

Updating N Recommendations for New, High Yielding Varieties of Spring Wheat

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Photo: Amy Mangin

The last time I was speaking
on wheat N fertilization ...



... and I was using U of MB
wheat N data from the 1970s

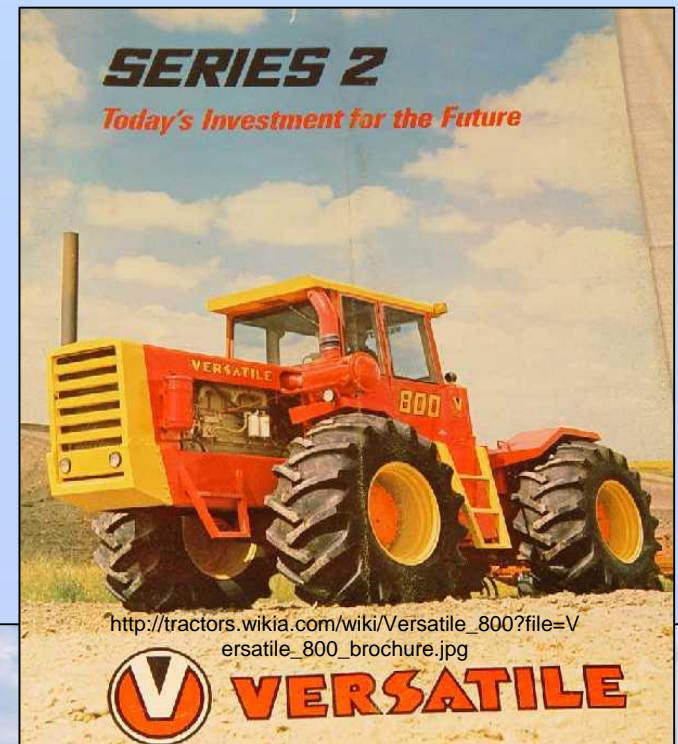


Photo: Rod Macivor /Ottawa Citizen



<http://www.thecanadianencyclopedia.ca/en/article/economic-canadian-american-relations/>

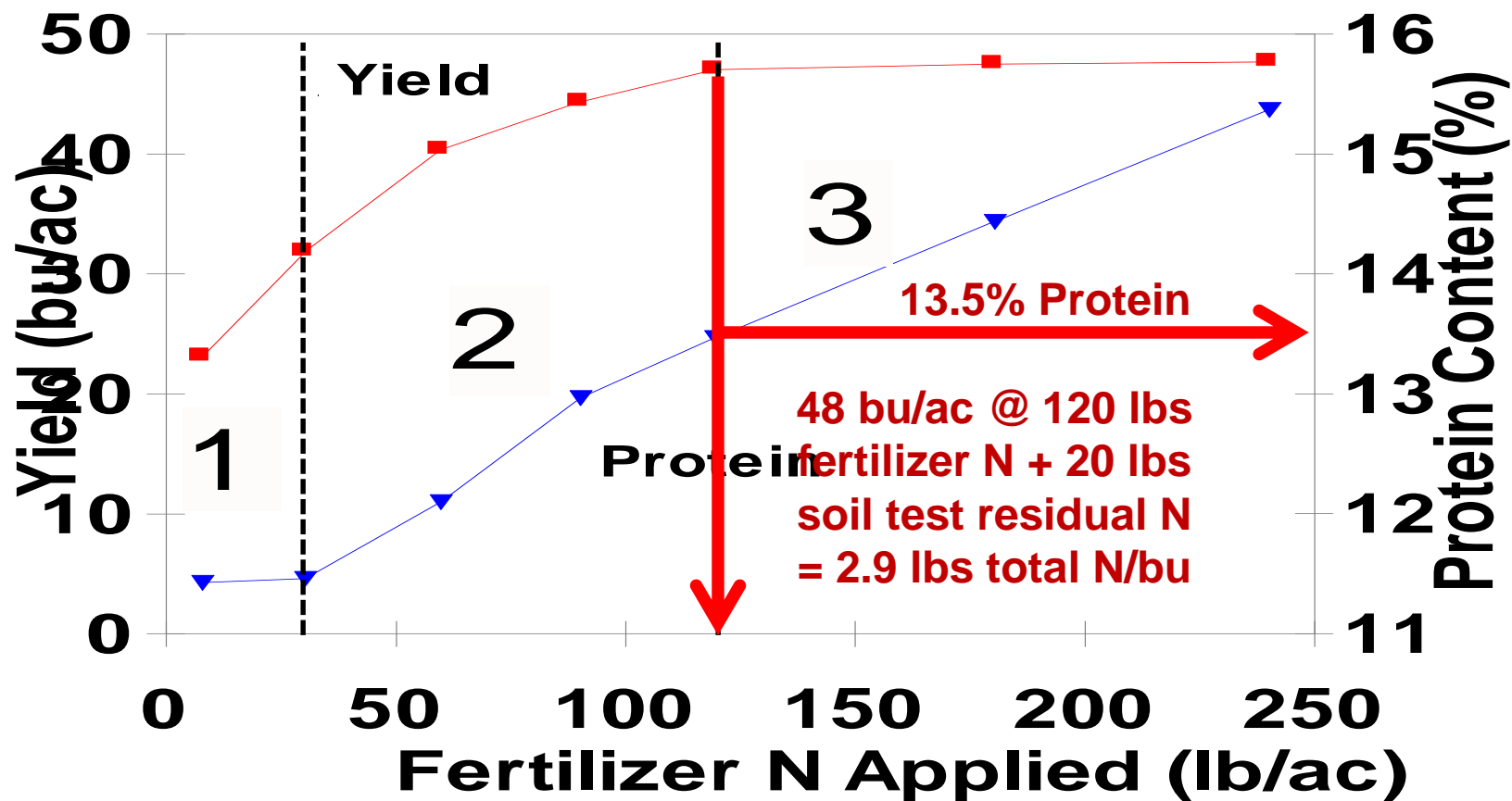
... and I was using U of MB
wheat N data from the 1970s



Effect of Early Season N Applications

- **Dr. G. Racz's studies at U of M in 1970s**
- **6 and 8 site years of field trials in moist and dry areas of Manitoba, respectively**
- **soils with v. low nitrate-N (17-27 lb N/ac)**
- **small plots, managed for “high yields”**
- **ammonium nitrate (34-0-0) broadcast at planting**
- ***Neepawa* variety of CWRS**

Effect of N on Yield and Protein CWRS Wheat (Moist: <127 m



Agronomic data from G. Racz

Appendix Table 1. Nitrogen recommendations for hard red spring wheat (based on spring broadcast application)⁵⁴. (Manitoba Soil Fertility Guide 2007)

Nitrogen Recommendation (lb/ac)										
SOIL MOISTURE CATEGORY		DRY			MOIST			IDEAL		
TARGET YIELD (bu/ac)		30	35	40	35	40	45	40	45	50
Fall Soil NO ₃ -N										
lb/ac in 0-24"	Rating									
20	VL	30	55	110	30	55	110	65	90	120
30	L	10	30	80	25	45	85	45	70	100
40	M	0	10	60	5	30	65	25	50	80
50	M	0	0	40	0	15	50	5	30	60
60	H	0	0	20	0	0	25	0	10	40
70	H	0	0	0	0	0	0	0	0	20
80	VH	0	0	0	0	0	0	0	0	0
90	VH	0	0	0	0	0	0	0	0	0
100	VH+	0	0	0	0	0	0	0	0	0

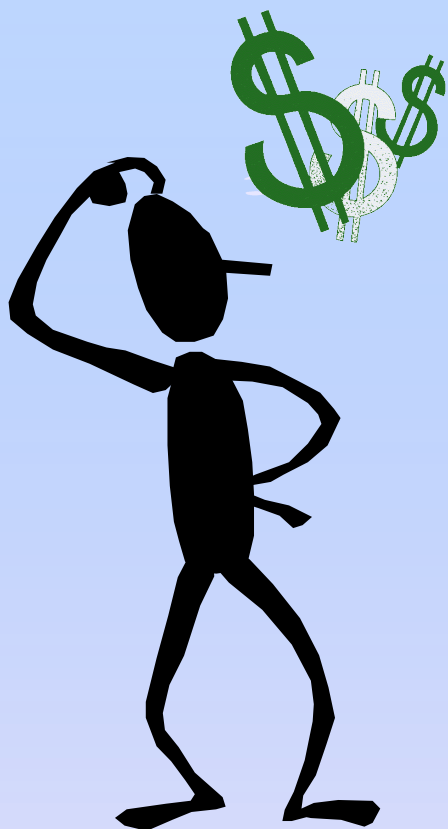
**20 lbs N from soil test +
120 lbs N as fertilizer =
140 lbs total N for 50 bu
... ie. 2.8 lbs N/bu**

**But what about N rates
for increasing yields
above 50 bu/ac?**

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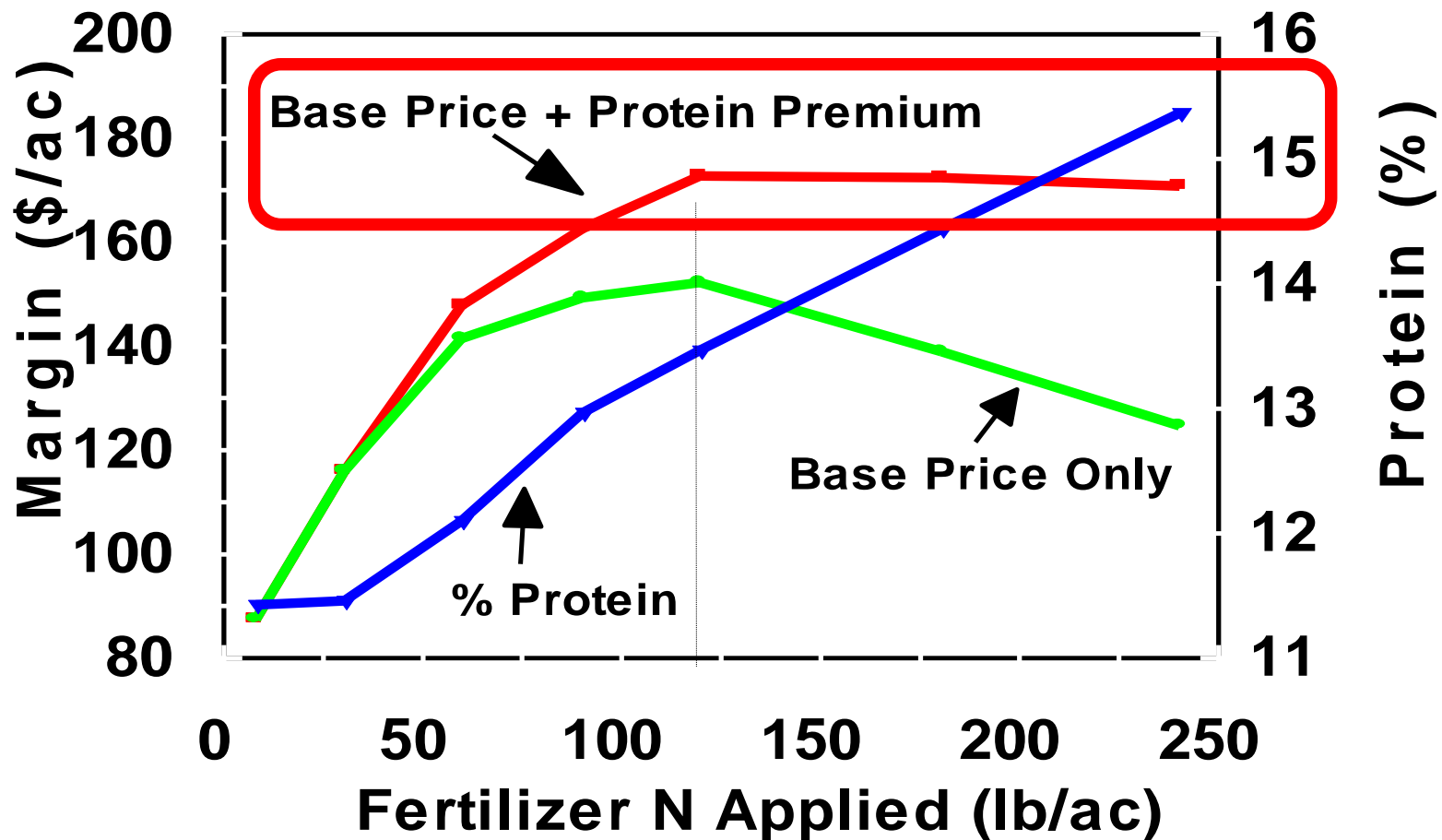
Nitrogen Recommendation (lb/ac)										
SOIL MOISTURE CATEGORY		DRY			MOIST			IDEAL		
TARGET YIELD (bu/ac)		30	35	40	35	40	45	40	45	50
Fall Soil NO ₃ -N		70 lbs/10 bu = 7 lbs/bu			6.5 lbs/bu			5.5 lbs/bu		
lb/ac in 0-24"	Rating									
20	VL	30	55	100	45	70	110	65	90	120
30	L	10	30	80	25	45	85	45	70	100
40	M	0	10	60	5	30	65	25	50	80
50	M	0	0	40	0	20	50	30	60	90
60	H	0	0	20	0	10	40	10	40	70
70	H	0	0	0	0	0	30	0	20	50
80	VH	0	0	0	0	0	10	0	0	30
90	VH	0	0	0	0	0	0	0	0	10
100	VH+	0	0	0	0	0	0	0	0	0

However, the “old” system of calculating total N supply discounted fertilizer N by 50%, based on 15N uptake studies ... that may have under-estimated overall efficiency of fertilizer N after accounting for exchange with SOM



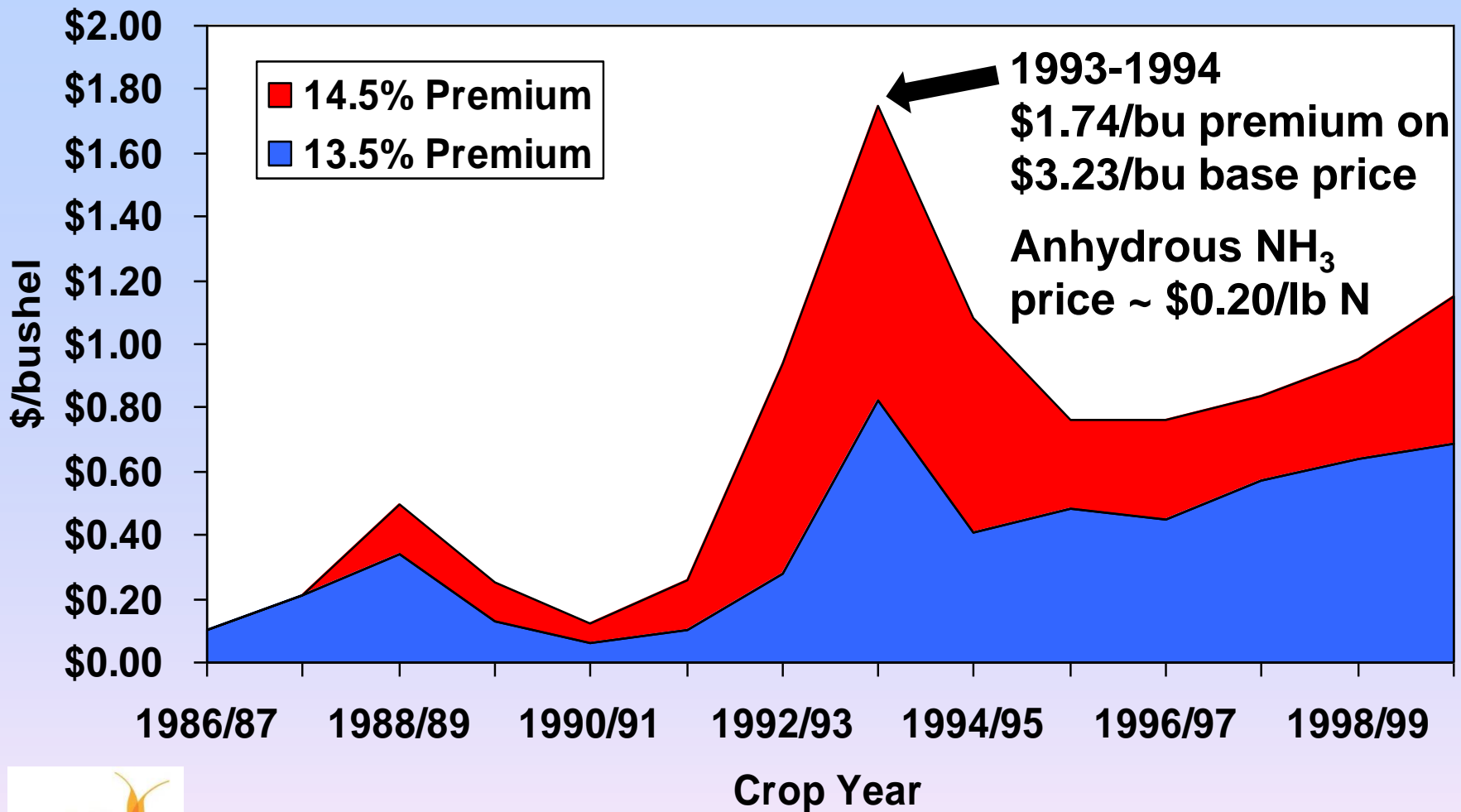
Economics?

Protein and Margin for #1 CWRS Wheat (1997/98 Final Prices, Moist Climate)



Agronomic data from G. Racz; base price for wheat @ \$3.88 N @ \$0.25

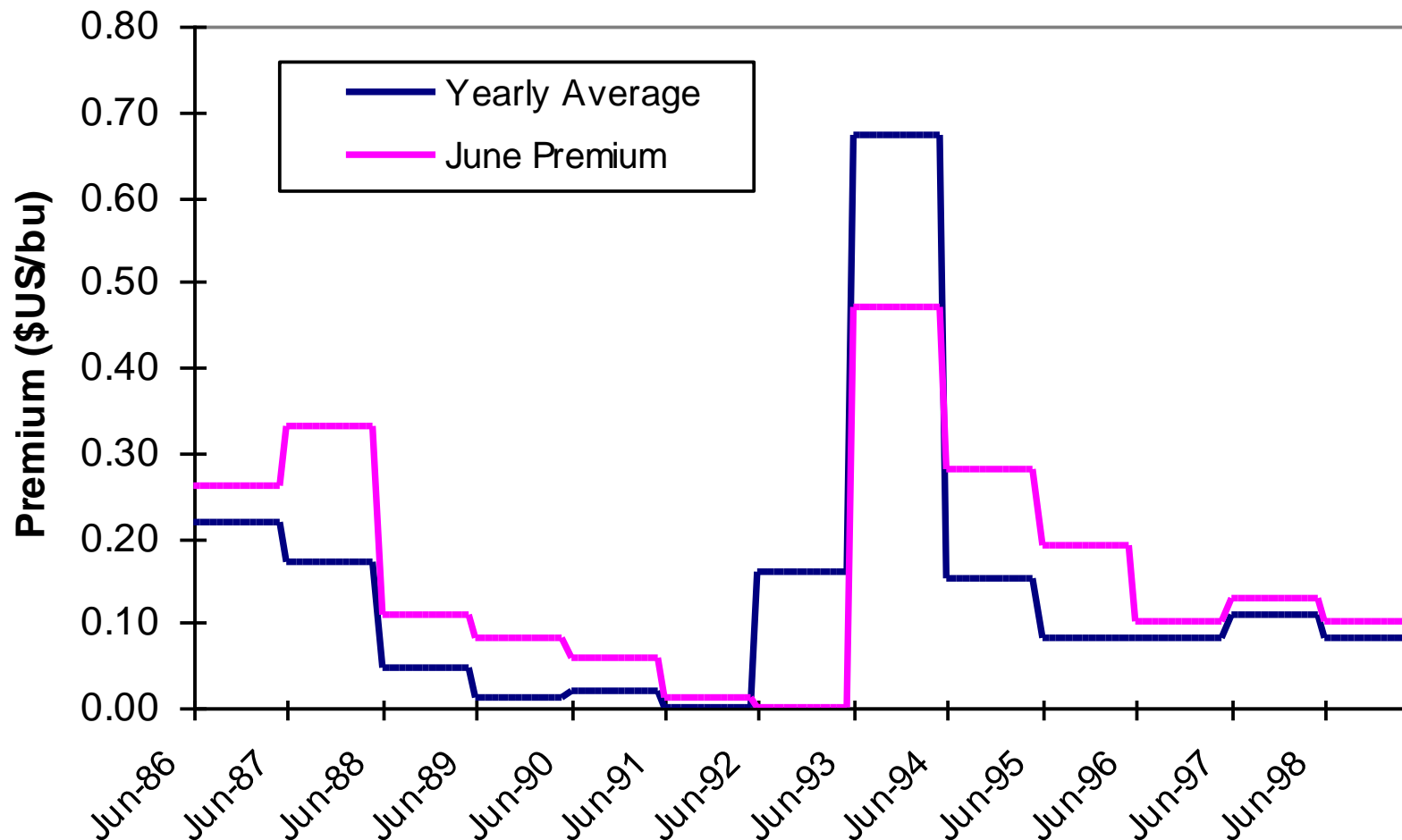
Protein Premiums for #1 CWRS Wheat from 1986/87 to 1999/00



Economic Analysis

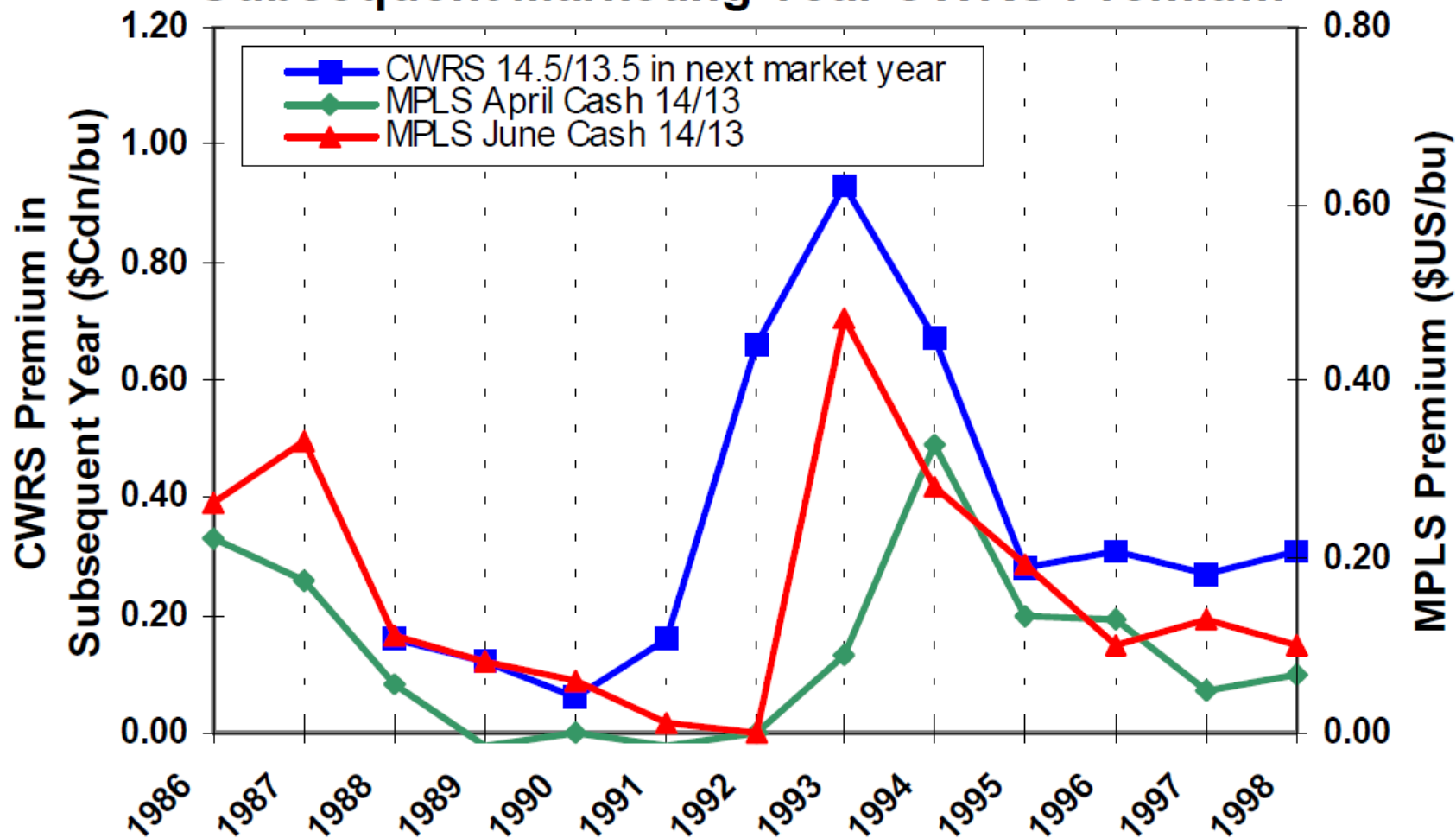
- if protein premiums are ignored, protein conc'n of <13-14% for CWRS wheat indicates suboptimal N status for yield
- “current” [2000] protein premiums create a broad “plateau” of profitable N application rates, above the rates considered optimum for yield, alone
- if protein premiums are high relative to the base price for wheat, application of additional N to increase protein to 14-15% is profitable

Monthly MPLS 14-13 June Cash Premium vs Marketing Year Average Premium



Flaten, G., Przednowek, D., and Flaten, D. 2000. Protein profits in the market place - watch for the signals. Pages 217-235. In Proceedings of the Saskatchewan Soils and Crops Workshop, Univ. of Sask., Saskatoon, Sask., Feb. 24-25, 2000.

Figure 16. MPLS Cash Protein Premiums vs Subsequent Marketing Year CWRS Premium



Flaten, G., Przednowek, D., and Flaten, D. 2000. Protein profits in the market place - watch for the signals. Pages 217-235. In Proceedings of the Saskatchewan Soils and Crops Workshop, Univ. of Sask., Saskatoon, Sask., Feb. 24-25, 2000.

Effect of Midseason Applications of N

- small yield benefit if applied after heading
- largest increase in protein content if applied at flowering
- periodic yield depression from foliar sprays (eg. due to leaf burning)
- amount of N required to raise protein content varies widely
- effect on protein quality is being examined (2000)

Typical Rates of Midseason N Required to Raise Protein Content from 13 to 14%*

- 11 to 16 lb N/ac for foliar UAN at boot stage at IHARF
- 23 to 26 lb N/ac for foliar UAN at boot stage at BRC
- 16 to 24 lb N/ac for b'cast AN at boot stage at BRC
- 13 lb N/ac for b'cast AN at heading stage in Westco expts., under very favourable conditions (eg. rainfall immediately after)

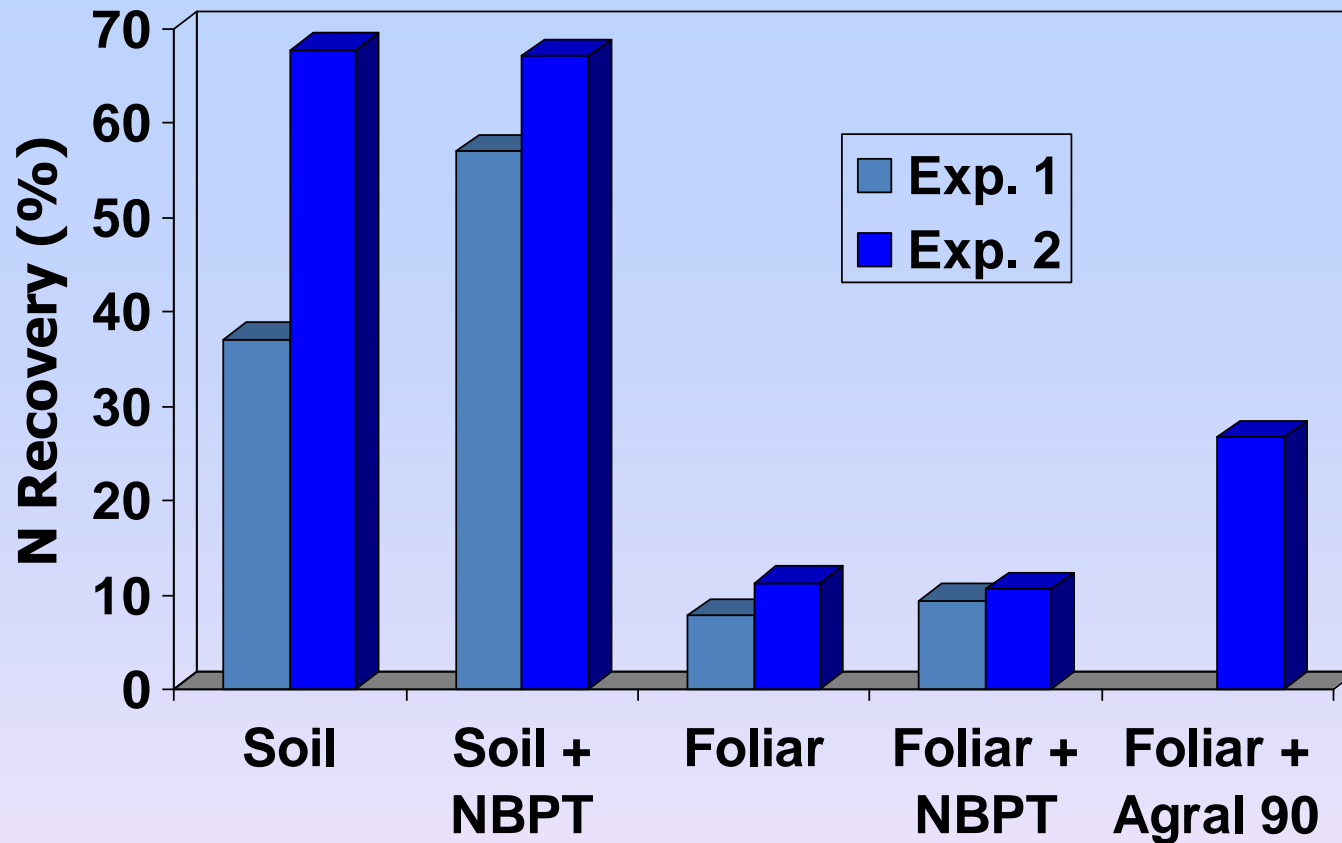
*For a 40 bu/ac crop of spring wheat in treatments where yield not lowered

Economics of Midseason N Applications

- **generally, protein premiums for 14.5% vs 13.5% must be at least \$0.10 to \$0.20/bushel to pay for additional N fertilizer @ \$0.25 per lb**
 - **not accounting for application cost**
 - **assuming minor losses of N**

Efficiency of “Foliar” Application of N

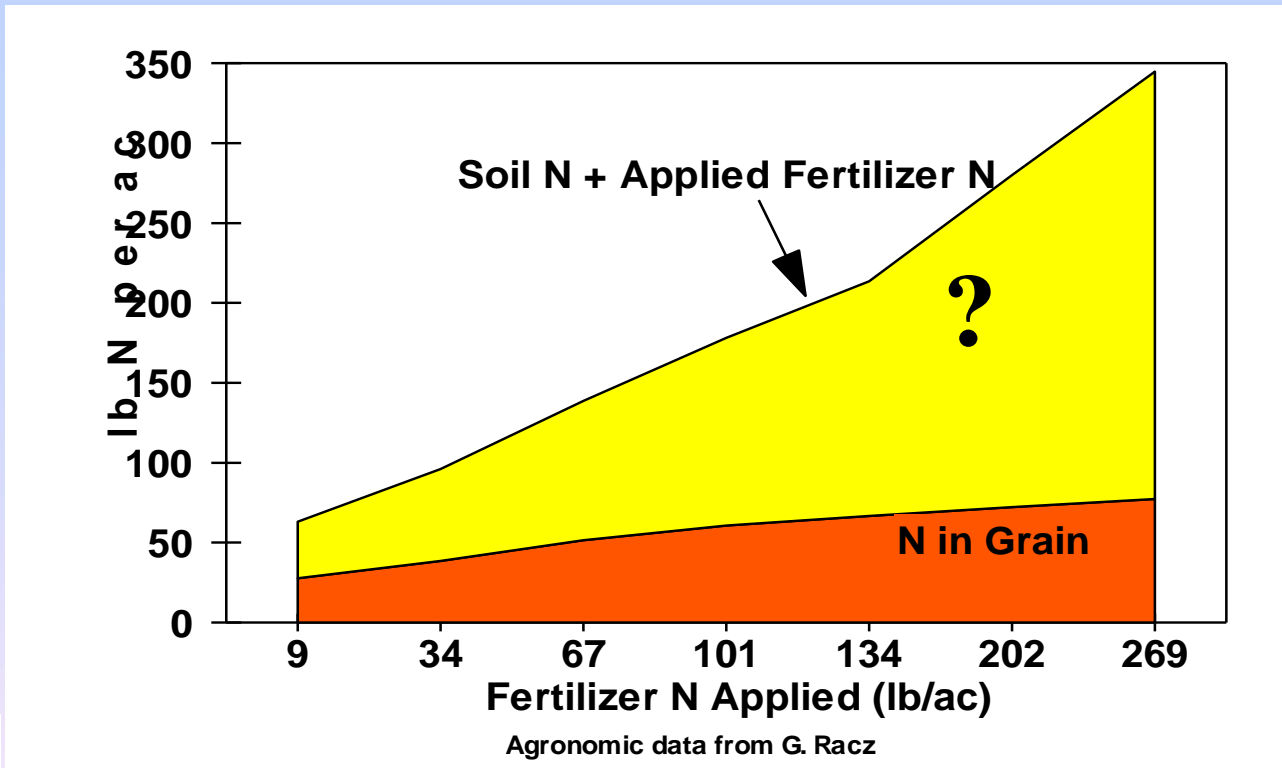
- growth chamber studies by U of M & BRC with ^{15}N -labelled urea showed very little uptake of “foliar” N by leaves of wheat



- Rawluk, Grant and Racz CJPS 80:331-334

Environmental Risks

- fertilizer N uptake efficiency declines at high application rates
- excess N often accumulates as nitrate, increasing risk of nitrate leaching into ground water, denitrification and increased production of greenhouse gases and destruction of ozone



Timeline for 2000 Wheat Crop Production Decisions vs. Protein Premium Information

Time	Agonomic Decision	Protein Premium Info.
Oct 1999 or Apr 2000	Apply N fertilizer	Previous experience?? Limited PRO info??
May 2000	Plant crop	Limited PRO info??
Jun 2000	Midseason N app'n?	U.S. cash markets??
Jul 2000		CWB initial prices ann.
Sep 2000	Harvest crop	Start to receive in. price
Jul 2001		Crop year ends
Jan 2002		CWB final payment

... so what about N management in 2017?



Photo: The Globe and Mail

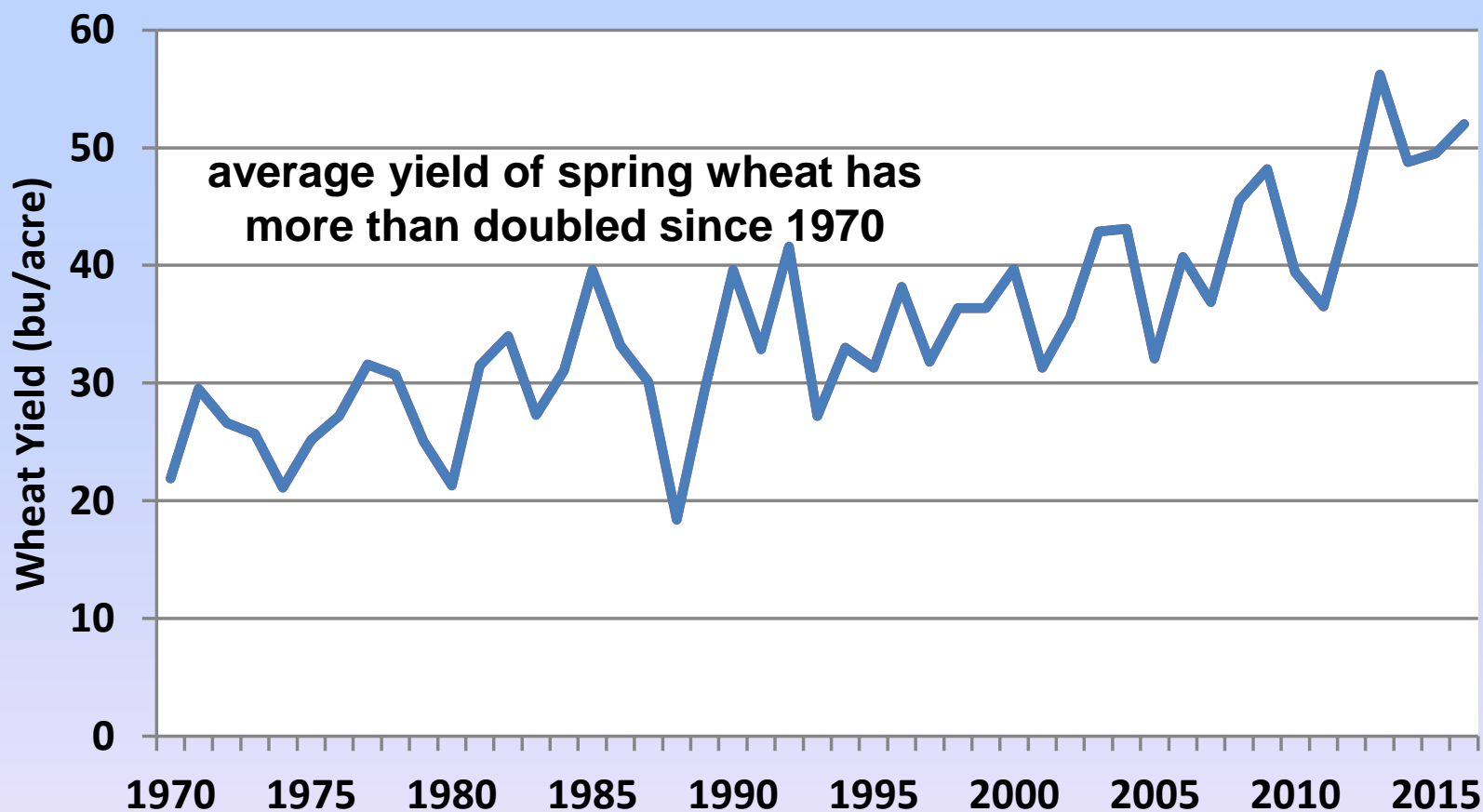


Photo: Wikipedia

... so what about N management in 2017?

- new varieties and cultural practices with very high yield potential

Average Spring Wheat Yields in MB (1970-2016)



Statistics Canada - Estimated areas, yield, production, average farm price and total farm value of principal field crops, in imperial units annual

N Management Challenges for High Yielding Spring Wheat

- Current guidelines for N recommendations do not address yield potential for current spring wheat production**
- Even when high yields are achieved, the risk of substandard protein content for milling market is substantial**
- The standard recommendation of applying 2.5-3 lb N/bu for milling quality spring wheat at planting represents a large financial risk to wheat growers, as well as a substantial agronomic and environmental risk (eg. lodging, leaching and nitrous oxide emissions).**
- Midseason fertilization might reducing these risks, but increase the risk of midseason “stranding” of fertilizer**
- Many questions about applying a true foliar application of 30 lb N/acre approximately one week after anthesis, using a 50:50 mix of urea ammonium nitrate (28-0-0) and water**