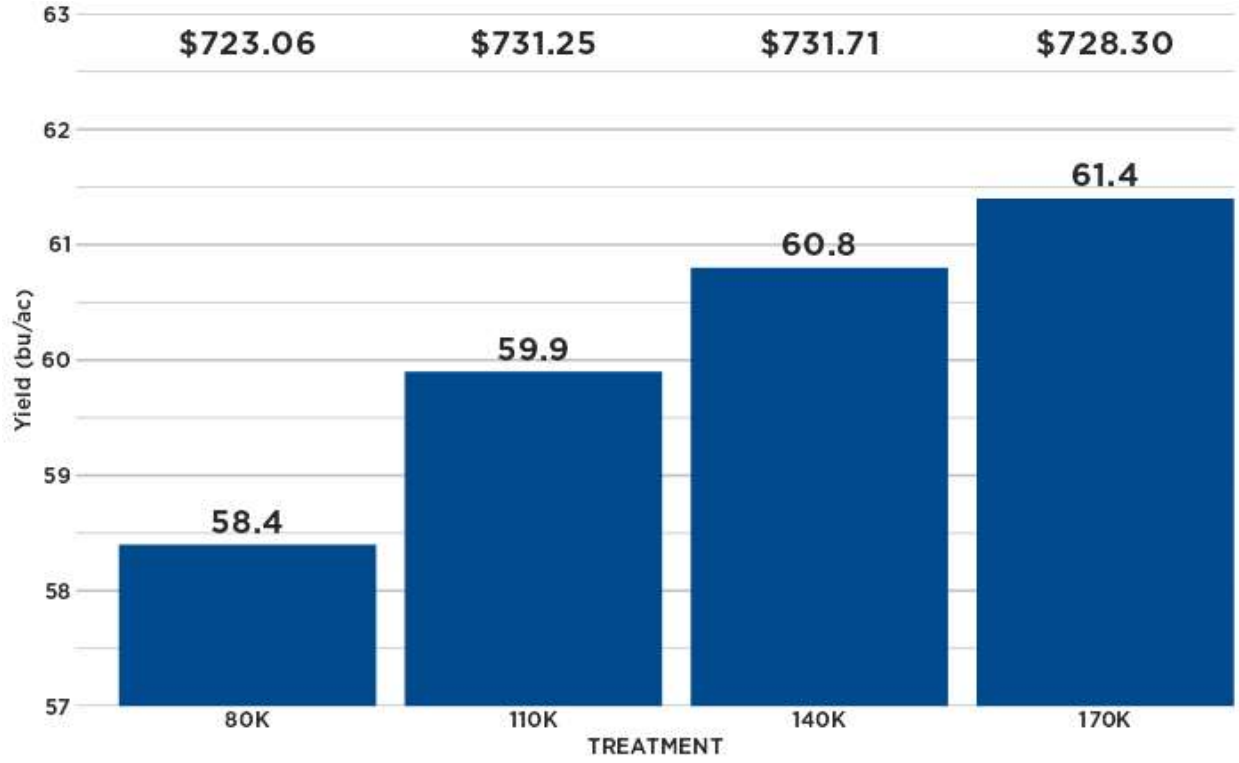

Figure 1. Yield response by seeding rate and the estimated partial economic return based on average yield. Estimated partial economic return was calculated by taking gross revenue – seed cost per acre. Returns per acre are shown in the top portion of figure 1.

The 2023 results showed no statistically significant differences in yield across 23 locations between the seeding rates of 170K, 140K, and 110K seeds per acre. The seeding rate of 80K seeds per acre did show a statistically negative significant difference in yield from the other three targeted seeding rates. Based on a

sale price of $12.89 per bushel and a cost of $52 per 140,000 seeds, we found that 140K had the greatest return on investment for farmers but only by $0.46 per acre over 110K (Figure 1).

Trial Distribution and Yield Response

Below is a map of the distribution of where trials were located across the state (Figure 2). We subdivided the results into four geographic clusters based on similar soil types, topography, and weather.

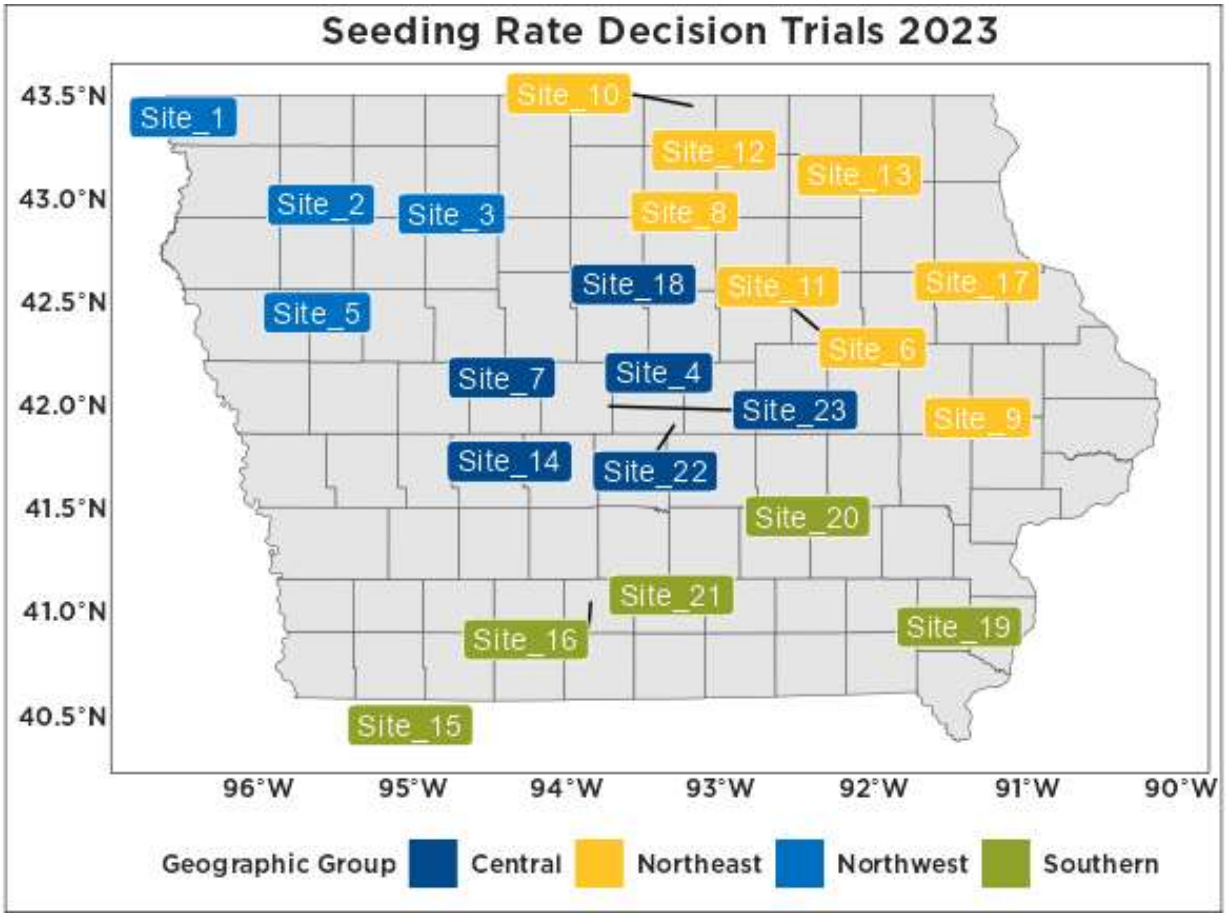

Figure 2. Site locations in 2023. Sites were grouped according to similar geographic areas and similar landforms.

The following graphs show the yield response for each trial (Figures 3,4,5, and 6). Trials with an "NS" indicate that there was no statistically significant difference in the observed yield at a given location. Trials noted with an "*" showed at least one treatment was statistically different from other treatments. While individual site analysis can be helpful, the reliability of treatment response will be greater when multiple locations and years of data are combined.

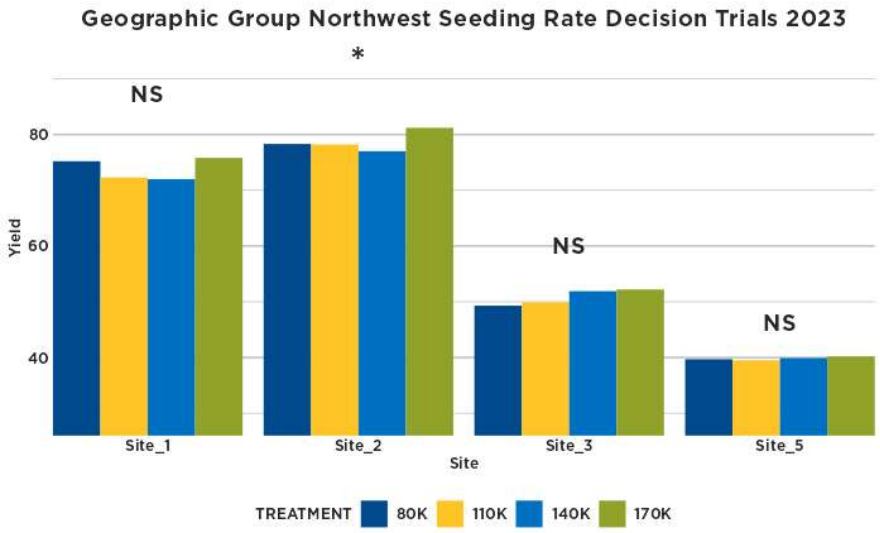

Figure 3. Geographic group Northwest yield results. Sites not statistically significant are indicated by "NS", sites marked with * represent a significant response.

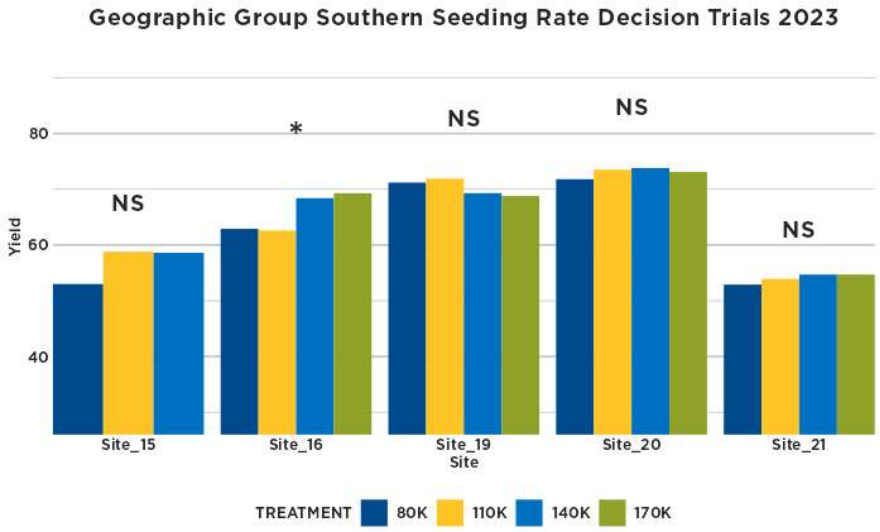

*Figure 4. Geographic group Southern yield results. Sites not statistically significant are indicated by "NS", sites marked with * represent a significant response.*

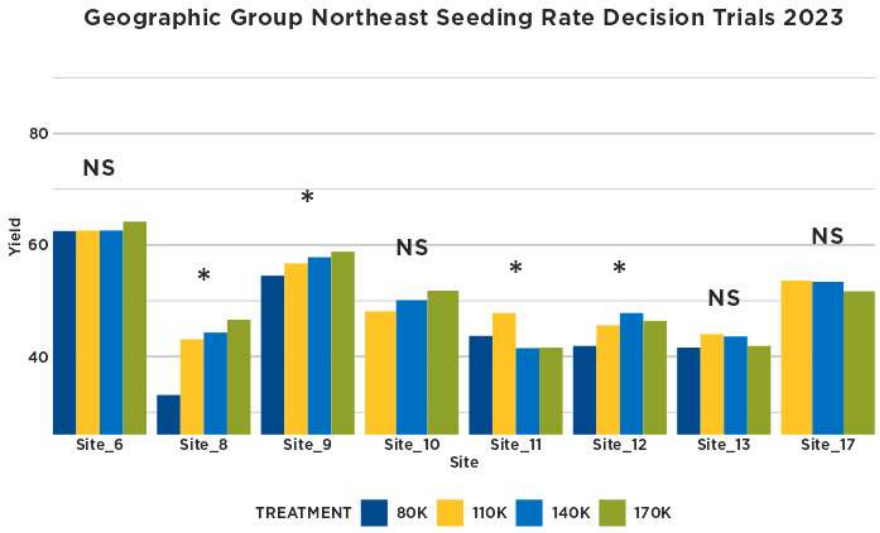

*Figure 5 Geographic group Central yield results. Sites not statistically significant are indicated by "NS", sites marked with * represent a significant response.*

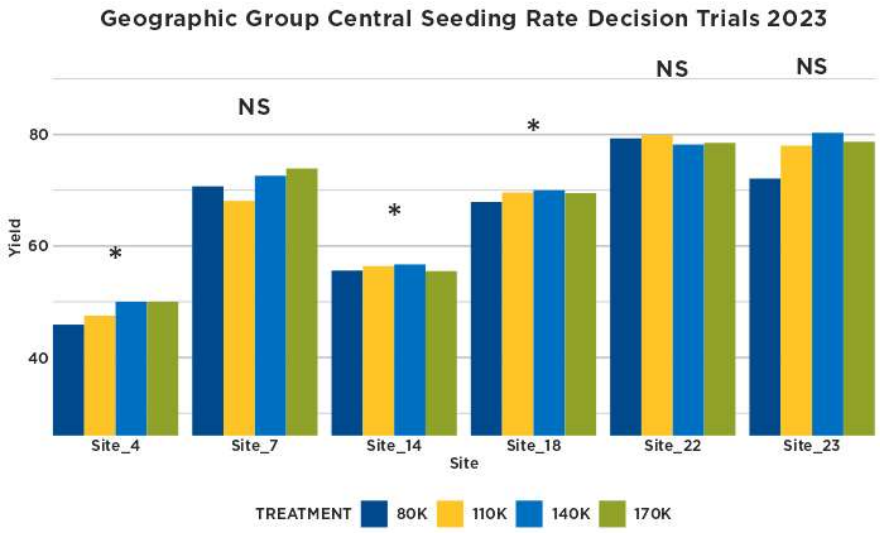

*Figure 6. Geographic group Northeast yield results. Sites not statistically significant are indicated by "NS", sites marked with * represent a significant response.*

Planter Performance

Target seeding rates compared with the as-planted map 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 occurring and positive values indicate over seeding. A value of 0 indicates a planter operating accurately. The lower seeding rates have the highest accuracy in their planting and even have over seeding occurring at the 110K rate; whereas at the higher rates we have under seeding occurring to the point where most values observed at 170K were under seeded.

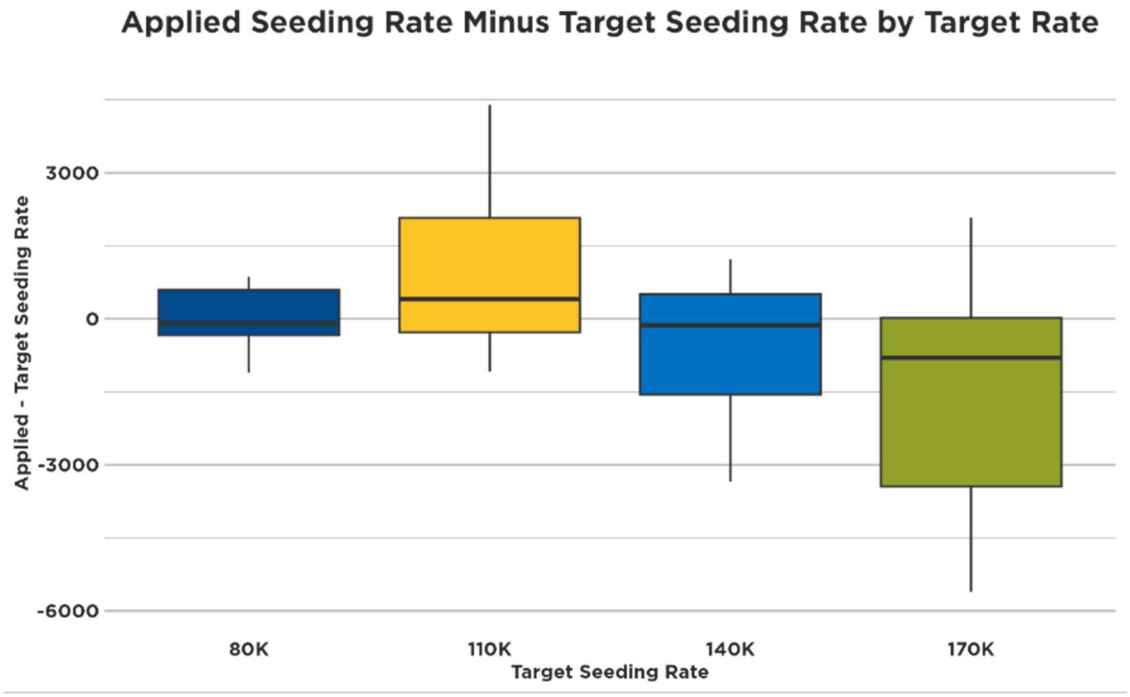

Figure 7. Comparison of planting equipment performance at each seeding rate. At higher rates of seeding planting equipment tended to under seed as compared to the lower rates.

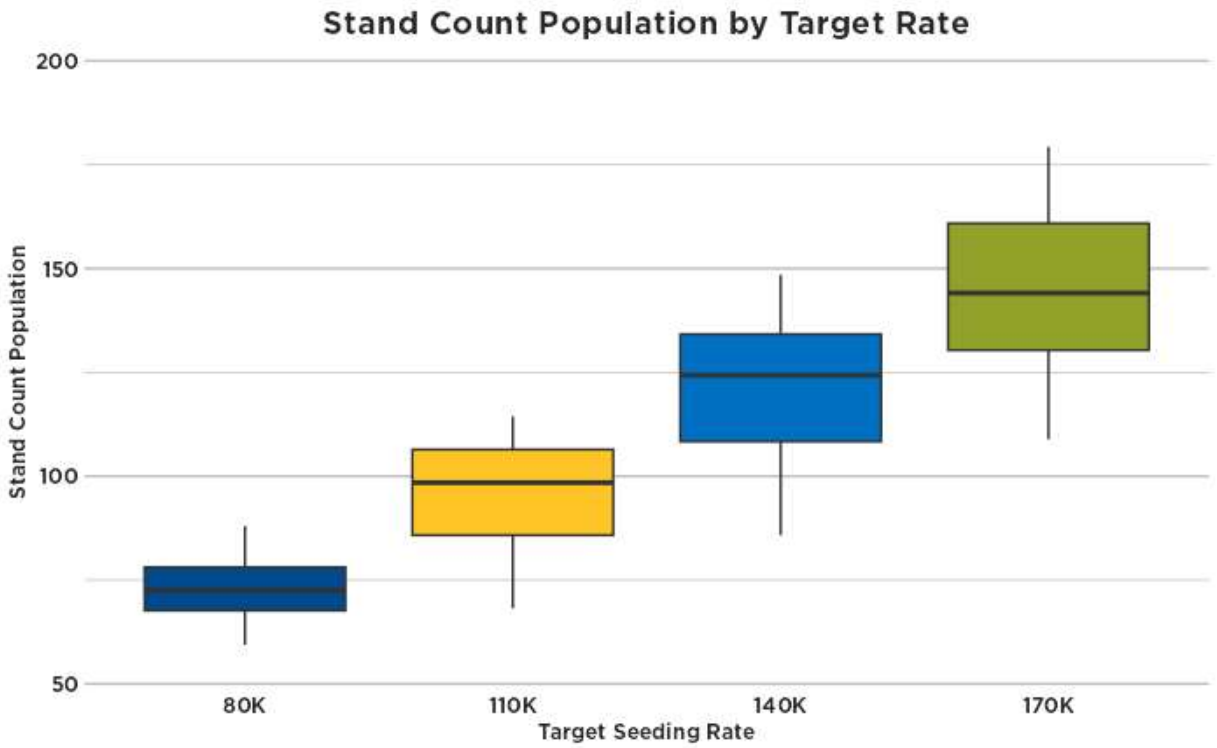

Figure 8. Comparison of stand count population at each seeding rate. The higher the rate of seeding the greater the difference between the target seeding rate and the stand count population. Stand count population (y-axis) is expressed as population/1000.

The results of comparing stand count populations with target seeding rates are seen above (Figure 8). Stand counts were collected at the V2 growth stage in each treatment pass by counting the number of plants in 1/1000th of an acre. Assuming a 90% germination rate 80K, 140K, 140K, and 170K 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 in the fact that the average 80K target rate stand count was ~70,000 and the average 170K target rate stand count was ~140,000. These differences were likely influenced by the planting equipment performing more accurately at the lower seeding rates compared to at the higher seeding rates.