Fall fertilization options for winter wheat and fall rye

After another dry spring with little rainfall to incorporate spring broadcast urea or dribbled UAN solution, winter cereal growers may be considering alternative nitrogen (N) fertilization approaches.

Several spring fertilized rye fields suffered N deficiency due to stranding of the surface applied N, which moved very little in the soil with the lack of spring rainfall (Figure 1). Applying a greater portion of the N in the fall means there is some N supply in place should the spring conditions be too dry for rain incorporation, or too wet to allow timely field applications.

Figure 1. Spring 2020 dribbled UAN into rye, stranded at soil surface under dry spring conditions (Photo A. Knaggs)

The traditional risks from fall N fertilization of winter cereals in Manitoba are:

- Excessive top growth and reduced winter hardiness. Past research has shown that seedplaced phosphorus is very effective at counteracting this lack of winter hardiness. Phosphorus improves establishment in the fall and encourages recovery from winter injury.
- Nitrate N (NO_3-) is at risk of loss due to leaching or denitrification in wet winters and springs. Since winter wheat and fall rye are sown when soils are still warm (exceeding 10^O C) there is lots of opportunity for urea or UAN to convert to nitrate form. To reduce the risk of loss, N can be banded and/or protected forms of N can be used – either with physical protection and slow release characteristics, like ESN, or with nitrification inhibitors to slow conversion to nitrate (like SuperU or Instinct treated urea, or N-Serve and Centuro for anhydrous ammonia)
- Surface applied N is subject to volatilization losses or runoff
- Investment in N when crop may not survive the winter

Recent research across the Prairies evaluated the performance of N source, placement and timing on winter wheat[1]. Results should be useful for fall rye growers to consider as well.

Table 1. AC Radiant winter wheat yields with different N sources, placement and timing (16 site-years, including 3 at Brandon).

Nitrogen Sources	Urea	Agrotain	SuperU	ESN
Placement and Timing	Yield bu/ac[1]			
Side band at seeding	66.3	67.5	66.3	67.5
Spring broadcast	65.4	67.8	67.8	63.2
½ Sideband, ½ Spring broadcast	66.5	67.6	68.1	66.6

[1]Yields are considered significantly different when treatment yields differ by at least 2.8 bu/ac

Across these many sites, fall application at seeding in a sideband performed well compared to the traditional spring broadcast. Slow release N such as ESN is obviously not appropriate for spring application where ready access to N is needed. In Manitoba, where moister conditions are more prevalent, the split application may be most prudent.

In a second study, various split timings evaluated how early a spring split application of N needed to be applied (Table 2). It is apparent that even delayed springtime N was effective **as long as ½ the N was sidebanded.**

Table 2. AC Radiant winter wheat yields with different source, time and placement options.

Nitrogen sources	Urea	SuperU	ESN
Nitrogen Placement and Timing	Yield bu/ac[1]		
Side band	55.5	55.8	55.9
½ sideband + ½ Fall broadcast	54.1	55.3	54.1
½ sideband + ½ spring broadcast stem elongation	56.1	54.9	55.5
½ sideband + ½ spring broadcast start boot	55.2	55.2	55.8
½ sideband + ½ spring broadcast swollen boot	57.0	58.3	54.0
	Protein %[2]		
Side band	10.6	10.7	10.5
½ sideband + ½ Fall broadcast	10.2	10.3	10.3
½ sideband + ½ spring broadcast stem elongation	10.5	10.8	10.7
½ sideband + ½ spring broadcast start boot	10.5	10.7	10.7
½ sideband + ½ spring broadcast swollen boot	10.7	11. 0	10.4

[1]Yields are considered significantly different when treatment yields differ by at least 2.9 bu/ac
[2]Proteins are considered significantly different when treatments differ by at least 0.4%

Lower yields and the least protein resulted when ½ of the N was applied as a late fall broadcast, suggesting surface fall treatments are subject to losses. Again use of a slow release N was inappropriate with the latest split timing (low yield and protein)

So it appears that in-soil banding a portion of the N at seeding can be a suitable and flexible strategy for fall seeded cereals. In these instances, the advantages of enhanced efficiency products were not large, compared to what one might expect under Manitoba's traditionally moister overwintering and spring conditions.

[1]B.L. Beres et al. 2018 Enhanced nitrogen management strategies for winter wheat production in the Canadian prairies. Can. J. Plant Sci. 98: 1–20 (2018)