Research on Seeding Rates for Dryland Wheat in Western Kansas

K-State agronomists conducted a study from 2014 through 2018 at Garden City, Tribune, and Colby to evaluate wheat yield response to different varieties and seeding rates and address these questions:

- Are K-State seeding recommendations appropriate for current varieties?
- Is there a need for variety specific seeding rates (other than adjusting for seeds per lb)?
- How region-specific should seeding rate recommendations be?

Popular varieties representing a range of tillering potential were selected and seeding rates were selected to represent the range of rates. Four wheat varieties (TAM111 in 2016 and 2017, TAM114 in 2017 and 2018, Byrd, T158, and Winterhawk) were seeded at five seeding rates (30, 45, 60, 75, and 90 lbs/ac) at Garden City, Tribune, and Colby into no-till or reduced-till fallow in a wheat-sorghum-fallow rotation. Data were collected from 960 individual plots across 14 site-years throughout the study. The 2014 study was preliminary, subsequently we chose to evaluate a wider range of seeding rates. For the purposes of evaluating seeding rate response curves, only data from 2015-2018 is reported in this article.

Interactions of variety and seeding rate were examined. Varieties responded similarly to seeding rates in 12 of the 14 site-years. As expected, variety selection is important as it significantly affected grain yield in all 14 site-years. Similarly, yields responded to changes in seeding rate in 13 of 14 site-years (over a wide range of seeding rates, we would typically expect a yield response). However, optimal seeding rate depended on the variety used in only two site-years. These two years had untreated stripe rust and higher seeding rates of the stripe rust-susceptible varieties were able to partially compensate for the effects of the rust, resulting in different yield responses to seeding rate. Therefore, in a majority of the site-years, varieties responded similarly to seeding rates.

Effect of Location

While location affected the overall yield level, with yields increasing in the order of Garden City < Tribune < Colby, location did not affect the overall yield response to seeding rate. As shown in Figure 1, the seeding rate response curve is similarly shaped for all locations when averaged across years and varieties.

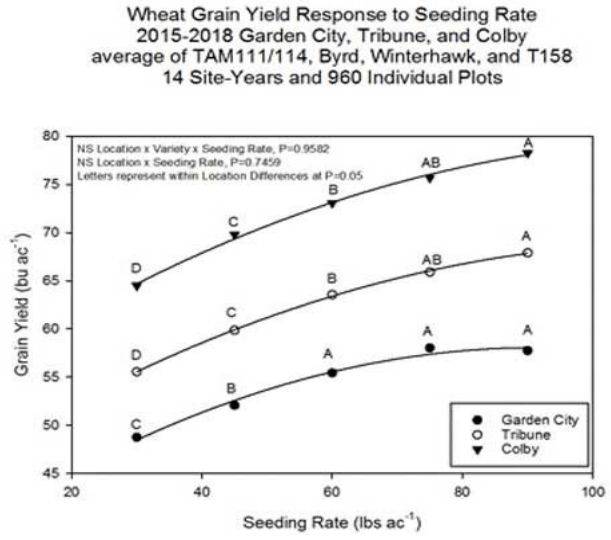

Figure 1. Seeding rate response by location.

In Figure 1, data points within a location that have the same letter are not statistically different. For example, at Garden City there was no difference between the 60, 75, or 90 lb/ac rates, while all three of those rates were higher yielding than the 45 lb/ac rate, which was higher yielding than the 30 lb/ac rate. At Tribune and Colby, there was no significant difference in grain yield between the 60 and 75 lb/ac rates, however the 90 lb/ac rate was significantly higher than the 60 lb/ac rate. With location and variety selection not playing a significant role in optimal seeding rate, all data were then combined for the overall response to seeding rate (Figure 2.)

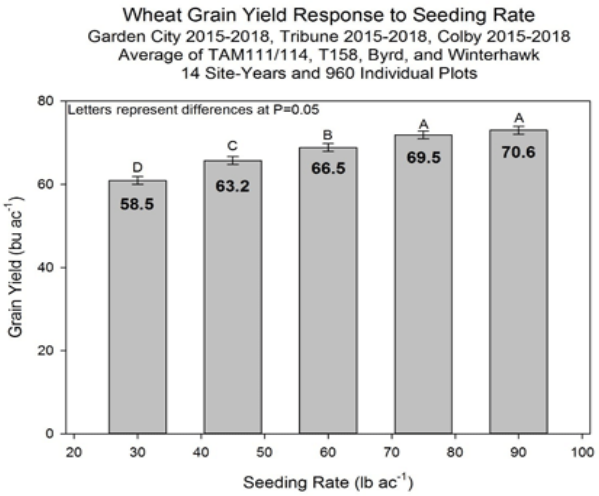

Figure 2. Effect of seeding rate on grain yield, averaged across varieties and site-years.

When the response to seeding rate was evaluated (Figure 2), grain yield significantly increased with increasing seeding rate up through the 75 lb/ac seeding rate. Yield between the 90 and 75 lb/ac rate were not significantly different. When translated into a seeds/ac basis, these seeding rates would have been 452,000, 678,000, 903,000, 1.13 million, and 1.36 million on average.

Important points to keep in mind

- This study was conducted on a lb/acre basis. However, range in seed size was modest (an average seed size of 15,056 +/- 19%) when compared to the differences between seeding rates. Conducting the study on a seeds/ac basis would not have significantly changed the shape of the overall seeding rate response curve.
- Fields used in this study are managed to be non-fertility limiting, however they are not excessive in fertility. Fields with excessive soil test phosphorus levels will likely result in additional fall tillers and thus satisfactory performance might be obtained from seeding rates lower than what these results suggest are optimal.
- Due to dry seeding conditions experienced during the study, seed was often dusted in, or planting was delayed until a rain. Therefore, emergence was often later than what would be obtained from planting on the optimal planting date into good moisture. Previous work by K-State in Colby has shown the importance of increasing seeding rates as planting is delayed, due to reduced opportunity for tillering. This may be why the distinction between the 60 and 75 lb/ac or the 90 lb/ac rate is not clear cut.

Key Results

- The data collected is not supportive of variety-specific seeding rates (other than adjusting for seeds/lb).
- The seeding rate response curve was similar across varieties and locations for three sites in western Kansas.
- Across all site-years, 75 lb/ac (an average of 1.13 million seeds/ac) was sufficient to maximize grain yields. When broken down by location, 60 lb/ac (an average of 903,000 seeds/acre) was sufficient to maximize grain yields at Garden City, while at Tribune and Colby the optimal rate appears to lie near 75 lb/ac (approximately 1.13. million seeds/ac).