4R N Management in Spring Wheat

Developing Best Management Practices (BMPs) for nutrient applications has long been focused on the 4R principles which refer to using the: 1) right source, 2) right rate, 3) right timing and 4) right placement method. These factors are not necessarily independent of each other. For example, depending on the source, application timing or placement options that might normally be considered high risk can become more viable. The objective of this trial was to demonstrate the overall nitrogen (N) rate response along with the feasibility of various N management strategies using spring wheat as a test crop.

A field trial was established near Indian Head in the fall of 2018 to demonstrate spring wheat response to a range of N fertilizer rates and contrasting management strategies. Nitrogen rates were adjusted for residual nitrate and ranged from 39-219 kg N/ha (soil plus fertilizer). Seven N fertility levels were evaluated and, for this aspect of the trial, all N was side-banded urea. Yields were optimized at approximately 156 kg N/ha and peaked at 3813 kg/ha, 46% higher than the control which yielded 2594 kg N/ha (Figure 1). Grain protein increased with N rates up to 188 kg N/ha, peaking at 16.1% compared to the 11.5% in control. Although both NDVI and leaf chlorophyll (SPAD) values increased with N fertilization, they did not predict the magnitude of response as the values peaked at substantially lower N rates than either yield or protein.

Focusing on N management strategies, four N sources (untreated urea, ESN®, Agrotain®, and SuperU®) were either side-banded or broadcast (without incorporation) in the fall or early-spring. For all response variables (NDVI, SPAD, yield, and grain protein), there was a significant overall advantage to side-banding over the broadcast applications. Differences between fall versus spring broadcast applications were somewhat inconsistent with NDVI suggesting an early-season advantage to the fall applications, but the protein responses showed a greater advantage to the spring application timing. The only variable affected by N source was NDVI where an interaction suggested slightly lower values with ESN when left on the surface and a subtle advantage to fall broadcast SuperU® over the other formulations when applied in the same manner. Neither yield nor protein were affected by N source and there were no interactions with the timing/placement options suggesting that the relative performance of the difference sources was consistent regardless of how the N was managed.

The results of field trials such as this can vary widely depending on the environmental conditions encountered. While side- or mid-row banding of N generally provides consistent results across a broad range of conditions, enhanced efficiency fertilizer formulations are still recognized as a way to mitigate the risks associated with less optimal timing/placement options.

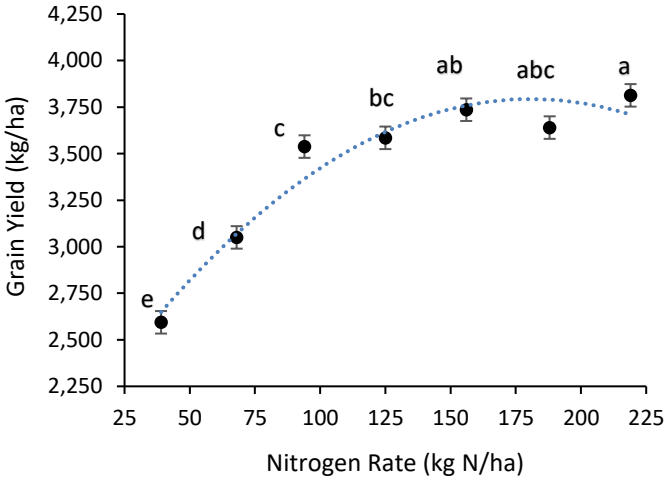

Figure 1. Nitrogen fertilizer rate effects on wheat grain yield at Indian Head (2019). Nitrogen rates are residual soil NO_3-N plus fertilizer and the primary N source was side-banded urea. Error bars are S.E.M.

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