NEWS & VIEWS

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Dr. Terry L. Roberts, Western Canada Director

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Is It Too Late to Topdress Spring Wheat?

DON'T put all your eggs in one basket! That's good advice for your investments and good advice for your fertilizer, especially nitrogen (N). Topdressing, or split applications of N, can improve fertilizer efficiency and reduce weather-related risks. The Europeans have successfully used split applications on winter wheat for years. The reasons for their success…long growing season, high N requirement, high rainfall and great potential for leaching and lodging. But will topdressing work in the prairies where our N requirements and rainfall are usually lower?

There hasn't been a lot of research on split N applications in western Canada. Some field trials have found topdressed N does a poor job of increasing grain yields, but does a good job of increasing protein. Other studies have found a good yield response to topdressed N. For example, **Table 1** shows results from fertility trials in Manitoba where topdressing N increased wheat yields compared to a single pre-seeding application. In these trials, the same amount of total N was applied, but application of 35 lb/A at the beginning of stem extension increased wheat yield from 2 to 7 bushels per acre in 4 of the 6 years studied. The average net return from the split application was $31.80 per acre compared to $26.25 per acre for the single application…a benefit of $5.55 per acre.

Table 1. Effect of split N application on yield on HY320 spring wheat.

N Applied, lb/A	1985	1986	1987	1988	1989	1990	Mean
105	107	60	59	43	37	58	61
70/35*	109	64	66	42	36	65	64

*70 lb N/A (82-0-0) applied pre-seeding and 35 lb N/A (34-0-0) applied at Zadoks' growth stage 31 (first node of stem visible).

Source: Canada Grains Council 1992

Delaying N application will often have a more positive impact on protein than yield. **Figure 1** shows results from a field trial where ammonium nitrate was topdressed on wheat at flowering (anthesis) at two different N rates. As the relative proportion of topdressed N increased, yields declined, or remained unchanged, but protein increased. Late application of N is a good management tool that can increase protein. However, for topdress applications to be most effective the N applied needs to move into the root zone where the crop can take it up. In the Westco study (**Figure 1**), a half inch of rain fell on the site within 24 hours of N application, which effectively moved the N into the root zone. However, if timely rains do not fall, the N could get stranded on the surface and be unavailable to the crop.

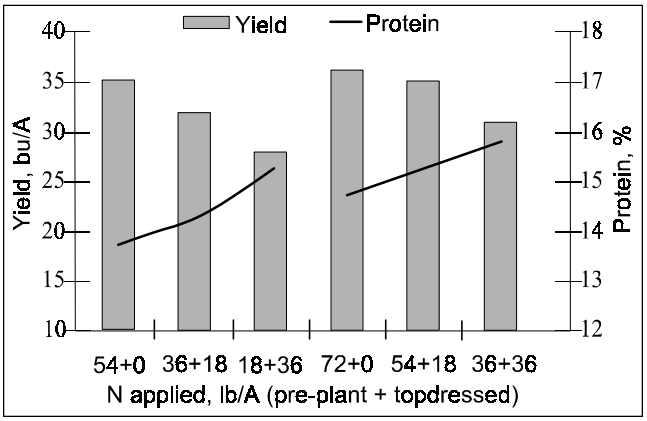

Figure 1. Effect of topdressing N at flowering on spring wheat yield and protein in Alberta (Westco).

Point injection offers a good post-emergent alternative to surface application. This method uses a spoke wheel to

Agronomic market development information provided by:
Dr. Terry L. Roberts, Western Canada Director
Potash & Phosphate Institute (PPI)/Potash & Phosphate Institute of Canada (PPIC)
Suite 704, CN Tower, Midtown Plaza, Saskatoon, Saskatchewan Canada, S7K 1J5
Phone: (306) 652-3535

inject liquid fertilizer 3 to 4 inches into the soil at regular intervals. The spokes do not disrupt the soil and do little damage to plant roots making it suitable for post-emergent application. **Figure 2** compares point injection and broadcast post ermergent application of N to spring wheat in Alberta. Yields declined as N application was delayed for both methods, but under the moisture conditions at this site, point injection produced higher yields than broadcast application. Both methods did a good job of increasing grain protein as application was delayed.

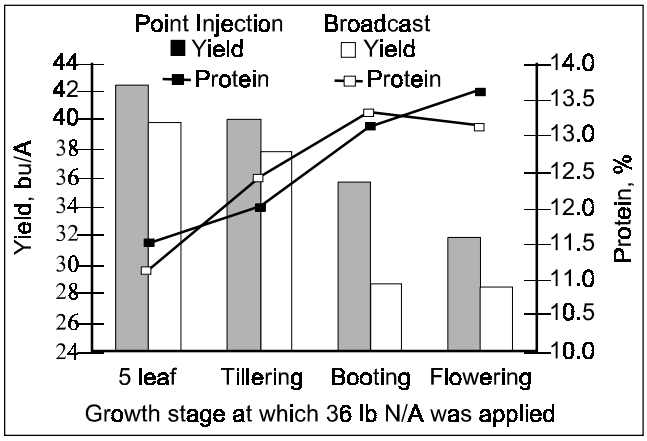

Figure 2. Effect of point injected 28-0-0 and broadcast 34-0-0 on spring wheat yield and protein at Pincher Creek, Alberta (Source: Roberts 1994).

While there is plenty of interest in increasing protein, risk management may be the greatest potential benefit of topdressing N on spring wheat. Moisture is usually the most limiting nutrient in the Canadian prairies. It takes 4 to 5 inches of available water (spring soil moisture and growing season precipitation) to produce the first bushel of spring wheat. Beyond that, each additional inch produces an extra 3 to 4 bu/A. Normally, we set target yields at seeding based on soil moisture conditions and expected growing season precipitation. This approach has worked well when there's a good reserve of soil moisture at planting. However, when spring soil moisture is low, the proper yield goal and correct amount of fertilizer to apply is more uncertain due to greater reliance on growing season precipitation.

If the moisture situation improves after the crop is up, the target yield can be adjusted accordingly and additional N can be applied. It takes about 2.5 pounds of available N to produce a bushel of hard spring wheat and about 2.0 pounds per bushel for Canadian Prairie spring wheat.

Understanding N distribution in the wheat plant at different stages of development can help determine when to apply N and whether it may increase grain yield or protein. The N content of spring wheat at different stages of development is shown in **Figure 3**. Peak N uptake in leaves occurs during flag-leaf-extension through the boot stage and then in the stems at about anthesis **(Figure 3**). After that, N is translocated from leaves and stems to the spike. Anthesis and post-anthesis are critical development stages relative to achieving grain yield potential in spring wheat. Under good growing conditions (i.e. good moisture and fertility) mature spring wheat can accumulate just over 100 lbs N/A. From early tillering until the spikes begin to appear, daily N uptake can equal 2 lbs/A/day. To assure there is sufficient N and phosphorus (P) in the plant, fertilizer must be applied before that critical period.

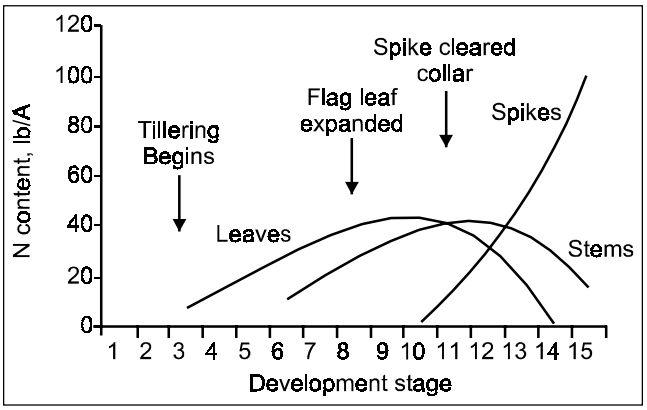

Figure 3. Nitrogen content in leaves, stems and spikes of spring wheat at different plant development stages (Source: Bauer at al. 1987).

Phosphorus is not normally topdressed on a cereal crop because it's immobile in the soil and roots of cereal crops do not access P near the soil surface. Adequate P should be applied prior to, or at seeding and is essential to ensure optimum response to N. This is apparent in long-term wheat rotations in Alberta, where N and P applied together increased stubble wheat yields 18 to 22 percent more than N applied alone (**Table 2**).

Table 2. Phosphorus improves N response in spring wheat grown on stubble in long-term rotations at Lethbridge, Alberta (1972-84).

Fertilizer, lb/A		13 year average wheat yield, bu/A	
N	P_2O_5	Fallow-Wheat-Wheat	Continuous Wheat
0	0	18	17
40	0	23	22
0	40	18	19
40	40	28	26

Source: Janzen 1986

Is it too late to topdress some N…do you need to? Re-evaluate your yield potential and the fertilizer that's already been applied. If you've received more rainfall than anticipated your crop may need more N. But remember, additional N should be applied by the flag-leaf stage since translocation of N from the leaves to the spike begins then. ■