Soil Fertility Update

Ag Agent Update

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MONTANA STATE UNIVERSITY EXTENSION

AGRICULTURE

MAKING A DIFFERENCE IN MONTANA COMMUNITIES

Recent and Current Projects

- Enhanced Efficiency Fertilizers and Nutrient Uptake Timing Extension Bulletins (2009)
- Updated Nutrient Management Modules 7-12 (2009)
- Gardening Articles in Big Sky Small Acres and Zone 4 (Spring and Summer 2010)
- Soil Fertility Management on Organic Farms Extension Bulletin (~June 2010)
- Collaborating with NRCS on identifying practices that reduce nitrate leaching (for incentive payments)
- Overwinter nitrate-N differences (3rd year)
- Legume green manures in conventional systems (w/ Perry Miller)
- Urea volatilization (w/ Rick Engel)

Objectives

- Explain types of EEFs
- Describe how they work
- Show their benefits and limitations

Enhanced Efficiency Fertilizers (EEFs)

- Any fertilizer designed to:
  - Increase fertilizer availability
  - Decrease fertilizer losses

- 3 major methods of action
  - Stabilized - alter soil microbial or enzymatic reactions
  - Slow release - have additives which require chemical or biological decomposition to release nutrients
  - Controlled release - a semipermiable coating, usually a polymer, regulates release

Partial list of available stabilized EEFs

- **Stabilized**
  - Nutrisphere-N® (NSN)
  - Agrotain®
  - Avail®
  - NSource®
  - NServe®
  - Instinct®
  - SuperU®
  - Nitamin Nfusion®

Partial list of available controlled and slow release EEFs

- **Controlled Release**
  - ESN®
  - Polyon®
  - PolyS®
  - Duration®
- **Slow Release**
  - NSure®
  - Nitroform®
  - Nutralene®

Under what growing conditions should EEFs work better?

- High potential volatilization loss
  - coarse soils
  - moist surface
  - warm temps
  - long time between application and incorporation
- High potential leaching
  - coarse soils
  - high moisture content/irrigation/rainfall

NBPT (Agrotain) uses

- Can minimize urea volatilization for up to 14 days
- ‘Buys’ time for rainfall, irrigation or mechanical incorporation to protect urea
- Warm weather top-dressing
- Cool weather broadcast

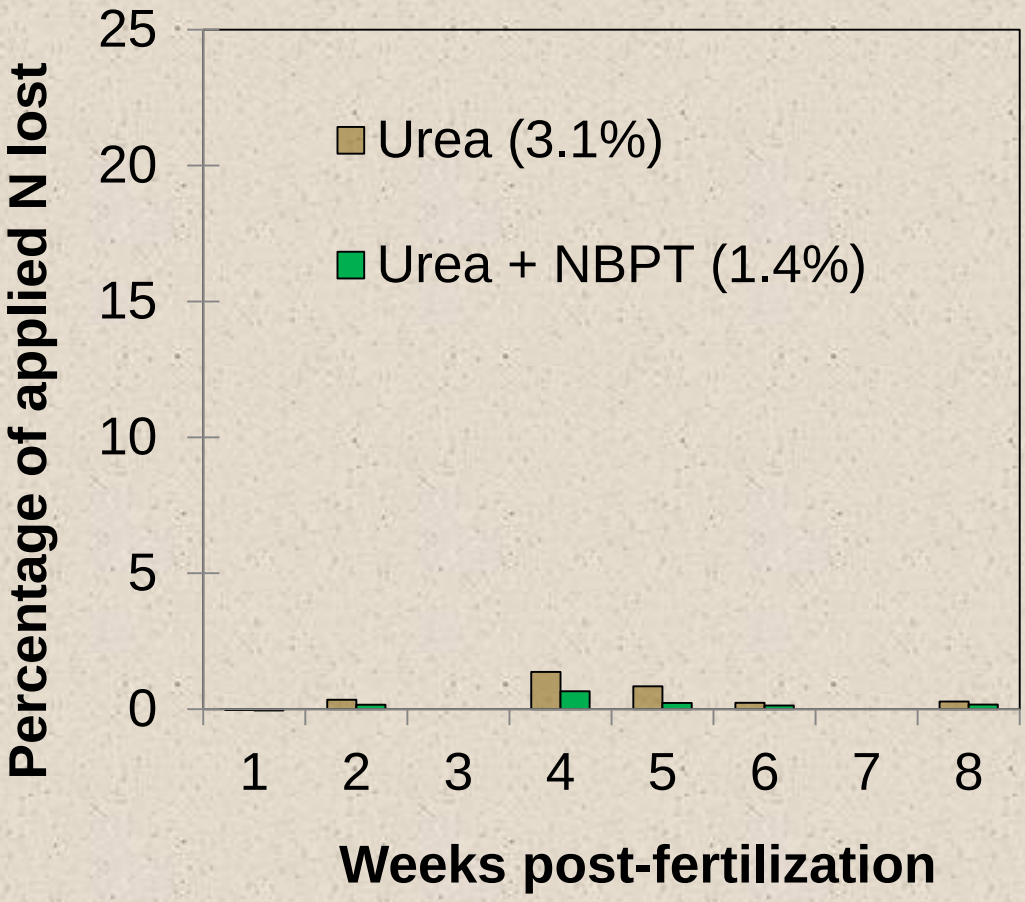
Next 4 slides are from two sampling campaigns of Rick Engel’s and my project on urea volatilization in the Golden Triangle

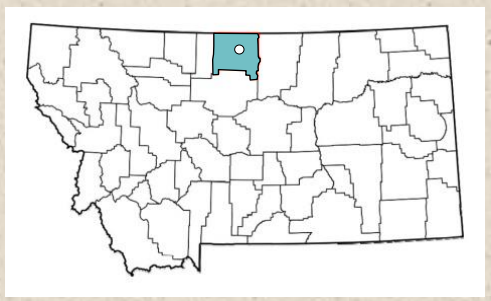
Campaign #2 – low NH_3 losses observed

- October 9, 2008 application, air-temp. 45 °F, dry soil surface
- no rain for 24 days and then Nov. 2-5 field site received 0.98”ppt.

1 wk post-fertilization
prills not dissolved

Campaign #2 - Kaercher farm





Mean Air Temp ~ 42 F

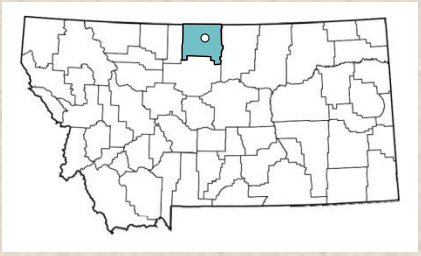
Mean Soil Temp ~ 41 F

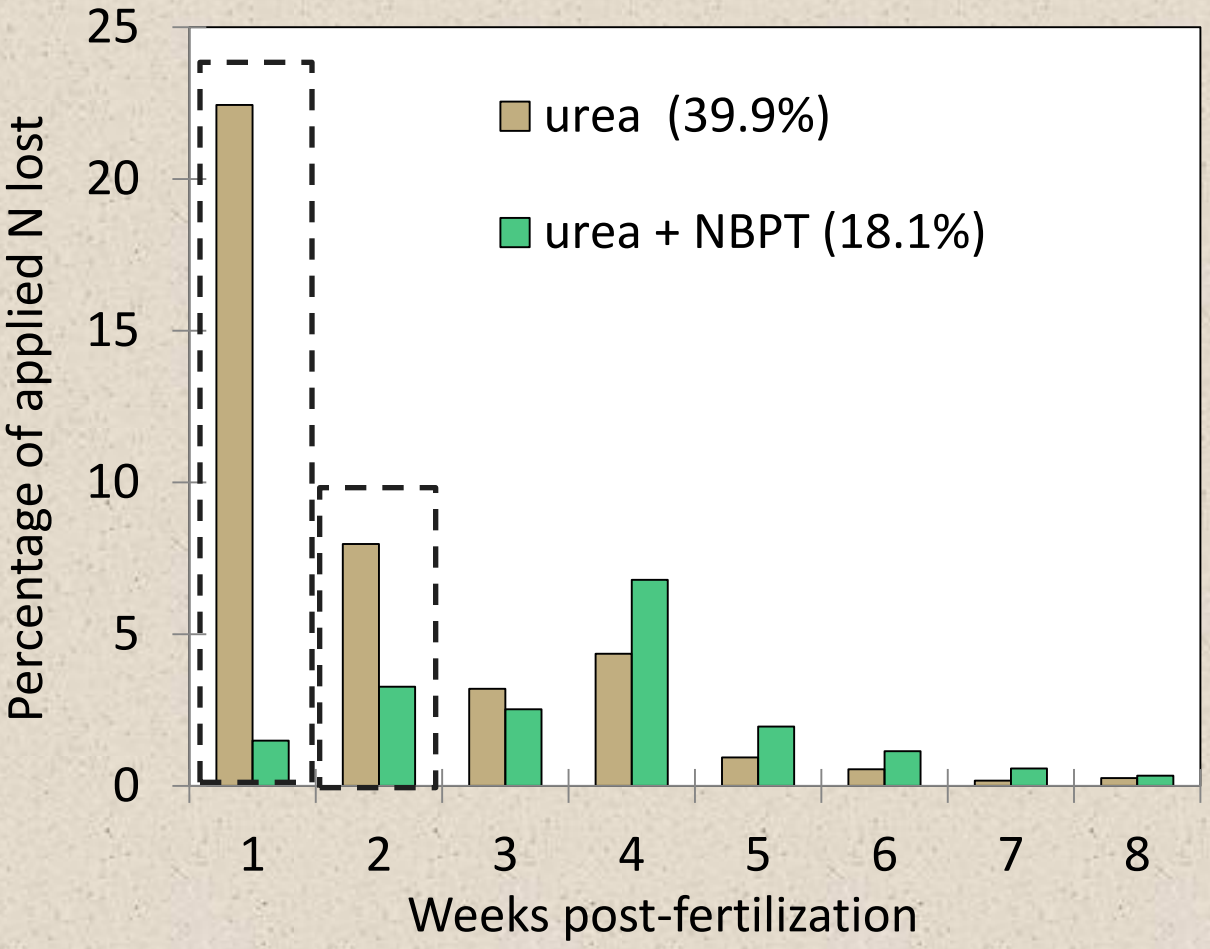
Campaign #5 - high NH_3 losses observed

Fertilizer applied on Mar 26, 2009
light snow on soil surface and air
temp = 21 F

soil surface with fertilizer prills
beginning to dissolve

Campaign #5 - Kaercher farm





Precipitation

no rain 0-2 wks

1.54" 2-8 wks

Mean temperature

Soil = 38 °F

Air = 39 °F

Conclusion: High losses observed even though temperatures were cold!

Summary (% N loss)

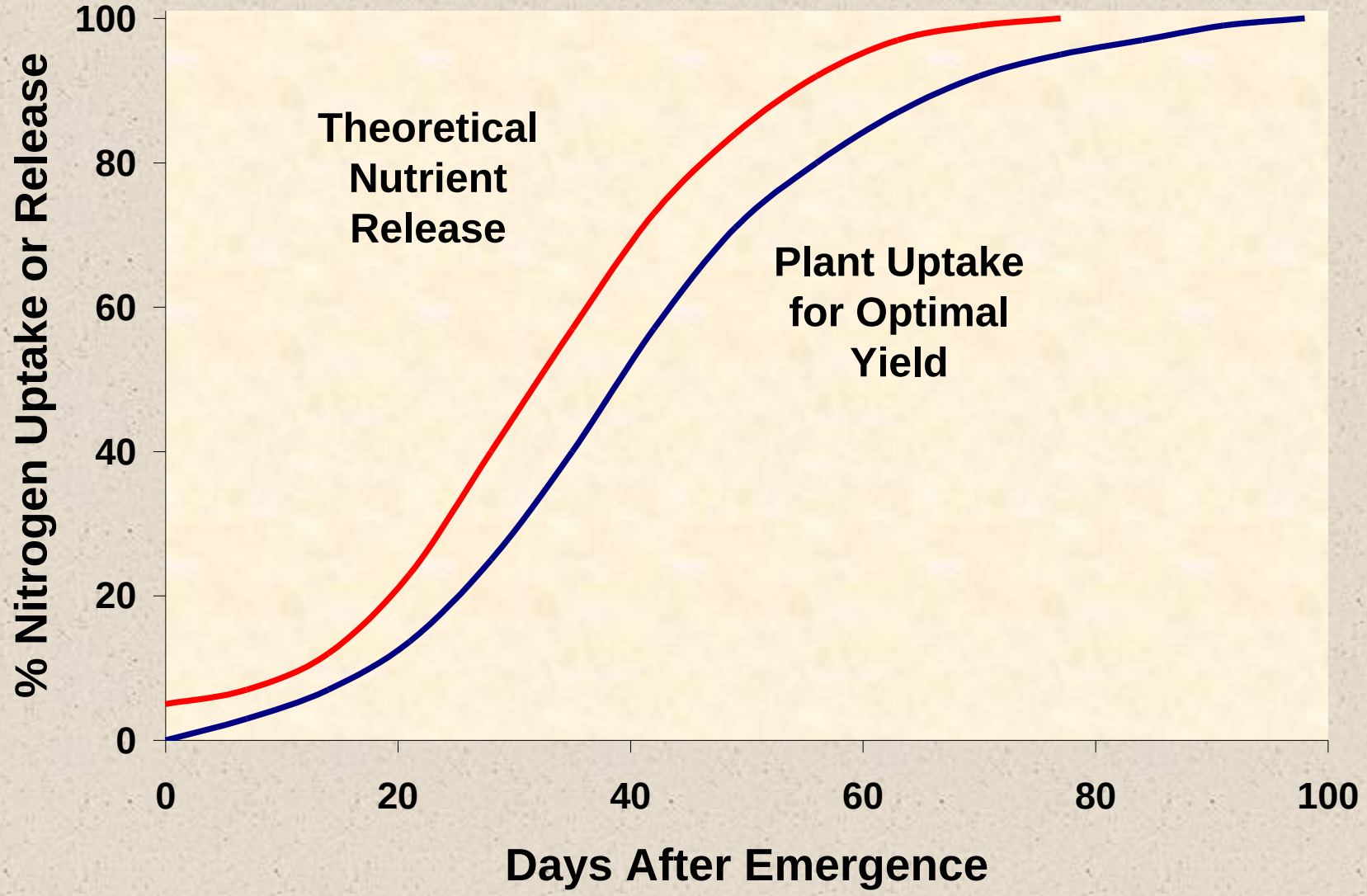
Campaign	Cooperator	Fertilization date	Urea	NBPT - urea
			--------- % ---------	
1	Kaercher	Apr 3, 2008	8.4	4.4
2	Kaercher	Oct 8, 2008	3.1	1.4
3	Peterson	Nov 14, 2008	31.5	4.0
4	Peterson	Mar 25, 2009	35.6	18.0
5	Kaercher	Mar 26, 2009	39.9	18.1
6	McCormick	Oct 6, 2009	10.7	3.3
7	Kaercher	Oct 13, 2009	10.4	4.8
8	Peterson	Oct 19, 2009	15.7	3.4
		Average	19.4	7.2

Take home messages on volatilization

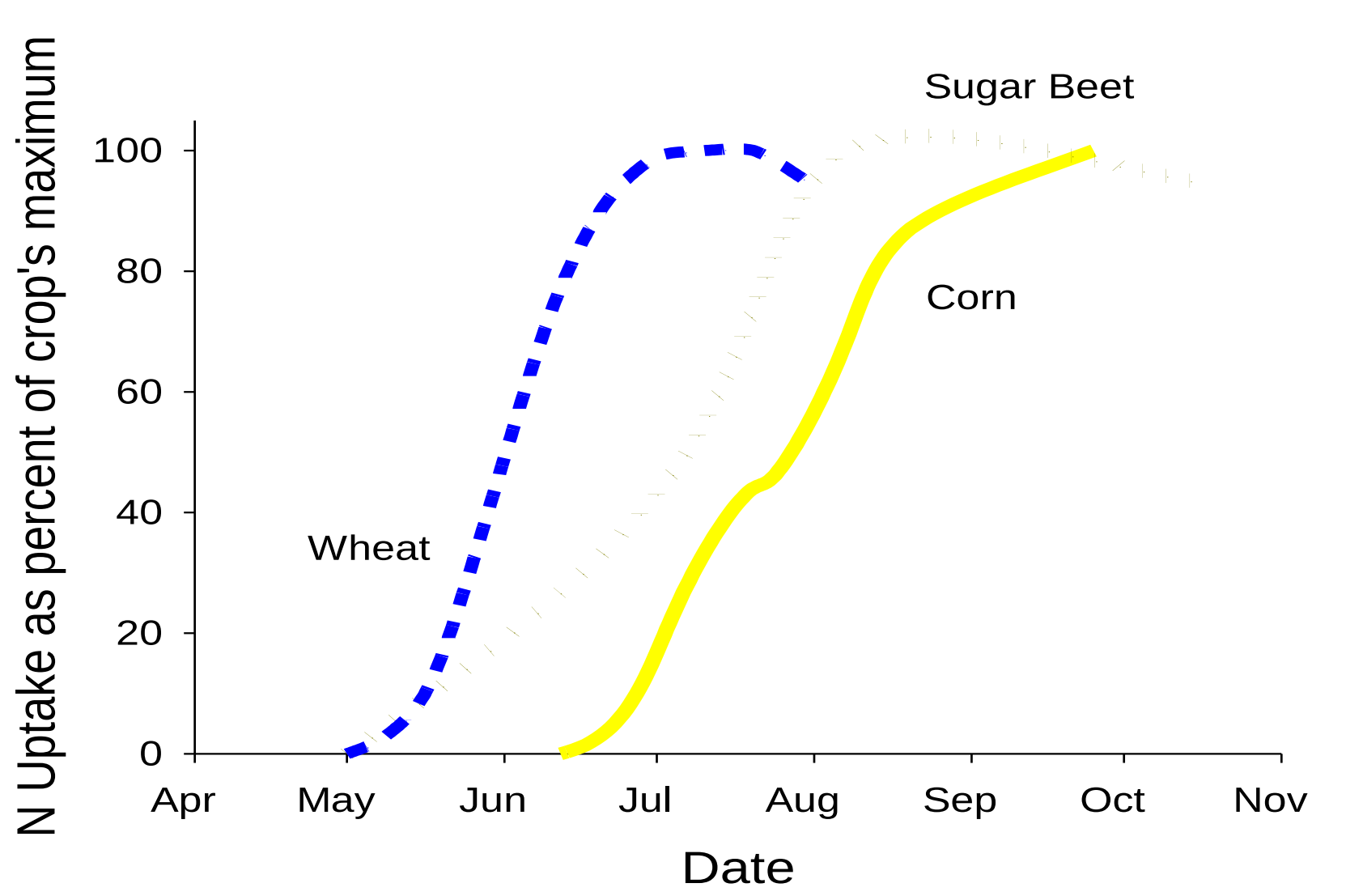
- Urea volatilized even from cool soils (surface temperature is important factor, not air temp)
- Applying urea to wet soils w/ no chance of precipitation resulted in highest loss rates
- Difference between Agrotain and urea treatment was about a 12% loss – Agrotain ‘premium’ is about 15%, but highly dependent on urea cost
- Several studies by G. Jackson in the 1990s showed little difference in yields between ammonium nitrate (low volatilization) and urea.
- I’ll need to revise EB0173 (Management of Urea Fertilizer to Minimize Volatilization).

Questions on Urea Volatilization?

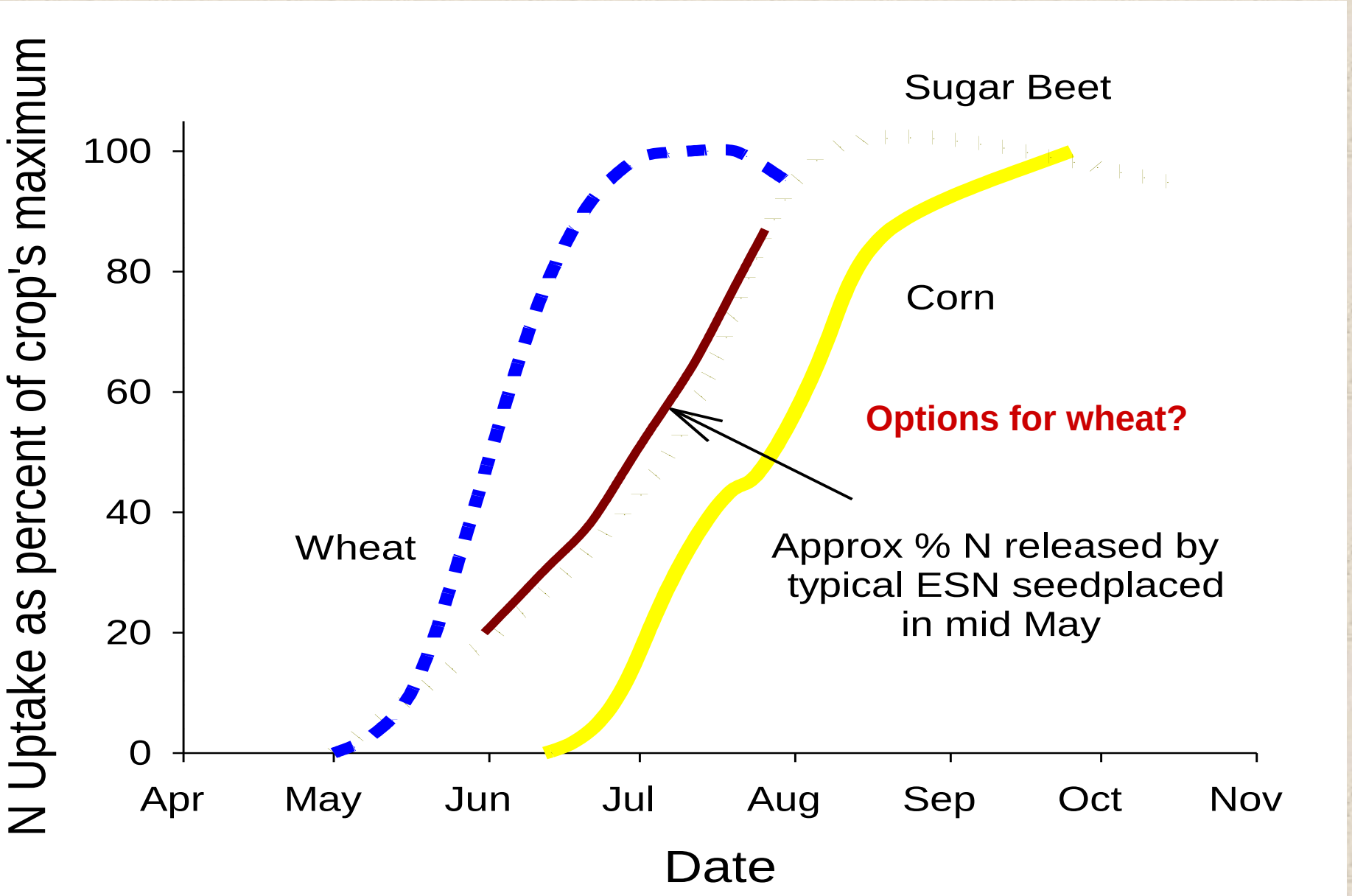
Nutrient availability from ideal slow release fertilizer



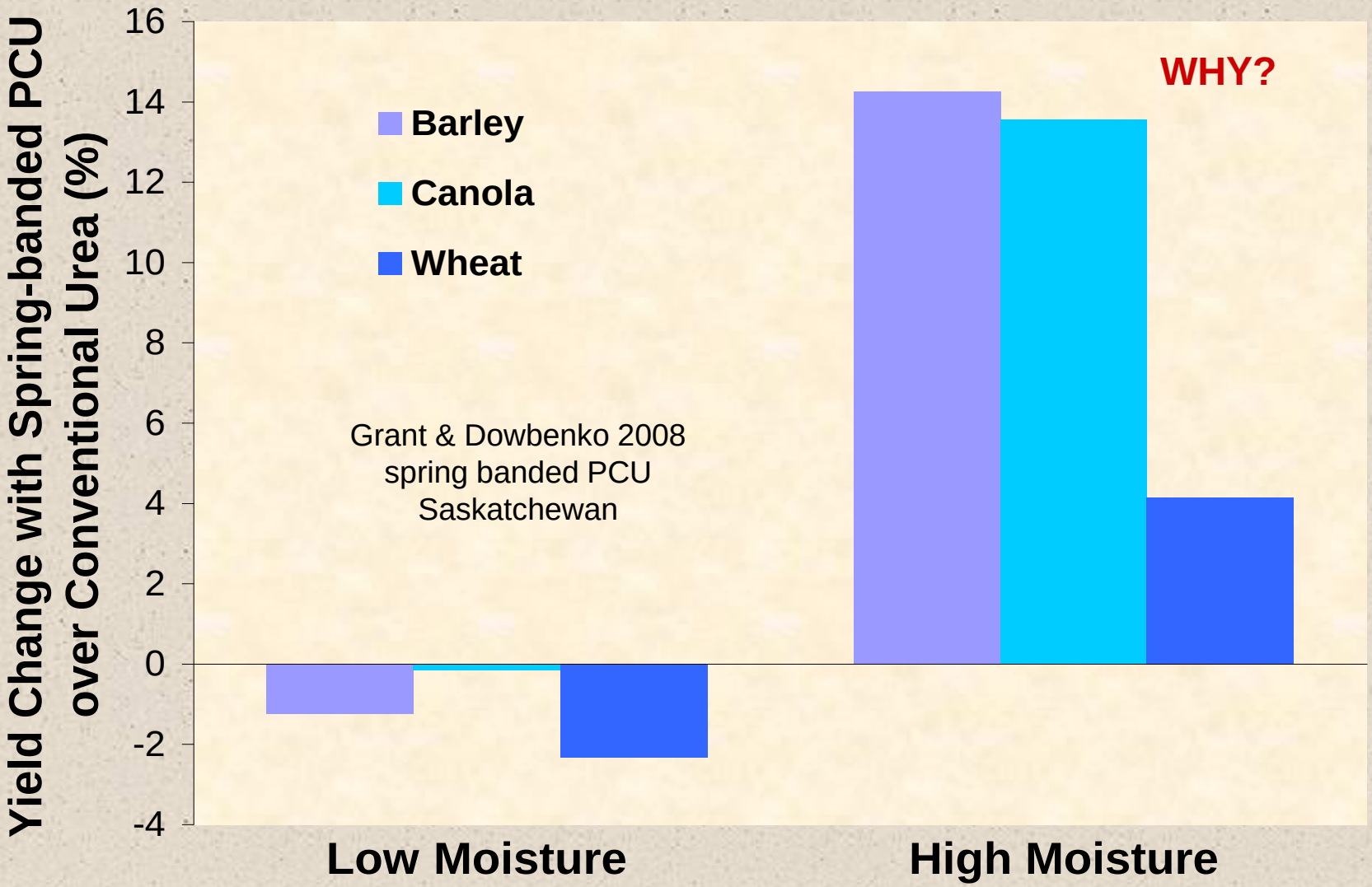
Timing of nutrient uptake by crops



Timing of ESN® nutrient release



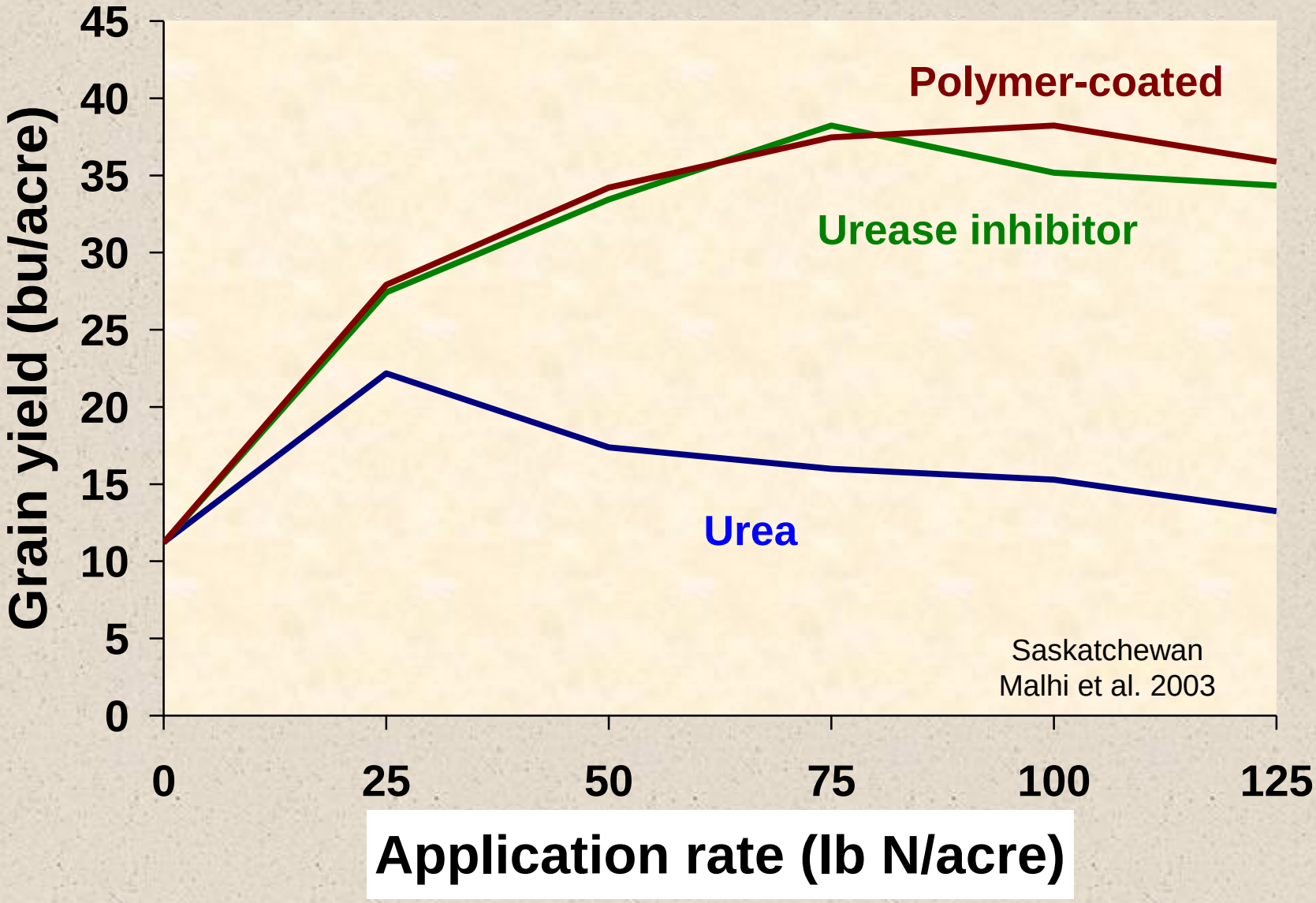
Effects of over-winter moisture conditions on effectiveness of PCU (i.e. ESN)



Seed placing EEFs

- Can apply ~ 2 – 4x as much slow release product as urea directly with small grain seeds
- Saves on field passes – fuel, labor, soil disturbance

Effect of N source applied with the seed on dryland spring wheat yield



Phosphorus EEF

- Types
  - Polymer coated
  - Avail® which reduces the rate of P mineral formation
- Limited regional research
  - Research in MT, ND, and SK has shown no benefit of Avail
  - Some barley yield increases observed in AB

Potential limitations of Avail®

- Mechanism may have difficulty in highly calcareous soils
- Existing soil properties may outweigh product ability

Ex: 100 lb MAP with Avail® contains < 0.25 lb of organic acids – the active ingredient

Organic acids occur naturally in soil, and are elevated in the root zone

Products other than ESN, Agrotain, and Avail

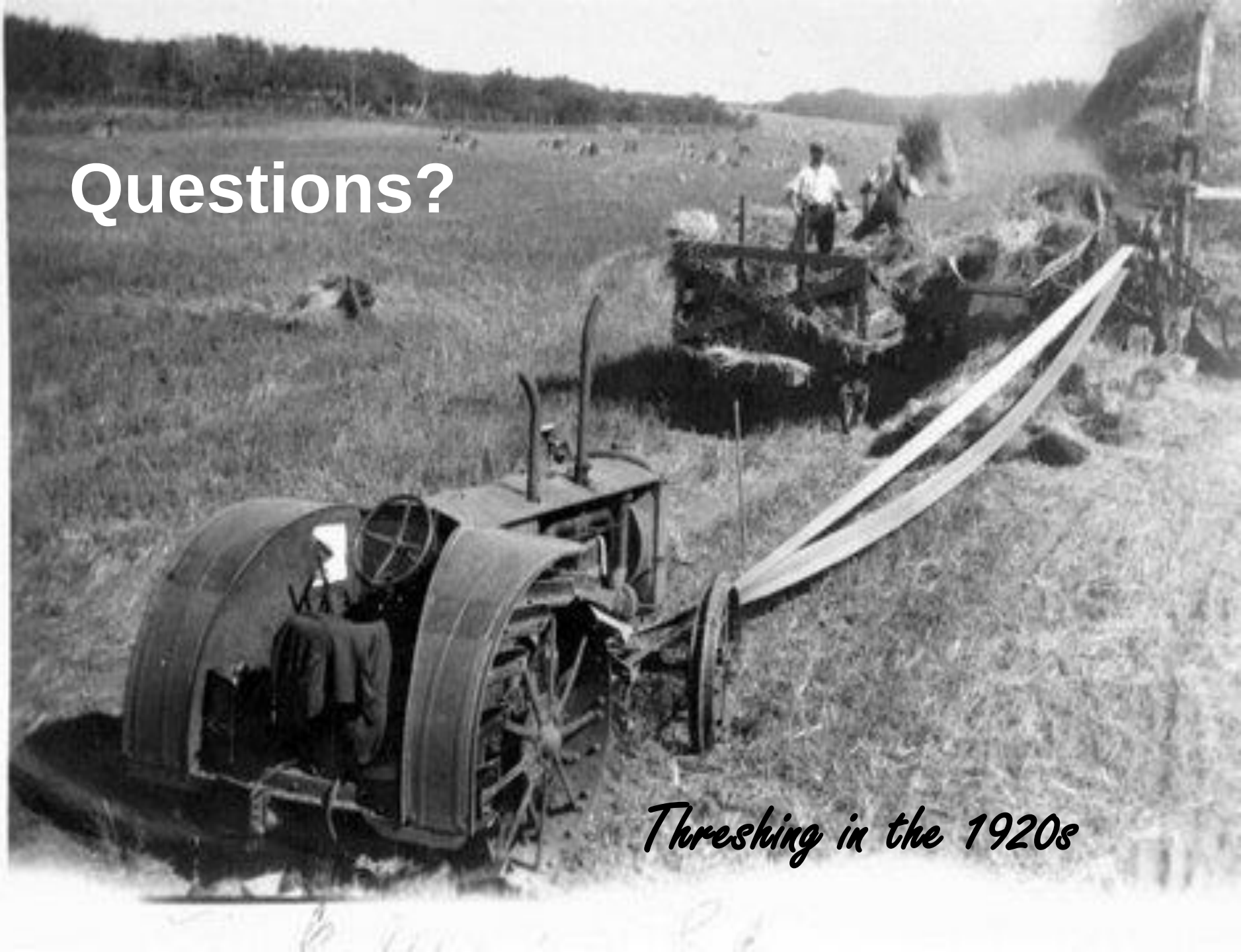
- Little to no regional research
- Express caution with growers until research data set grows

Conclusions

- Enhanced efficiency fertilizers (EEFs) will not always increase yields and nutrient recovery.
- Improved EEFs and blending with conventional fertilizer may provide a good match between crop uptake and fertilizer availability.
- More EEF can be placed with the seed than conventional fertilizer
- EEFs can reduce losses to the environment, especially in wet soils.

Additional info in:

Enhanced Efficiency Fertilizers (EB0188)
http://landresources.montana.edu/soilfertility
Go to Fertilizer Information


Questions?
Threshing in the 1920s