Factsheet: Nitrogen Fertilizer Management Options for Winter Wheat

Objective:

The specific objectives were to demonstrate

1) the feasibility of side-banding the entire N requirements of winter wheat at seeding relative to top-dressing N fertilizer in the early spring,
2) the potential merits of using slow release N products (i.e. Super-Urea®, ESN®) for both fall side-band and spring broadcast applications and
3) the potential merits of split N applications where some N is applied at seeding and the remainder is top-dressed in the early spring.

Methodology:

Winter wheat field demonstrations / trials were established in both 2012 and 2013 at Indian Head, and 2013 at Scott Saskatchewan. A total of 24 N fertilizer treatments were arranged in a four replicate RCBD where the rates, placement methods, timings and forms of N fertilizer were varied. The applied N rates were 0, 75 or 115 kg N ha^{-1} and the forms were untreated urea (46-0-0), ESN (44-0-0), SUPERU (SU; 46-0-0), UAN (28-0-0) or AN (34-0-0). In 2012-13, NutriSphere-N was used in place of SUPERU. Nutrisphere-N is also purported to reduce or inhibit volatilization and nitrification; however, the active ingredients and modes of action of SUPERU and Nutrisphere-N differ and performance of the two products is not necessarily expected to be equal. An additional BMP treatment was included in 2013-14 where AN was spring broadcast at rates based on commercial soil test recommendations (ALS Laboratories). For fall applications, granular fertilizers were placed in a side-band (SB) or mid-row band at Scott while, for spring applications, granular fertilizer was broadcast on the soil surface (BC). Liquid UAN was always applied in surface dribble-band (DB).

Table 1. Treatments evaluated in ADOPT winter wheat N management demonstrations at Indian Head and Scott, Saskatchewan.

#	Rate (kg N ha^{-1})	Formulation	Timing / Placement
1	0	N/A	N/A
2	75	Urea	Fall / Side-band
3	75	ESN	Fall / Side-band
4	75	NSN/SU	Fall / Side-band
5	75	UAN	Fall / Surface-band
6	115	Urea	Fall / Side-band
7	115	ESN	Fall / Side-band
8	115	NSN/SU	Fall / Side-band
9	115	UAN	Fall / Surface-band
10	75	AN	Spring / Broadcast
11	75	Urea	Spring / Broadcast
12	75	ESN	Spring / Broadcast
13	75	NSN/SU	Spring / Broadcast
14	75	UAN	Spring / Surface-band
15	115	AN	Spring / Broadcast
16	115	Urea	Spring / Broadcast
17	115	ESN	Spring / Broadcast
18	115	NSN/SU	Spring / Broadcast
19	115	UAN	Spring / Surface-band
20	115	Urea	Split Application (40/60)
21	115	ESN	Split Application (40/60)
22	115	NSN/SU	Split Application (40/60)
23	115	UAN	Split Application (40/60)
24	Soil Test Recommended	AN	Spring / Broadcast

Urea – untreated urea; ESN – Environmentally Smart Nitrogen®; NSN – NutriSphere-N® (2012-13); SU -SUPERU™ (2013-14); UAN – urea ammonium nitrate

The full report is available at www.warc.ca. The project was supported by the Agricultural Demonstration of Practices and Technologies (ADOPT) initiative under the Canada-Saskatchewan Growing Forward 2 bi-lateral agreement.
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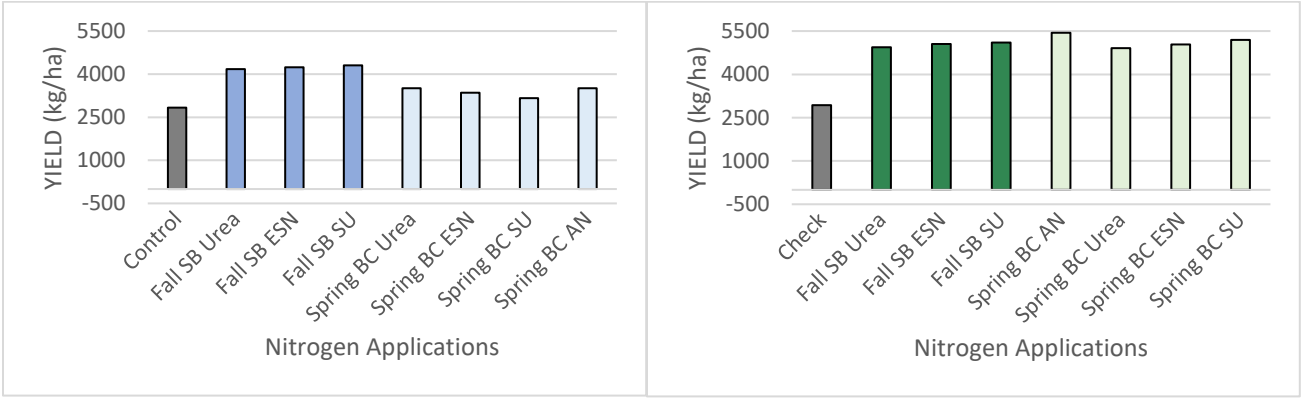
Key Findings:

- The environmental conditions varied significantly at the three sites (2012-13 Indian Head, 2013-14 Indian Head, and 2013-14 Scott), as the conditions from planting to early spring varied from extremely dry to relatively wet.
- Under dry conditions, fall applications performed well and tended to be less risky than applying the entire N application in the early spring. However, under these conditions the effect of slow release N were negligible, as the overall response to N fertilizer was low. Furthermore, when the fall and early spring were dry, fall side-band applications of fertilizer performed as well or better than the traditional recommended practice of broadcasting ammonium-nitrate (AN) (34-0-0) in the early spring.
- In wet spring conditions, applying N in the spring performed well and resulted in yields that were similar to or higher than when all N was applied in the fall. Under these wetter conditions, broadcast AN was extremely effective and produced some of the highest yields in the demonstration. As well, fall side-banded ESN and SUPERU and spring broad-casted SUPERU performed similarly to spring broadcast AN.
- It is also important to note that yields with untreated urea were lower than those with spring broadcast AN, regardless of whether the urea was side-banded at seeding or broad-casted in the early spring.
- As expected, fall dribble-band UAN did not perform consistently and that practice should be avoided, particularly under wetter conditions.
- Split applications performed well under all conditions and may be the lowest risk option for winter wheat producers under a broad range of conditions, especially if using untreated urea where the potential for losses may be high.
- Another potential benefit to split applications is that total N rates can be adjusted in the spring, after the stand and environmental conditions can be more accurately assessed. That being said, there is a cost associated with spring application of N fertilizer which must be considered when weighing the risks and benefits of the different options.
- While slow release products such as ESN and SUPERU are sold at a premium and are therefore more expensive than untreated urea, this cost could be offset by avoiding the additional time and cost of a spring application and, as such, may be an attractive alternative for many growers.



[a] [b]

Figure 1. Demonstrating the effects of nitrogen applications on winter wheat in [a] dry conditions and [b] wet conditions.

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