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Polymer-Coated Urea

Feasibility and Considerations

Background

Most prairie soils are deficient in plant-available nitrogen (N). Therefore N-fertilizer application is necessary to optimize crop yield. However, the N-use efficiency (NUE) from applied fertilizers is usually less than 50% in the year of application. Improving NUE is critical to:

- ✓ increase economic returns
- ✓ minimize environmental damage from fertilizer-N moving from the soil to water and air

Urea as a nitrogen source

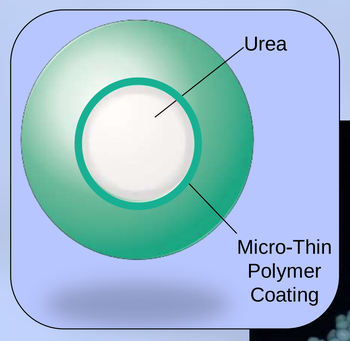
Urea (uncoated) is the most common dry nitrogen (N) fertilizer in Saskatchewan's Parkland Region in large part due to price. One-pass combined seeding and fertilizer application (i.e., direct seeding) allows for placement of seed and fertilizer in the same or separate bands in the soil. The advantage is that subsoil urea fertilizer placement reduces volatilization losses of N and improves fertilizer use efficiency.

Seed-placement of urea is a popular option. However, close proximity of urea to seed can result in seedling damage, reduce seedling emergence (also known as seedling density, stand density, plant density), or reduce yield when applied at rates to satisfy the crop's N-demand for the season.

Polymer-coated urea: what is it?

Polymer-coated urea (PCU) is a urea granule (prill) coated in a flexible, thin, porous polymer membrane or coating. Water passes through the coating to create a urea-water solution. The coating then controls the release rate of the fertilizer solution into the soil. Temperature and soil moisture are the major factors that control the release rate - the same major factors that affect plant growth. In theory, fertilizer release is synchronized to plant needs.

These characteristics improve the NUE by increasing N uptake and reducing accumulation of residual nitrate-N in soil, results in lowering the potential of N leakage to water and air and increases crop yield and produce quality (i.e., economic benefit). PCU can potentially be used to overcome some of the problems observed with seed-placement of conventional (uncoated) urea. But the higher cost of PCU must be offset by economic gains.



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Comparing urea vs. polymer-coated urea

Field trials

The relative performance of using uncoated urea vs. ESN (a PCU product from Agrium Advanced Technologies) to grow canola, wheat and barley was evaluated under field conditions in Star City and Melfort, Saskatchewan. At Star City, the major focus was on application timing (spring, fall, split) and tillage systems (conventional, zero-till). At Melfort, the major focus was fertilizer placement (side-banded, seed-placed). At both sites, N-rate was evaluated. Measured responses at Star City included seed yield and soil N_2O gas emissions. In addition, an economic analysis was conducted to determine if yield gains outweighed the additional cost of using ESN. At Melfort, evaluation was limited to seedling emergence and seed yield.

Selected Findings

- N-rate, regardless of source, plays a large role in seed yield (increasing N → higher yield).
- Fall-banded ESN out-yielded fall-banded urea treatments.
- Spring banded ESN, 50:50 blend and split application out-yielded spring banded urea in 2 of 3 years.
- Fall-applied urea under wet soil conditions lead to greater N_2O gas emissions than spring-applied urea treatments.
- Fall-applied ESN application tended to have reduced N_2O gas emissions over urea application.

! Economic analysis revealed that despite lower yields, applying urea produced net revenue equal to or greater than ESN, 50:50 blend and split applications.

- Seed-placed urea reduced seedling emergence compared to side-banded urea, especially in canola.
- Increasing urea rate in seed-placed application reduced seedling emergence.
- Seed-placed ESN had little to no detrimental effect on seedling emergence
- Seed yield was generally greater with seed-placed ESN than urea at higher N-rates

Conclusions

- When wet, fall soil conditions exist, ESN can be an effective management tool to enhance seed yield and reduce N_2O gas emissions.
- Producers can use ESN to safely increase seed-placed N-rates to maximize yield and reduce the need to split N-application.
- The economic analysis revealed that urea netted the same or higher returns as ESN. Producers need to evaluate cost vs. convenience.
- Since many factors influence yield (e.g., soil texture, row spacing, equipment, crop, etc.), producer should make their own on-farm yield comparisons by applying test strips of urea and PCU.

Additional Information

Read the article **Feasibility of Polymer-Coated Urea (ESN) for Agronomic and Environmental Considerations in the Parkland Region of Saskatchewan,** found on the NARF website: www.neag.ca. Look under *Research Results*.

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