



Controlled Release Fertilizer
 A *smarter* source of nitrogen.
 A *smarter* way to grow.



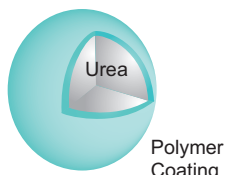
spring wheat

a focus on protein

How the ESN Technology Works

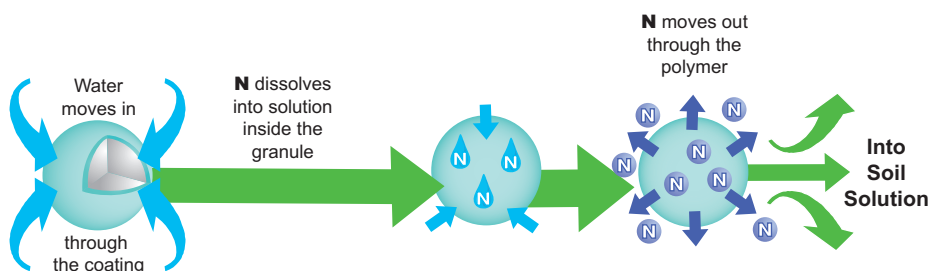
Coated Nitrogen Granules

ESN is a coated nitrogen (N) fertilizer that delivers N to the crop with control and predictability. A flexible, micro-thin polymer coating, over top of the N granule, enables this precision.



Predictable Nitrogen Release

This unique membrane allows water to diffuse into the granule, dissolving the N within. The N liquifies into a solution, yet remains encapsulated within the coating. The N release rate through the coating is governed through soil temperature, which is a major factor in crop growth and nutrient demand. The N solution moves through the membrane in a predictable manner, matching the N demand curve of the crop.



Temperature Controlled Diffusion

ESN Recommendations For Canadian Prairies and Upper Northern Tier States: Cereals

Nitrogen Nutrition of Cereals

Proper N nutrition of cereals is critical to high yields and overall plant health. Nitrogen is essential for vegetative growth and protein synthesis. Nitrogen is a critical component of the photosynthetic factory that converts solar energy to proteins, starches, and oil in the grain. Excess N early can cause excessive vegetative growth and lodging. Excess vegetative growth can also deplete soil moisture leading to greater moisture stress during grain fill. Controlling the rate of N supply with ESN can help increase N-use efficiency by protecting most N from loss until the period of rapid crop uptake. Figure 1 shows the N uptake demand for wheat.

Interactions of weather conditions, timing of N demand, and potential for N loss should be considered in determining the most appropriate ESN application or blend of ESN, for different geographies and uses.

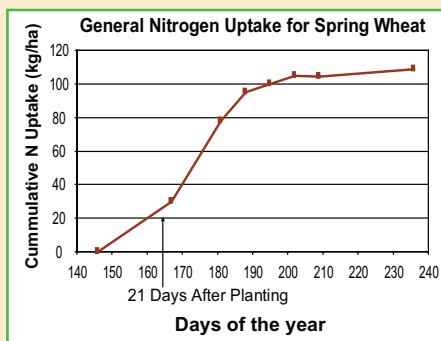


Figure 1. Nitrogen Uptake for Wheat
 Modified from Johnston, 1998

Canadian Prairies and Upper Northern U.S. Tier States

Nitrogen management presents numerous challenges. Crops require relatively high N rates, but most of the N fertilizer is applied in advance of peak crop demand. Precipitation during fall and winter, and especially during early spring, produces potential for N loss by leaching and denitrification. ESN provides greater protection against N loss as compared to conventional N sources.

ESN - A New Nitrogen Technology for Spring Wheat: A Focus on Protein

Application Timing

Fall applied ESN remains partly encapsulated, in the urea form, or in the ammonium N form heading into soil freeze-up. About 35 - 50% of ESN-N can be released over a 60-day time period, as soil temperatures drop from 10°C to 0°C.

For northern geographies, ESN applied by itself, may not release enough N in the time for crop uptake demand. ESN applied at seeding can release about 35 - 50% of its N within the first 25 to 30 days after application. ESN blends well with other granular fertilizers, and blends of ESN with urea and/or ammonium sulphate can be used to "build" a programmed N release to match crop N demand with regional environmental conditions.

Application Rates

ESN is recommended at rates similar to conventional N fertilizers. When applied at normally recommended rates, increased N efficiency with ESN usually results in yield increases over conventional N forms (see ESN Research Summary). Where N efficiency does not limit yields, increased N efficiency may not produce significant yield increases, and greater advantage of ESN may be observed by maintaining yields with reduced N rates.

ESN Influence on Protein

Spring wheat generally shifts from the vegetative to reproductive growth mode during the 3 to 5 leaf (tillering) stage, moving toward stem elongation. Early season available N is used firstly to meet the plant's yield demand/goal – N left over from this requirement, is progressively used for protein production. Applied N, and soil N, firstly satisfy N requirement for crop yield; N that is remaining/made available during the growing season contributes to (increasing) protein.

A large number of field trials conducted across western Canada were used to determine if ESN could maintain crop yields, and increase grain N and N use efficiency compared to the current practice of pre-plant banding of urea N fertilizer (figure 2). This work showed that crop uptake of N from seed-placed ESN was sufficient to provide yields similar to those of pre-plant banded urea N. Urea placed in the seed row significantly reduced plant stand densities as compared to the side-band control; plant stands with seed-placed ESN were not significantly different from side-band applied urea.

Grain N concentrations of the ESN treatments were higher, on average, than those from banded urea, resulting in 4.2% higher N use efficiency across the entire N application range from 25 to 100 kg ha⁻¹ (figure 3). Higher levels of removal of N in grain from ESN, as compared to banded urea resulted in less residual N remaining in the soil and limited the possibility of N losses due to denitrification and leaching.

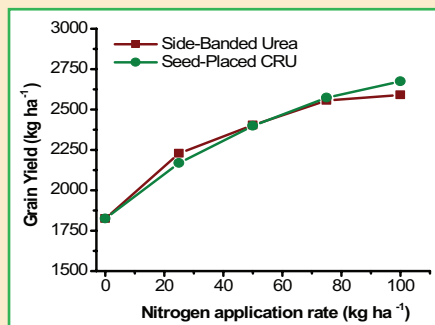


Figure 2. Spring wheat yield as affected by N source and application method (Haderlein et al., 2001).

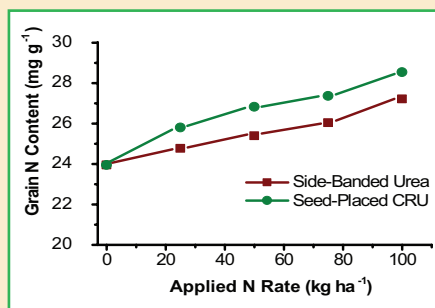


Figure 3. Spring wheat N content as affected by N source (Haderlein et al., 2001).

ESN Use to Increase Protein

The controlled release feature of ESN can be used solely on its own to influence both yield and protein - beneficially over other pre-plant N sources. Or, ESN may be used as part of a N blend to provide both early season N availability to promote and support wheat yield, and as a promoter of protein production.

As part of a N blend, it is recommended that your standard N source be applied to meet your historical yield potential/goal, and that ESN be additionally added to that blend to provide for later season controlled release N that will aid in building protein.

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