ESN

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

Agrium Advanced Technologies

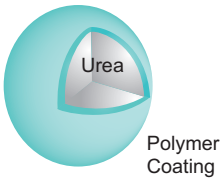
spring cereals

Use Recommendations

How the ESN Technology Works

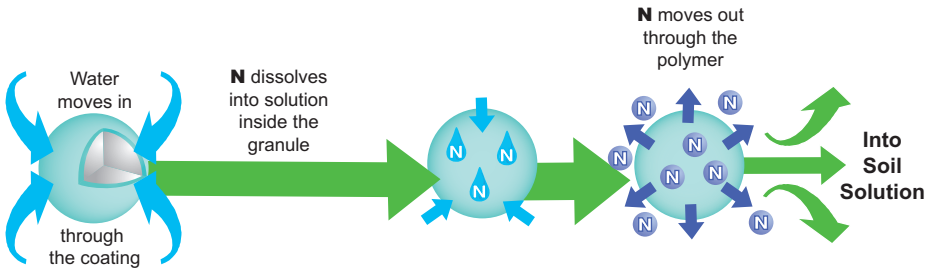
Coated Nitrogen Granules

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 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.

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.

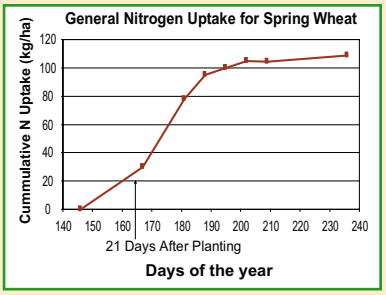


Figure 1.
Nitrogen Uptake for Wheat
Modified from Johnston, 1998

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.

ESN - A New Nitrogen Technology for Spring Cereals

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 Applied in Spring

- Pre-plant band, side/mid-row band
- Pre-seed broadcast and incorporated
- Seed row placed (Table 2.)
- Broadcast unincorporated
- Crop residue is necessary to hold both soil and ESN in place (broadcast applications)
- Heavy crop residue may restrict ESN - soil contact, and potentially affect N release from ESN due to poor ESN to soil moisture contact
- Post-emergent application may result in delayed N availability from ESN, as it relates to crop N uptake demand for annual spring seeded crops
- For early spring ESN applications, ESN provides greater protection against N loss, as opposed to conventional N sources applied at the same time
- Under average conditions in these areas, 35 - 50% of ESN-N is expected to be released in 25 to 30 days after application. The balance of ESN-N will be released over the following 30 to 40 days
- Impregnating crop protection chemicals on ESN has not been evaluated

Exhaustive research work has not been completed with respect to the use of ESN in seed placement situations. Work in Saskatchewan (Brandt, et al.) on canola, found that rates up to four times the provincially published safe N rate did not cause yield reductions.

At this time Agrium cannot make nor imply any guarantees with respect to seed safety for seed placed application of ESN. Neither Agrium nor its retail group can assume responsibility for environmental conditions or specific grower practices which may affect ESN performance in a seed row application. However, Agrium recognizes that such applications will be undertaken, and offers the following guidance.

Table 2. Guidance for Use of ESN in Seed Row Applications

Established Safe Rate of N*	0 to 50 lb/acre	ESN may be used to increase N rate by 50%**
Established Safe Rate of N	60 to 80 lb/acre	ESN can be used to increase N rate by 30%*

* Provincial Agriculture Departments Publish Safe Nitrogen Rate Guidelines for Seed Placed Nitrogen Fertilizer. The highest published N rate is 70 lb N/acre. Rates are based on equipment, crop, texture and soil moisture at time of seeding.

** Apply ESN - N to the limit of published safe N rate, add additional N as required, utilizing your traditional N source (following limits listed above). eg. Safe rate is 50 lb N/acre, add ESN - N at 50 lb rate, add additional 25 lb (50%) N from your regular N source.

ESN Applied in Fall

- Band applied
- Broadcast and incorporated
- Broadcast un-incorporated
- Crop residue is necessary to hold ESN in place (broadcast applications)
- Heavy crop residue may restrict ESN - soil contact, and potentially affect N release from ESN due to poor ESN to soil moisture contact
- Under average conditions for these areas, ESN-N will release N in the urea form, and N will either be encapsulated, in the urea form and/or in the ammonium - N form going into fall freeze-up
- At spring-time ESN-N will be releasing N in the urea and ammonium N forms; the earlier released N (ammonium) will be undergoing conversion to nitrate-N forms
- ESN research in S. Alberta (McKenzie, 2003-2005) has shown that September applied ESN (sideband and seed row) is in crop available N forms for winter wheat N uptake and production at spring time (See ESN use in Winter Wheat Production)
- Under average fall application conditions for these areas, ESN is expected to release between 35 and 50% if its N in the urea form, over 60 days, as the soil temperature drops form 10C to frozen soil condition
- Conversion of urea to ammonium (and potentially nitrate) is dependent upon application timing and local climatic and environmental condition(s)

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