Nitrogen Management in Winter Wheat

This project was initiated to demonstrate winter wheat response to different nitrogen (N) management strategies and a wide range of rates. A field trial with winter wheat was conducted in 2018-2019 and repeated the following two seasons (2019-2020 and 2020-2021) at Indian Head in the thin-Black soil zone of southeast SK. The treatments were a factorial combination of three N timing/placement strategies (100% sideband; 100% early-spring broadcast; 50:50 split-application) and five N rates (60, 90, 120, 150, and 180 kg N/ha) plus a control where no supplemental N was applied. The N rates included residual soil NO_3-N. The N source/form was untreated urea. While the N form was not varied in this demonstration and enhanced efficiency N products can be a good fit with winter cereals, urea is the dominant N source in western Canada and an appropriate choice to demonstrate fundamental differences amongst the timing/placement options.

Winter wheat yields were optimized with 120-150 kg N/ha (soil plus fertilizer) with quadratic responses detected in all three years and the strongest overall response observed in 2019-2020, which was also the season where the highest yields were achieved (Figure 1). Grain protein also responded to N rate but continued increasing at higher N rates compared to yield and, in some cases, the response was linear. Regarding timing/placement effects, environmental conditions were not particularly conducive to leaching or denitrification losses of fall-applied N, and timely spring precipitation limited the potential volatile losses while increasing availability of the early-spring broadcast N. As such, all the N timing/placement options performed reasonably well. In two of three seasons and when averaged over the three-year period, there were no significant differences between timing/placement methods for either yield or protein when averaged across rates. The exception was in 2019-2020 where yields were highest with side-banded N but protein was higher with spring broadcast N (Table 1). Results with the split-applications were intermediate when differences occurred but were more similar to the fall side-band applications. This suggests that actual losses were not necessarily higher with the spring applied N; however, the availability shifted later into the growing season at the expense of yield but in favor of protein synthesis. While all three timing/placement strategies performed reasonably well under the conditions encountered, split-applications provide added flexibility and can buffer against both fall/early-spring N losses and early-spring N deficiencies.

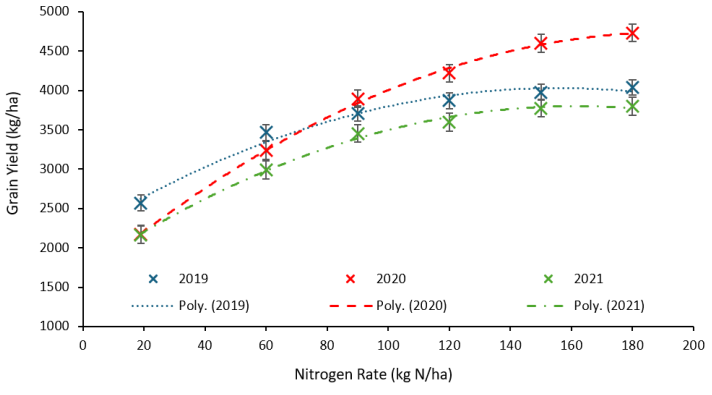

Figure 1. Winter wheat yield response to N rate at Indian Head in 2019, 2020, and 2021. Error bars are the standard error of the treatment means.

Table 1. Main effect means for average N timing/placement effects on winter wheat yield and grain protein. Means within a column followed by the same letter do not significantly differ.

Treatment	2018-2019	2019-2020	2020-2021	Average
	Grain Yield (kg/ha)			
Control	2570	2171	2166	2302
Side-Banded	3817 a	4287 a	3492 a	3865 A
Spr. Broadcast	3793 a	3952 c	3605 a	3783 A
50:50 Split App.	3825 a	4171 b	3472 a	3823 A
	Grain Protein (%)			
Control	10.4	9.9	10.6	10.3
Side-Banded	12.6 a	11.2 c	12.1 a	12.0 B
Spr. Broadcast	12.9 a	11.7 a	11.8 a	12.2 A
50:50 Split App.	12.8 a	11.4 b	11.9 a	12.0 B

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