

Time to make protein? The wheat grower's decision.

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Wheat growers are nearing decision time on whether to supplement their wheat crop with nitrogen for protein enhancement. A very detailed study at University of Manitoba¹ has just wrapped up and some results are summarized here.

1. NITROGEN REQUIREMENT

Yield and protein increased with N application at seeding across CWRS wheat (AAC Brandon) and CNHR (Prosper).

Table 1. Summary of 8 sites of wheat response to seeding applied nitrogen

Nitrogen rate Lb N/ac (not including soil test N)	Yield Bu/ac		Protein %	
	Prosper	Brandon	Prosper	Brandon
0	57	53	10.2	11.4
50	73	65	10.4	11.8
80	80	70	11.1	12.5
110	85	76	11.9	13.1
140	87	78	12.1	13.5
170	88	79	12.6	14.0

The economically optimum nitrogen rates were determined based on a 5-yr average urea price for urea and wheat prices (that assumed access to low protein markets) and soil test N. The economic optimum N supply (soil plus fertilizer) was 170 lb N/ac, OR a nitrogen supply of 2.0 lb N/bu of corn produced (across 7 sites, excluding a hailed site). This factor is important to consider when deciding if you have supplied enough N for the yield potential we are now seeing in the field.

2. Midseason applications of nitrogen often increased yield and always increased protein.

Table 2. Change in yield and protein with additional midseason N relative to the base rate of 80 lb N/ac at seeding (mean of 8 sites).

Seeding N (lb/ac)	Midseason N Rate (lb N/ac) and Timing	Yield bu/ac		Protein	
		Prosper	Brandon	Prosper	Brandon
80 N		80	70	11.1	12.5
80 N	30 N topdress urea at T1*	+9	+9.5	+0.9	+1.1
80 N	60 N topdress urea at T1	+8	+10	+1.4	+1.4
80 N	30 N topdress urea at T2	+7.5	+5.5	+1.0	+1.1
80 N	60 N topdress urea at T2	+9.5	+6.5	+1.8	+1.7
80 N	30 N as foliar UAN at T3	-2 (+4)**	-1.5 (+3)**	+1.3 (+2.4)**	+1.2 (+1.9)**

* T1 = stem elongation, T2 = flag leaf emerged, T3 = post anthesis

** at 4 of the 8 sites foliar urea was applied at 30 lb N/ac at T3. The amount in brackets is the change from the 80 N base rate at those 4 sites.

It is apparent with good yield potential and a modest rate of seeding time applied nitrogen (80 lb N/ac), the midseason supplementation of 30-60 lb N/ac was beneficial, yielding at least as much as equivalent rates applied at seeding. The tendency was that earlier applied nitrogen had greater influence of yield and later N had a greater influence on protein.

The UAN application after anthesis was foliar applied after dilution with water and caused some severe leaf burn. At 4 of the 8 sites liquid urea was tested similarly at 30 lb N/ac with less leaf burn and yield and protein increase was greater than with UAN.

How might growers use these results?

- 1) Firstly, many growers are applying higher base rates of N than the 80 lb N/ac so any midseason applications may have less impact on yield than in this study. But, if N supply was below this crop's yield potential, it is possible to see both yield and protein increases with applications made prior to heading (ie T1 or T2).
- 2) Most wheat has now advanced past flagleaf emergence and the remaining option is the post anthesis N (PAN). In 14/15 of MB on-farm-tests of the PAN practice, leaf burn was much less than in this study and yields were not reduced². Suggestions on reducing leaf burn include:
 - a. Dilute 10 US gal UAN with 10 US gal water per acre to supply 30 lb N/ac
 - b. Apply in the evening or morning when temperatures are cooler (<20°C)
 - c. Apply with flat fan nozzles. An Oklahoma study suggest that medium and coarse sized droplets may be advantageous over fine droplet size.
 - d. Apply after anthesis – about 5-10 days after your fusarium head blight spray.
- 3) This University of Manitoba study found favourable results using foliar applied urea. It may have helped that the urea solution was more dilute in the water carrier than the UAN. In general there is less on-farm experience with this practice but consider these pointers:
 - a. Expect less leaf burn than with UAN. However, as stated above leaf burn was not really a yield factor in our on-farm-tests.
 - b. If growers are choosing to use foliar urea, work with providers of high quality product. A by-product of urea production may be biuret, which is not a problem for soil applied urea, but is toxic at high rates in a foliar spray³. I have spoken to local ag retailers that are dissolving (or “melting urea”) and they generally assume that their urea manufacturers have low levels. Apparently Midwest Laboratories of Omaha NE will analyse for biuret.
 - c. There are many other specialty urea forms for foliar application. NDSU studies indicate that although they may be very safe, that in order to produce similar protein increase, the rates of N applied would need to be similar to UAN⁴.

Do we have a decision guide whether to do PAN?

We do not have a strong decision guide for growers yet. We are still evaluating some field scouting tools, like flag leaf N, NDVI, chlorophyll, to indicate whether protein is likely to be sufficient or if a large protein increase is likely with a nitrogen application.

Currently we suggest that if the yield potential of the wheat crop looks good, and higher than for the N rate initially supplied (ie at 2 lb N soil and fertilizer per bu), consider trying a treatment. And check with your marketing consultant whether market signals suggest a shortage of high protein wheat being harvested elsewhere.

¹ <http://www.mbwheatandbarley.ca/wp-content/uploads/2018/05/Mangin-Flaten-N-mgmt-for-HY-wheat-project-revised-technical-report-2018-03-31.pdf>

² <http://www.mbwheatandbarley.ca/wp-content/uploads/2014/11/OFT-summary-2017-FINAL.pdf>

³ [https://www.ipni.net/ppiweb/bcrops.nsf/\\$webindex/AFE7446D8AF92F988525732D0038FDCE/\\$file/07-3p06.pdf](https://www.ipni.net/ppiweb/bcrops.nsf/$webindex/AFE7446D8AF92F988525732D0038FDCE/$file/07-3p06.pdf)

⁴ <https://www.ndsu.edu/fileadmin/soils/pdfs/foliarNreport.pdf>