WHEAT

MANITOBA CROP ALLIANCE

MAXIMIZING SPRING WHEAT PRODUCTIVITY: YIELD, YIELD COMPONENTS AND LODGING RISK

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KEY POINTS

- Split nitrogen (N) application maintained yield, reduced lodging risk and increased protein content compared to other high-rate N fertilization strategies.
- Spikes per plant and kernels per spike had the greatest relationship to grain yield.
- To achieve consistent increases in yield, management practices should maximize early season N availability to increase spikes per plant and kernels per spike, which may require the use of a plant growth regulator (PGR) to balance the increased lodging risk.

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BACKGROUND

- Spring wheat yields in the Canadian prairies are increasing, but a gap remains between the yields being achieved and the yield potential of our current varieties.
- Different agronomic management practices influence grain yield through different yield components (plant density, spikes per plant, kernels per spike, kernel weight).
- The objective of this study was to determine the influence of agronomic management practices such as N fertilization and PGR application on grain yield, yield components and lodging risk.

MATERIALS AND METHODS

- Field experiments were carried out in Carman and Manitou, MB, in 2018 and 2019.
- Evaluated three spring wheat cultivars, five N management strategies and the application of a PGR (Table 1).

Cultivar			
	Wheat Class[†]	*Lodging Rating*	
AAC Brandon	CWRS	VG	
AAC Cameron	CWRS	G	
Prosper	CNHR	G	
N Management			
	Total N Rate	*App. Timing*	N Source
Check	0		
Reduced Rate	70 lb N acre^{-1}	Seeding	Urea
Standard	140 lb N acre^{-1}	Seeding	Urea
ESN Blend	100 + 40 lb N acre^{-1}	Seeding	ESN + Urea
Split App.	70 + 70 lb N acre^{-1}	Seeding + Flag Leaf	Urea + SuperU™
PGR			
	Product	*App. Timing*	*Rate*
Untreated			
Treated	Manipulator™	Stem Elongation[§]	0.7 L acre^{-1}

Table 1. List of treatments included in split-split plot experiment with a main plot of cultivar, sub-plot of N management and sub-sub plot of the application of the PGR chlormequat chloride.

[†] Canadian wheat classification. CWRS: Canadian Western Red Spring, CNHR: Canadian Northern Hard Red.
[§] Zadoks growth stage 31, first node detectable and 1 cm above tillering node.

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RESULTS

- Environmental conditions during the growing season are the largest determinant of grain yield.
- Cultivar and PGR application also affected yield, while there was no difference in yield between the N management strategies where N fertilizer was applied (Figure 1).
- The yield components spikes per plant and kernels per spike had the strongest relationship to grain yield.
- Withholding a portion of N fertilizer until flag leaf through split N application did not limit yield, but did increase grain protein content (Figure 2).
- Lodging pressure was low during this study. However, across cultivars, split N application had the most potential to reduce lodging when high N rates were applied (Figure 3). PGR application also reduced lodging when high N rates were applied.

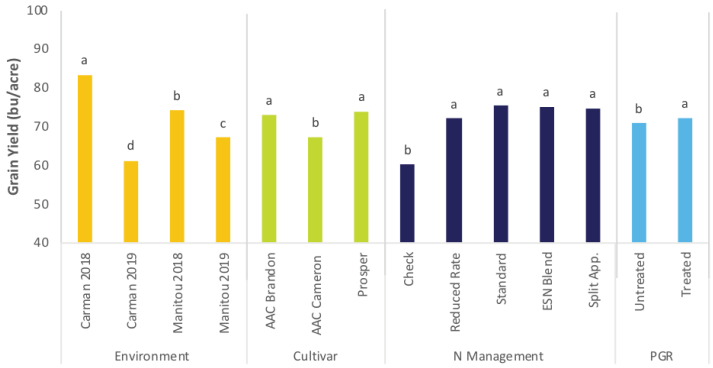

Figure 1: Mean grain yield for environments, cultivars, N management strategies (Check = 0 lb N/ac, Reduced rate = 70 lb N/ac urea, Standard = 140 lb N/ac urea, ESN blend = 100 lb N/ac ESN with 40 lb N/ac urea, Split app = 70 lb N/ac urea with 70 lb N/ac SuperU™) and application of the PGR chlormequat chloride (Manipulator™). Means with the same letter are not significantly different.

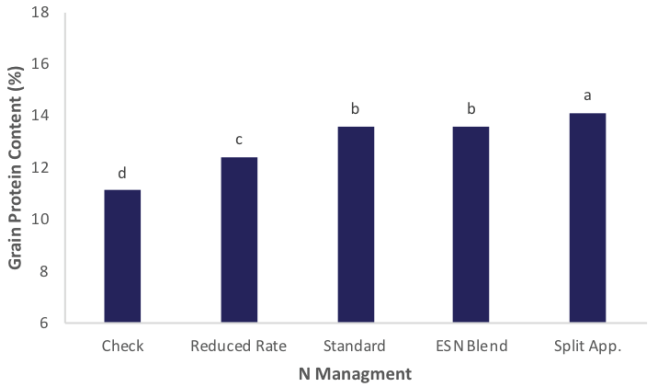

Figure 2: Mean grain protein content for N management strategies (Check = 0 lb N/ac, Reduced rate = 70 lb N/ac urea, Standard = 140 lb N/ac urea, ESN blend = 100 lb N/ac ESN with 40 lb N/ac urea, Split app = 70 lb N/ac urea with 70 lb N/ac SuperU™) and application of the PGR chlormequat chloride (Manipulator™). Means with the same letter are not significantly different.

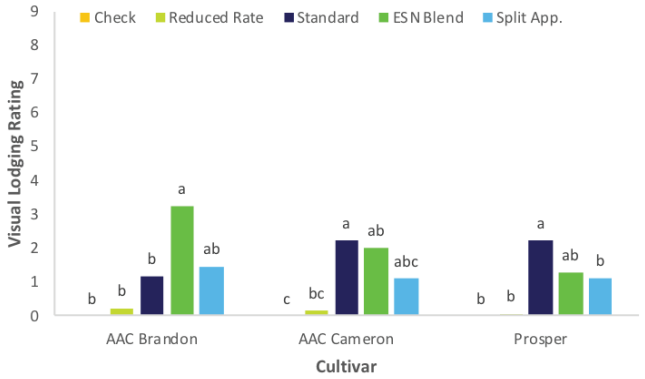

Figure 3: Means for the interaction of nitrogen (N) management strategies (Check = 0 lb N/ac, Reduced rate = 70 lb N/ac urea, Standard = 140 lb N/ac urea, ESN blend = 100 lb N/ac ESN with 40 lb N/ac urea, Split app = 70 lb N/ac urea with 70 lb N/ac SuperU™) with cultivar for visual lodging ratings (1-9 scale; 1 erect, 9 flat) at Manitou in 2019. Within each cultivar, means with the same letter are not significantly different. (Note: dry conditions during this study resulted in low lodging pressure. Lodging occurred only at low levels, and only at the Manitou site in 2019).

LEARN MORE

This project also studied grain protein and nitrogen use efficiency. For more information, view our factsheet titled "Maximizing spring wheat productivity: Grain nitrogen, grain protein and nitrogen use."

This research has been published in a peer-reviewed journal, available here: Mangin, A., A. Brule-Babel, D.N. Flaten, J.J. Wiersma, and Y.E. Lawley. 2022. Maximizing spring wheat productivity in the eastern Canadian Prairies I. Yield, yield components, and lodging risk. Agron. J. doi: 10.1002/AGJ2.21044.
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