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Enhanced N Management Strategies for Winter Wheat Production in the Canadian Prairies

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Introduction

This project was designed to enhance integrated nutrient management systems for winter wheat (*Triticum aestivum* L.). Multiple forms of controlled release urea (CRU) are available to producers; however, additional information is lacking regarding changes to CRU efficacy when timing and placement of nitrogen (N) is modified to suit specific N management strategies in winter wheat systems. The objectives of this study were to 1) identify fertilizer management practices that maintain yield and improve protein content to increase the frequency of achieving Select grade of high yielding winter wheat, and 2) determine if N management practices would differ to optimize yield and starch characteristics in soft white winter wheat for use as an ethanol feedstock.

Materials and methods

Experiments were established in 2008 at six sites across the Canadian prairies.

Treatments:

A. Varieties: Sown into canola stubble using no-till air drill (Fig. 1)
   a) AC Radiant (CWRW – milling quality Select variety);
   b) CDC Ptarmigan (General Purpose Soft white winter wheat – Ethanol feedstock)

B. N Form: (rates based on 80% of soil test recommendation)

   1) uncoated urea (46-0-0), 2) Agrotain®, 3) SuperU®, 4) Environmentally Smart Nitrogen® (ESN), Urea Ammonium Nitrate (UAN).

C. N Timing/Placement: 1) 1x sidebanded at seeding, 2) 1x broadcast in early spring, 3)1/2x sideband:1/2x broadcast in spring (air boom; Fig. 1).

A combined mixed model analysis was performed using SAS® version 9.2 (treatment effects fixed; rep, env. and their interactions random).

Fig. 1. Seeding, fertilizing and data collection at study site in Lethbridge, AB.

Results and discussion

- Aside from UAN in all scenarios, and ESN® and uncoated urea when all N was applied in spring, all other forms produced similar results across the timing/placement scenarios.
- Agrotain® and SuperU®, regardless of placement/timing scenario, produced high grain yield and acceptable protein; however, the results did not differ from several other systems involving uncoated urea or ESN® (Fig. 2).
- Radiant produced less grain but utilized applied N more efficiently than CDC Ptarmigan, which was more efficient at scavenging to recover soil nitrogen (Fig. 3a).
- Nitrogen uptake tended to be greatest in spring broadcast or split-application situations, using Agrotain® or Super U®. Those results did not differ from uncoated urea, but Agrotain® or SuperU® may allow for better N recovery than that observed using ESN® (Fig. 3b).

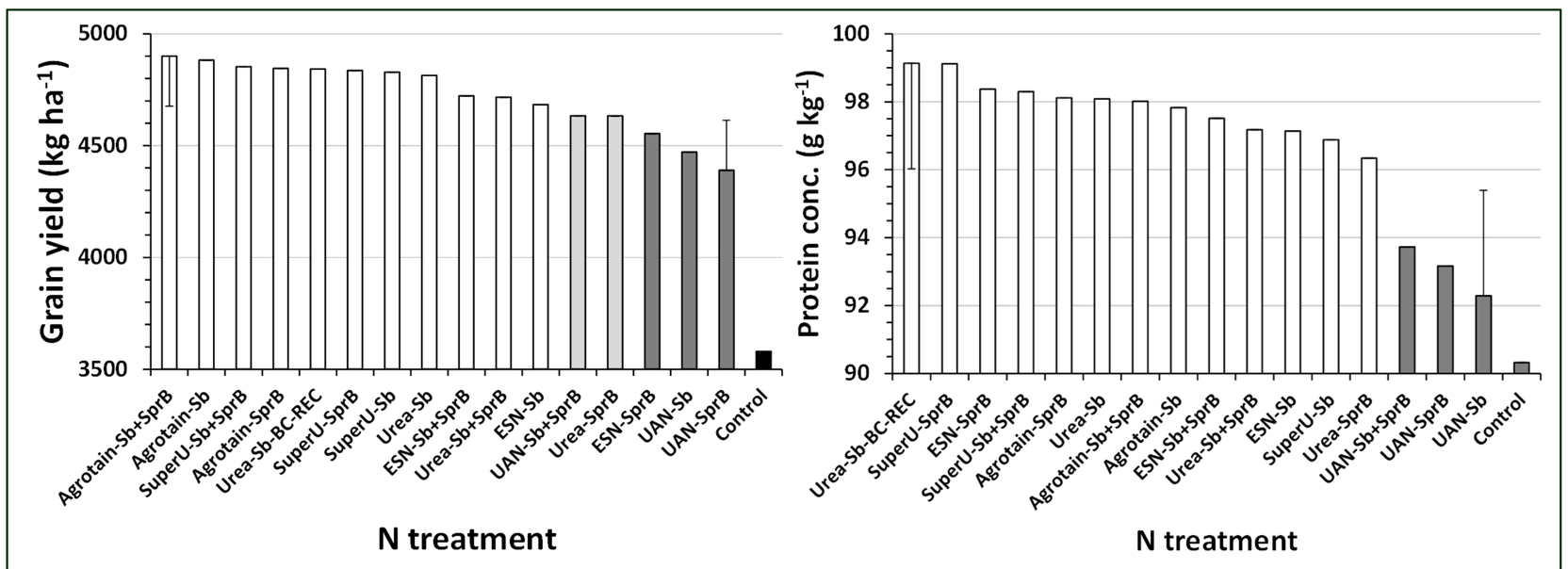

Fig. 2. Grain yield and protein response of winter wheat to N fertilizer form, timing, and placement scenarios. Abbreviations: Sb+SprB, 50% of N sidebanded + 50% broadcast in early spring (SprB); Sb, 100% of N sidebanded at seeding; SprB, 100% of N broadcast with air boom in early spring. Shade of bars represent significantly different values ($LSD_{0.05}$).

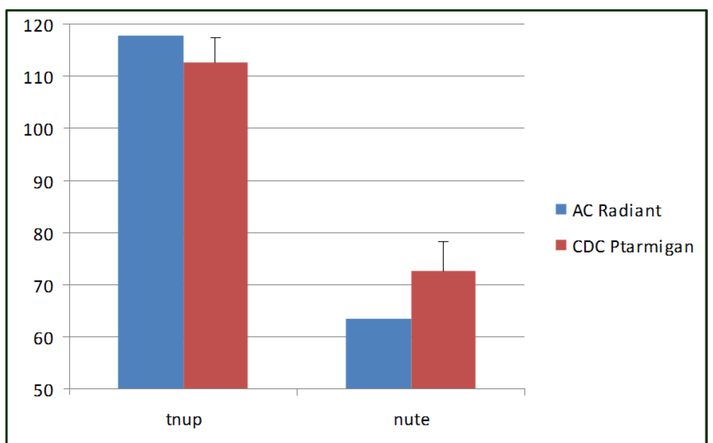

Fig. 3a. Comparison of total nitrogen uptake (tnup) vs. total nitrogen utilization (nute) between soft white winter wheat (CDC Ptarmigan) and hard red winter wheat (AC Radiant) cultivars.

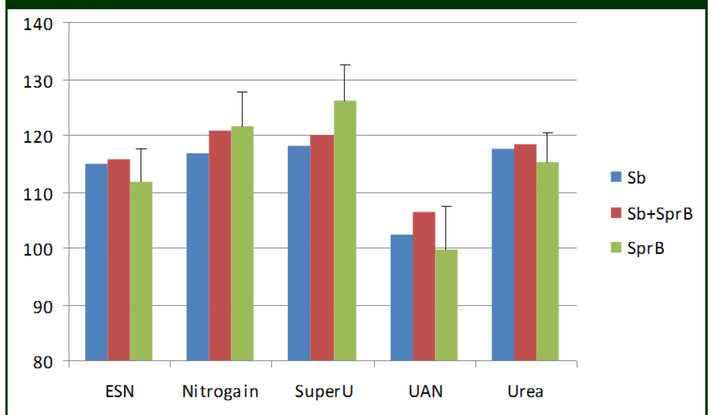

Fig. 3b. Comparison of total nitrogen uptake between nitrogen forms in three placement scenarios. Nitrogain = Agrotain.

Conclusions

- Split applications or sidebanding all product produced similar grain yield. However, greater nitrogen recovery may occur when splitting applications or applying most N in spring, particularly with Agrotain® or SuperU®.
- ESN® yield and protein varied and was at times lower than the other forms, which suggests release was too slow for the northern Great Plains (NGP). It is best utilized in NGP seed-placed systems or otherwise blended with uncoated urea (Beres et al. 2010; 2012).

References

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Acknowledgements

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