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Enhancing CWRS wheat through EEFs and N rates

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On Dark Brown soils, the use of a dual-inhibitor EEF resulted in increased grain yield and delivered improved net return benefit compared to urea. Other EEF sources tested yielded similarly in the Dark Brown soils. However, in the Black and Grey soils, the EEFs tested did not have a significant impact on grain yield, while protein concentration remained unaffected. A rate of 107 lbs/ac (120 kg N/ha) when coupled with EEFs, particularly a dual-inhibitor, was optimal for CWRS wheat grown under Prairie conditions.

Grain yield and protein concentration in Canadian Western Red Spring (CWRS) wheat is greatly influenced by appropriate nitrogen (N) fertility management. Granular urea fertilizer is an option; however nitrogen losses can be a challenge under certain conditions, reducing N availability for plant uptake. Nitrogen losses reduce plant growth, grain yield and protein formation. One method of addressing N losses is the use of enhanced efficiency fertilizers (EEFs) that help to mitigate losses and optimize plant uptake of applied N.

To determine the benefits of EEFs in grain yield and quality in CWRS wheat, field experiments were conducted from 2019 to 2022 across 8 sites in Alberta and Saskatchewan. The sites were located across Dark Brown, Black or Grey soils near Beaverlodge, Barrhead, Edmonton, Vermillion and Lethbridge, Alberta, and Indian Head and Scott, Saskatchewan.

The objectives of the study were to determine if the yield components of CWRS wheat can benefit from various EEFs compared to urea. Another objective was to investigate the N requirements of a modern high-yielding CWRS wheat cultivar to optimize both grain yield and protein concentration. Finally, the study provided recommendations for optimizing fertilizer management practices to enhance CWRS wheat productivity while meeting the quality requirements of the market.

The field experiments compared the effects of five N sources and four N rates. The N sources included:
i) urea;
ii) urea + urease inhibitor, N-(n- butyl) thiophosphoric triamide (NBPT) (Agrotain);
iii) urea + nitrification inhibitor, Nitrapyrin (eNtrench);
iv) urea + dual- inhibitor, NBPT + Dicyandiamide (SuperU); and
v) polymer-coated urea, ESN (Environmentally Smart Nitrogen).

The rates of N compared were 53, 107, 160, 214 lbs N/ac (60, 120, 180, and 240 kg N/ha). All fertilizer was applied either mid-row or side-banded at planting. The high-yielding CWRS variety 'AAC Viewfield' was selected for the experiments.

Dual-inhibitor improved yields and net returns in Dark Brown soils

The study results indicated that N source affected grain yield in Dark Brown soils only, but not in the Black or Grey soils. The dual inhibitor increased grain yield by 3.1% compared to urea, and 3.9% compared to polymer-coated urea, while all other EEFs had similar yield results in Dark Brown soils.

Compared to urea and polymer-coated urea, a dual-inhibitor EEF resulted in greater net returns in the Dark Brown soils, while other EEFs yielded similar results. The greatest grain yield, grain N uptake, total N uptake and agronomic efficiency were achieved with the dual-inhibitor EEF, while the polymer-coated urea resulted in the lowest measures. The net returns from the dual-inhibitor was $25.10/ac ($62/ha) higher than urea in the Dark Brown soils, while urease increased net return by $11.33/ac ($28/ha), and nitrification inhibitor increased net return by $8.10/ac ($20/ha) compared to urea. Polymer coated urea had the lowest net return at $13.77/ac ($34/ha) lower than urea.

However, in the Black and Grey soils, different EEFs did not have a significant impact on grain yield, while protein concentration remained unaffected regardless of soil type. In addition, in the Black and Grey soils, the source of N was less impactful on most grain yield, quality, and N use efficiency variables.

Generally, an N rate of 107 lbs/ac when coupled with EEFs, particularly a dual-inhibitor, was optimal for CWRS wheat grown in prairie conditions. An N rate of 107 lbs/ac applied at seeding as a side- or mid-row band optimized grain yield and net returns relative to the other N rates in the study. Protein concentration was also enhanced, increasing linearly with increasing N rate from 53 to 214 lbs N/ac, enabling growers to attain higher pricing premiums.

Overall, the study results demonstrate that when applied in side- or mid-row bands, the use of EEFs does not pose any limitations to modern high-yielding CWRS production or grain quality, even in scenarios where there is limited N loss as net returns at a minimum appear to offset input costs. Although urea continues to be a valid option for growers, including an EEF in conjunction with proper N rates can help optimize CWRS production in western Canada by enhancing grain yield and net returns while meeting the quality requirements of the market.

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