Plant Spatial Arrangement to Maximize Spring Wheat Yield in Manitoba

Samantha Clemis[1], Rob Gulden[1]
[1]Department of Plant Science, University of Manitoba, Winnipeg Manitoba Canada
clemiss3@myumanitoba.ca

Introduction

- Spring wheat (*Triticum aestivum* L.) is seeded to almost one-third of the crop acreage annually in Manitoba (MASC 2019)
- Planting at ideal densities for specific row spacings will allow spring wheat to capture and utilize above and below ground resources most effectively (Chen et al. 2008)
- Accelerating earlier ground cover can maximize solar interception for yield and suppress weed growth (Fahad et al. 2015)
- Information on the spatial arrangement of modern wheat cultivars for maximum productivity is lacking

Objectives

- Determine the combinations of plant density and row spacing in two modern spring wheat cultivars that maximize seed yield
- Determine if the previous stubble type affects the spatial arrangement and yield relationship

Materials and Methods

- Trials located at Carman, Howden, and Portage la Prairie
- Statistical design: Factorial RCBD (4 reps)
- 2 cultivars: AAC Brandon and Cardale
- 4 densities: 200, 300, 400, and 500 plants m^{-2}
- 3 row spacings: 9.5 cm (3.75”), 19 cm (7”), and 38 cm (15”)
- 2 stubble types: Canola, soybean
- Data Collection (2019-2020): Emergence, ground cover digital image analysis, plant heights, headcounts, biomass, yield, harvest index, TKW, protein

References

- Chen C, Neill K, Wichman D, Westcott M. 2008. Hard red spring wheat responses to row spacing, seeding rate, and nitrogen. Agron. J. 100: 1296-1302.
- Fahad S, Hussain S, Chauhan BS, Saud S, Wu C, Hassan S, Tanveer M, Huang, J. 2015. Weed growth and crop yield loss in wheat as influenced by row spacing and weed emergence times. J. Crop Prot. 71: 101-108.
- Manitoba Agricultural Services Corporation (2019)

Results

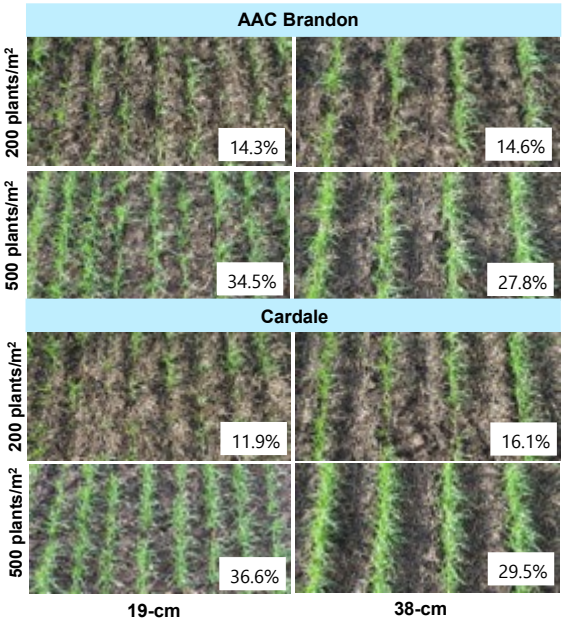

Figure 1. Percent ground cover of AAC Brandon and Cardale wheat (2 tillers + 4 leaves) seeded at two densities (200 and 500 plants/m^2) and two row spacings (19 and 38 cm).

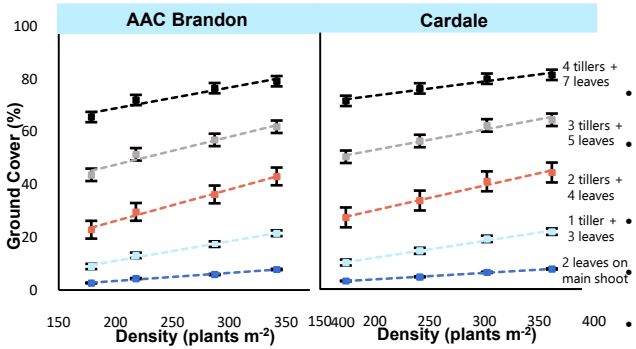

Figure 2. Mean ground cover (%) of AAC Brandon and Cardale wheat cultivars seeded in 19 cm rows during 5 different growth stages across mean actual plant densities among all site years.

Table 1. Yield-stability analysis of AAC Brandon and Cardale wheat over 5 environments.

		AAC Brandon			
		Soybean		Canola	
Row Width (cm)	Seeding Rate (seeds/m^2)	Mean Yield (g/12m^2)	Rank*	Mean Yield (g/12m^2)	Rank*
9.5	200	3496	6	3309	9
	300	3528	9	3302	6
	400	3430	9	**3312**	**10**
	500	3282	7	3240	8
19	200	3497	8	3307	8
	300	**3574**	**10**	3289	5
	400	3493	6	3302	7
	500	3400	4	3273	4
38	200	2992	1	2750	0
	300	**2869**	**-1**	2765	1
	400	2993	2	**2745**	**-1**
	500	**2855**	**-2**	**2684**	**-2**
		Cardale			
9.5	200	3404	5	3168	3
	300	**3418**	**10**	3281	7
	400	3436	7	3240	5
	500	3216	3	3060	8
19	200	**3578**	**10**	3254	6
	300	3578	9	**3374**	**10**
	400	**3457**	**12**	3341	9
	500	3362	8	3281	8
38	200	2996	0	2688	0
	300	3006	1	**2608**	**-2**
	400	3138	6	2709	1
	500	**2927**	**-1**	**2654**	**-1**

* Based on mean yield and adjusted for variation around mean yield among all 5 locations. The higher the ranking the greater the yield-stability.

Preliminary Key Findings

- Increasing plant densities resulted in more rapid ground cover, but not always greater seed yield
- Row spacing was the most consistent management factor affecting seed yield. Narrower rows consistently resulted in greater yield (up to 19.6%) compared with 38 cm (15”) rows.
- Seeding rate/row-spacing combinations that provided the greatest yield stability differed between cultivars and stubble types in 2019 and 2020
- When different, wheat cultivars produced greater seed yields when grown on soybean stubble
- AAC Brandon had greater individual seed weights (TSW). No other differences in yield components were apparent between the wheat cultivars in 2019 and 2020.
- More environments will be added to strengthen these conclusions.