Seeding Rates for Spring Cereals

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Choosing an appropriate seeding rate is important, as seeding rate impacts cost of production and yield. A dense, uniform plant stand can enhance weed competition, increase yield potential, and compensate for lost plants due to insects, frost, and disease.

Table 1. Recommended target plant stands for spring wheat, oat, and barley.

Crop	Target plant stand (pl/ft^2)
Spring wheat	23-28
Oat	18-23
Barley	22-25

Research was conducted at the Crop Diversification centres in Arborg, Carberry, Melita, and Roblin in 2017 and 2018 to determine if target plant populations need to be adjusted for newer high yielding cultivars of spring wheat, oat, and barley. Two cultivars of each crop were planted to achieve target plant populations of 15, 21, 27, 33, and 39 plants/ft^2. The cultivars planted were AAC Brandon and Prosper (spring wheat), CS Camden and Summit (oat), and AAC Synergy and CDC Austenson (barley).

The results from this study suggest that the current recommended target plant populations for wheat, barley, and oat are sufficient. At the wheat sites, there was a general trend of higher yields with increased plant stand (Figure 1); however, there were no significant differences in yields between target plant stands of 21-39 plants/ft^2 at four of the five sites. At Melita 2017, the target plant stand of 33 plants/ft^2 yielded significantly higher than 21 plants/f^{t2}, but there were no significant yield differences between the highest three target plant stands (Figure 1).

Oat yields did not significantly differ across the range of plant stands studied (Figure 2). At the barley sites, there was no significant yield difference between plant stands at four of the five sites; however, at Roblin in 2019 barley planted at the highest seeding rate had a significantly lower yield (Figure 3).

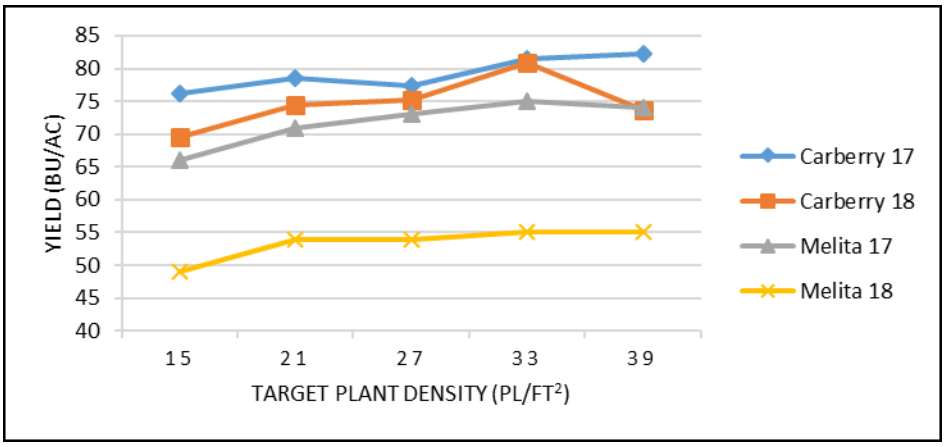

Figure 1. Yield by target plant density for spring wheat.

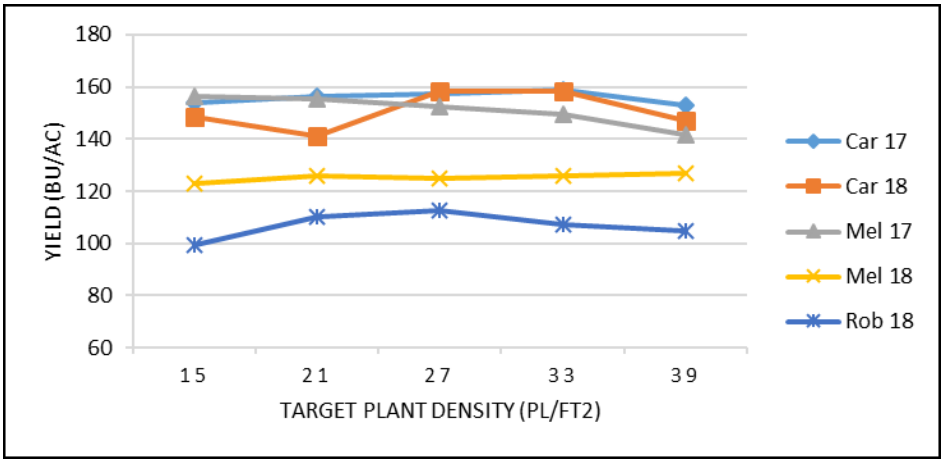

Figure 2. Yield by target plant density for oat.

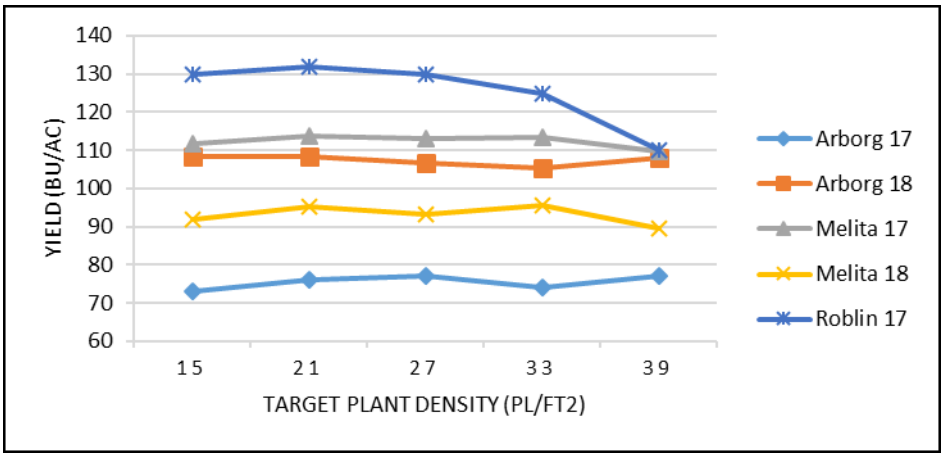

Figure 3. Yield by target plant density for barley.

Research conducted in North Dakota found that optimum seeding rates depend on the cultivar planted and the growing environment. Mehring et al. (2016) found that optimum seeding rate for spring wheat ranged from 14 to 46 plants/ft^2, depending on the capacity for tillering. Varieties that tiller well require lower seeding rates than those that do not. This study also found that seeding rates could be slightly reduced in higher yielding environments (Mehring et al. 2016). Stanley (2019), found that seeding rates above 29 seeds/ft^2 did not increase yield, although optimum seeding rate depends on cultivar and environment.

Calculating Seeding Rates

Use the formula below to calculate seeding rate. Knowing your target plant stand, the thousand kernel weight of your seed, germination and mortality rates is important to accurately calculate seeding rate in pounds/acre.

$$\textbf{Seed Rate (lb/ac)} = \frac{\textbf{Target plant stand/ft}^2 \textbf{ x 1000 kernel weight (g)}}{\textbf{Expected seedling survival* x 10}}$$

*Includes percent germination and seedling mortality

Wheat seeding rate example:

Target plant stand = 28 plants/ft^2
1000 kernel weight = 39 g
Germination = 99%
Assumed mortality = 15%
Expected seedling survival = (.99 x (1-.15)) = 0.8415

$$\text{Seed Rate (lb/ac)} = \frac{28/\text{ft}^2 \text{ x } 39 \text{ g}}{0.8415 \text{ x } 10} = 130 \text{ lb/acre}$$

How is seedling mortality determined?

Seedling mortality is the percent of viable seed that will germinate but will not produce a plant. Seedling mortality can vary greatly, and for cereals can range from 5 – 20%. A seedling mortality rate of 5 – 10% is often assumed, but adjustments should be made depending on soil moisture and temperature, residue cover, amount of seed-placed fertilizer, seeding depth, seeding date, and disease and insect pressure.

The cereal seeding rate research conducted at the Diversification Centres found that seedling mortality increased at higher seeding rates. This result is in line with wheat seeding rate research conducted by Grant Mehring at North Dakota State University, where he found 3% mortality at the lowest seeding rate up to 21% at the highest seeding rate. This research

suggests using a seedling mortality of 10 – 20%, even under good seedbed conditions (Mehring 2015).

Seedling mortality depends on environmental conditions and management practices of individual farms. Producers should keep track of emergence in their fields each year, this information will help with future mortality estimates and seeding rate calculations.

References:

Mehring, G., Wiersma, J., and Ransom, J. 2015. Determining optimum seeding rates for diverse hard red spring wheat varieties. Manitoba Agronomists Conference 2015. Available online: https://umanitoba.ca/faculties/afs/agronomists_conf/media/9_Dec_17_PM_Mehring_15_MAC_Seeding_Rate.pdf

Mehring, G., Wiersma, J., and Ransom, J. 2016. What do the results from the recent seeding rate studies suggest for new spring wheat varieties? NSDU Crop and Pest Report. Available online: https://www.ag.ndsu.edu/cpr/plant-science/what-do-the-results-from-recent-seeding-rate-studies-suggest-for-new-spring-wheat-varieties-05-05-16

Stanely, J. 2019. Optimal seeding rates for new hard red spring wheat cultivars in diverse environments. PhD Thesis Dissertation, North Dakota State University. Fargo, North Dakota.