Optimizing returns from your fertilizer investment-broadcast, banding, fertigation and source

Prepared for 2009 Montana/Wyoming Sugarbeet Symposium

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MONTANA STATE UNIVERSITY EXTENSION

Goals today

- Review mobility of plant nutrients
- Discuss potential nitrogen (N) and phosphorus (P) losses
- Show data on the effects of N placement and source on sugarbeet sucrose yield and rotation crop yield and quality
- Show results on effects of P placement

There are 14 mineral nutrients that have been found to be essential for growth of most plants:

Macronutrients	Micronutrients
Nitrogen (N)	**Boron (B)**
Phosphorus (P)	**Chloride (Cl)**
Potassium (K)	**Copper (Cu)**
Sulfur (S)	**Iron (Fe)**
Calcium (Ca)	**Manganese (Mn)**
Magnesium (Mg)	Molybdenum (Mo)
	Nickel (Ni)
	Zinc (Zn)

The macronutrients are simply needed in larger amounts by the plant than the micronutrients.

Nutrient deficiencies of the bolded nutrients have been observed in Montana

Mobility in soil of selected nutrients

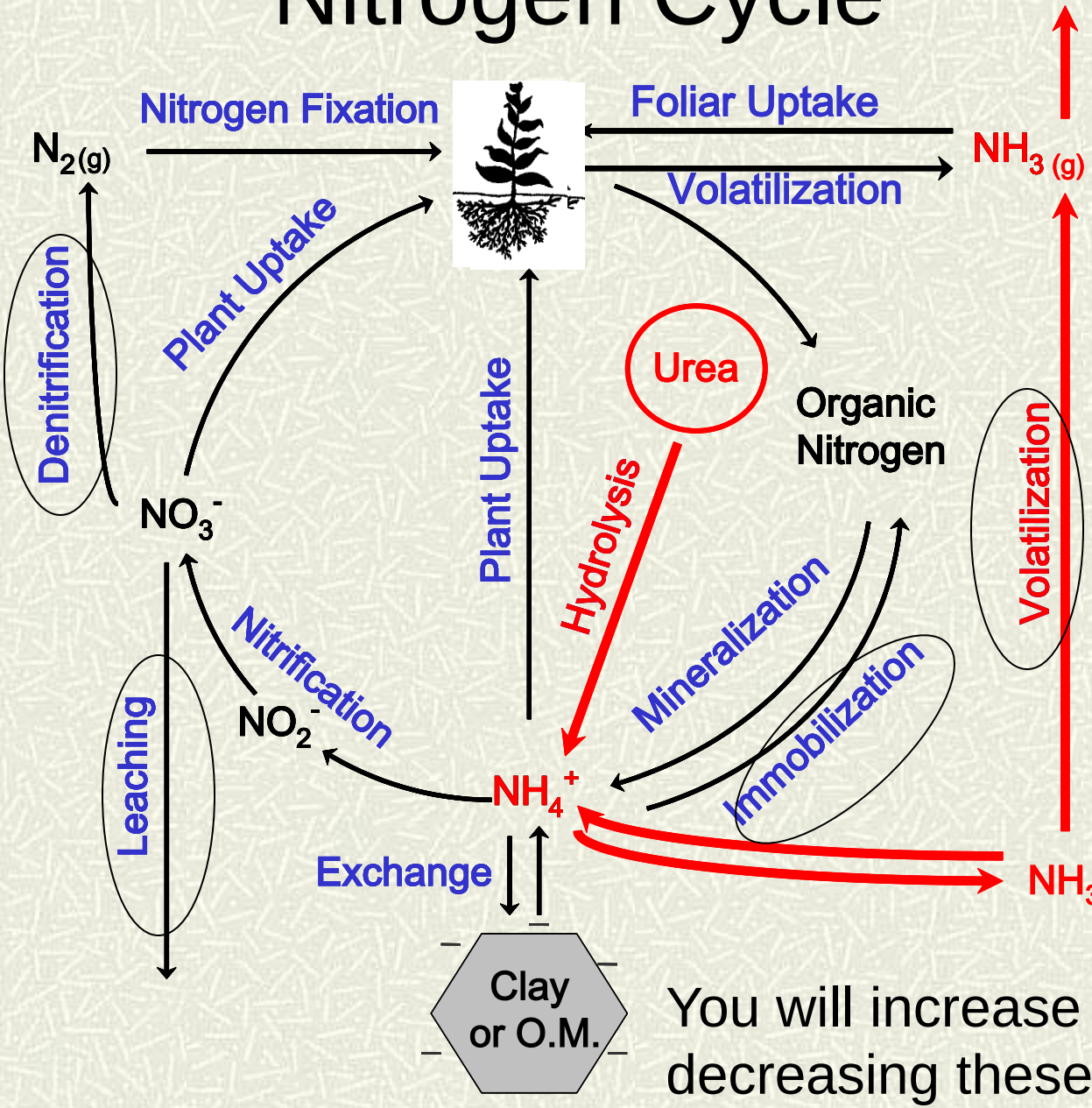
Mobile (and soluble)	Relatively immobile	Very immobile (and insoluble)
Nitrogen (as nitrate) Sulfur Boron Chloride	Potassium	Phosphorus Copper Iron Manganese Zinc

Why important? **Can affect optimum fertilizer placement**

So how do I optimize my return on my fertilizer investment?

- Optimize yield and quality
- Reduce fertilizer losses

Nitrogen Cycle

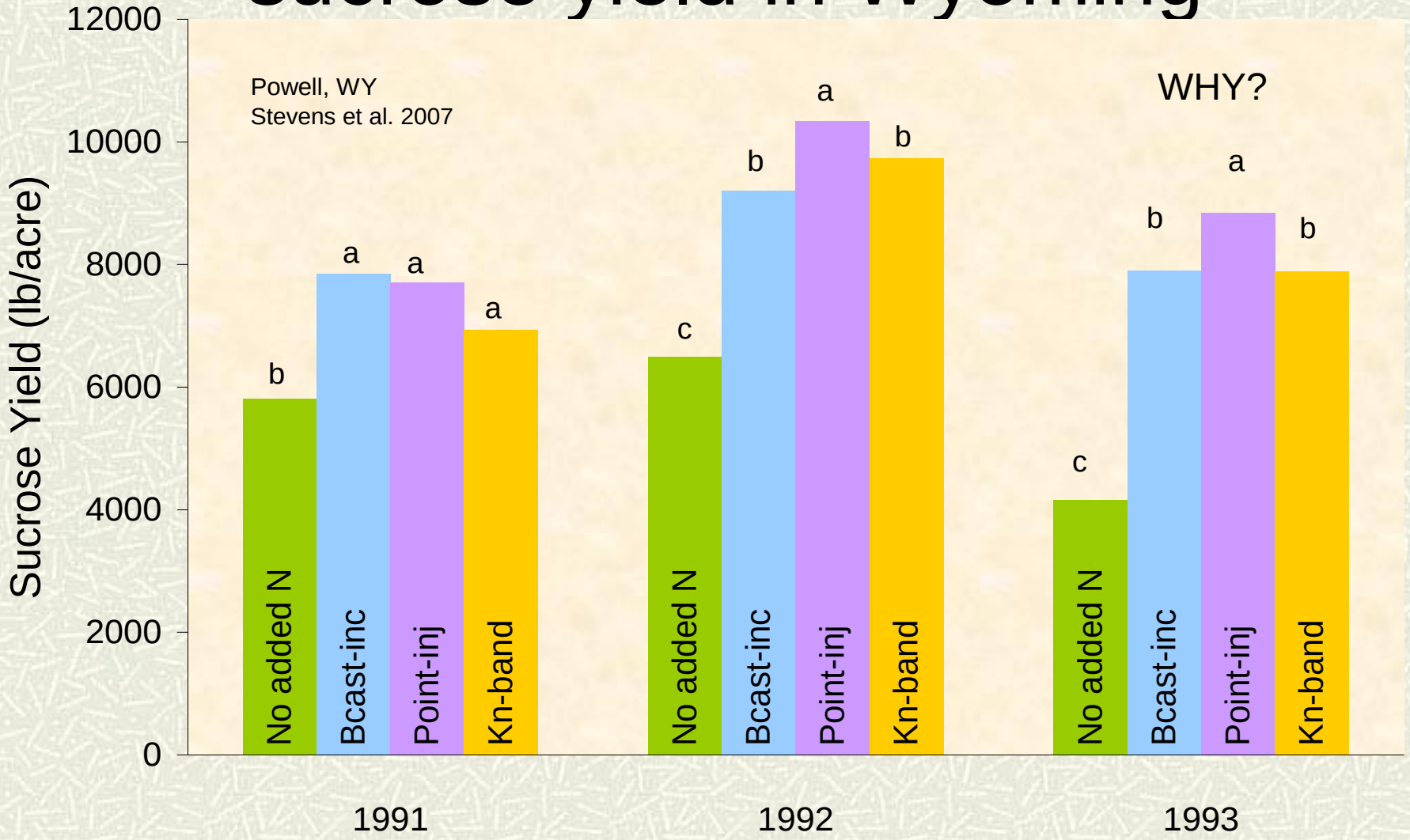


You will increase your ROI by decreasing these losses

Fertilizer Placement Methods

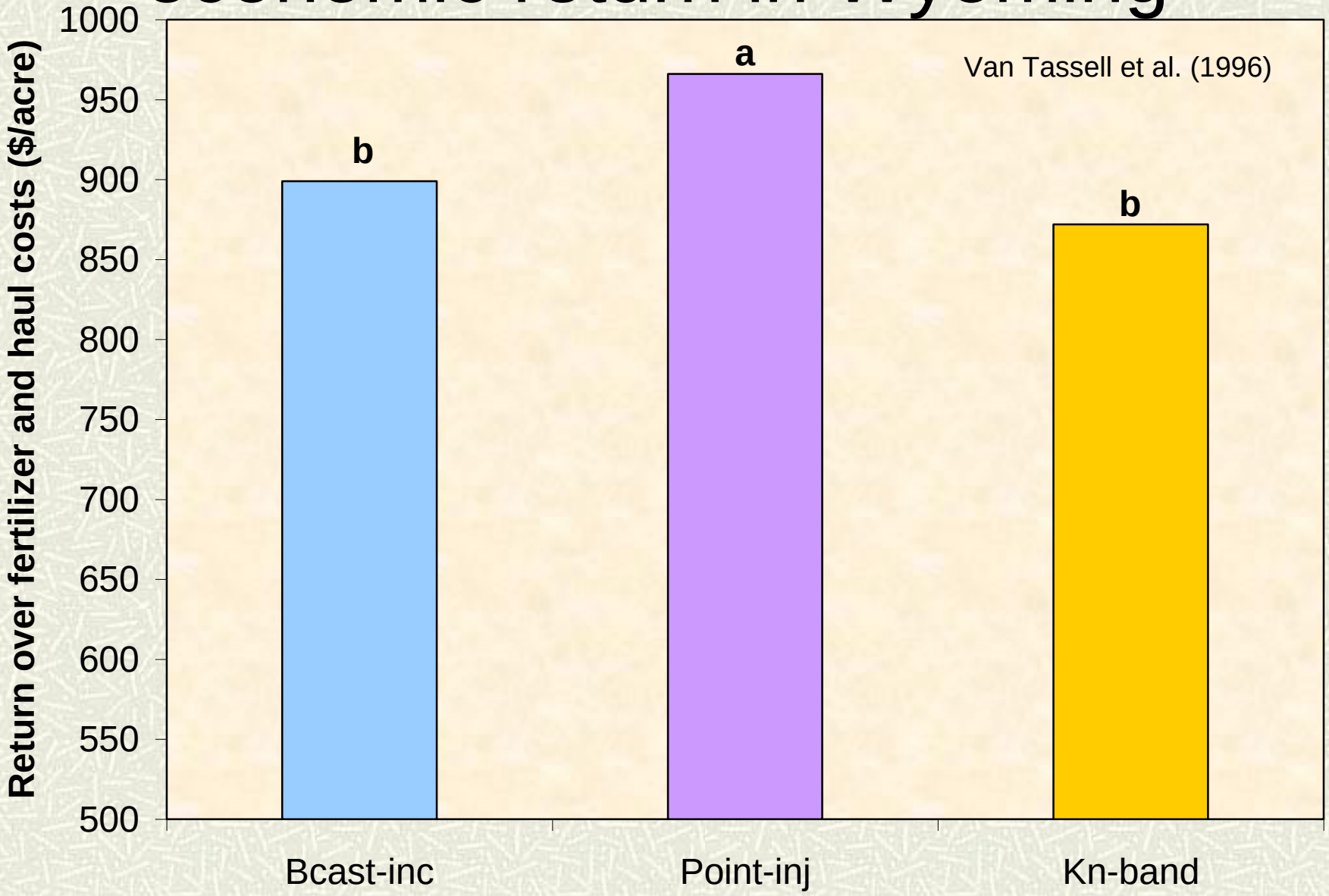
- Broadcast
- Broadcast/Incorporated
- Banded
- Injected (ex: spoke)
- Fertigation/Foliar

Effect of N placement on sugarbeet sucrose yield in Wyoming

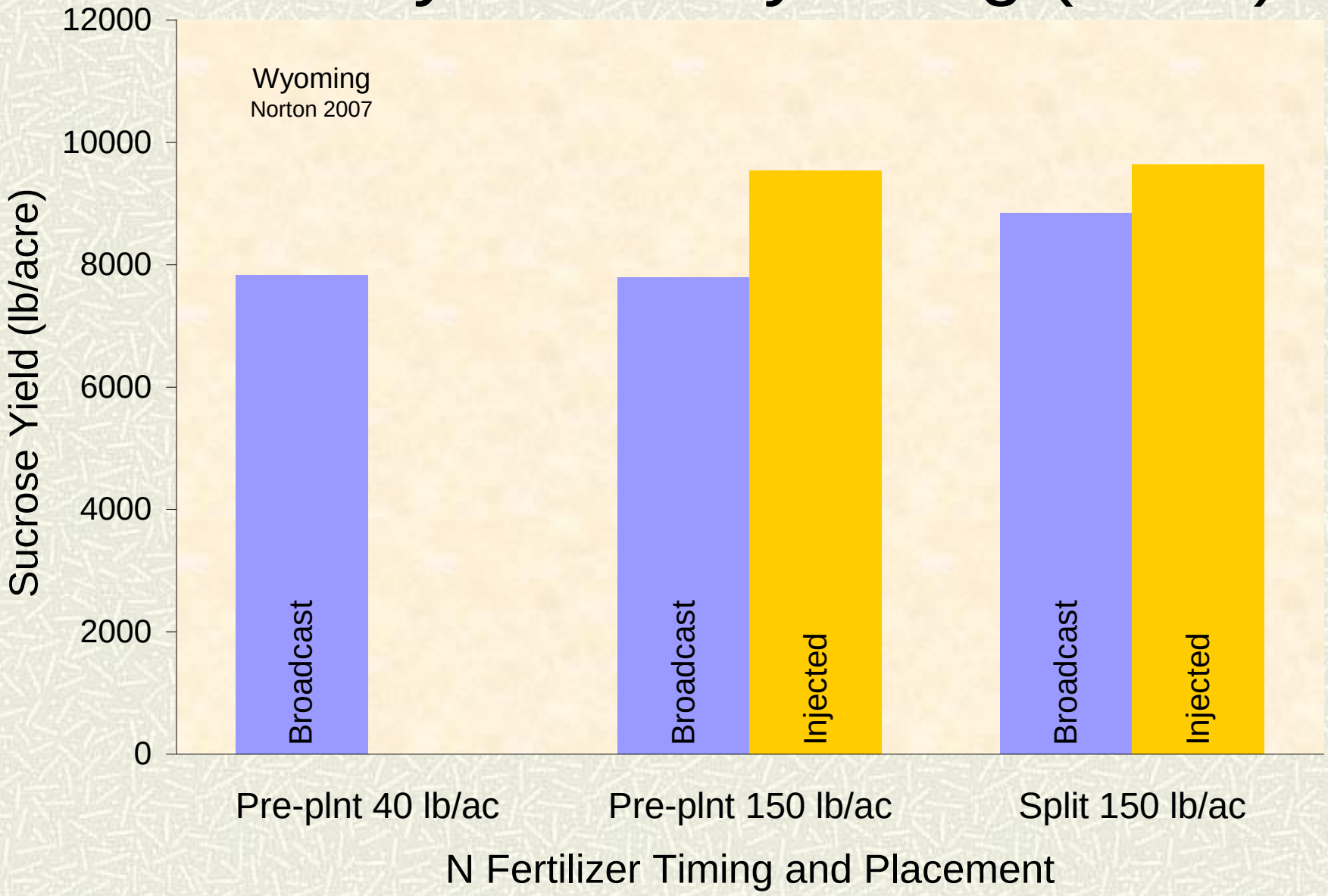


PI was 3” to side of seed and 3” below surface

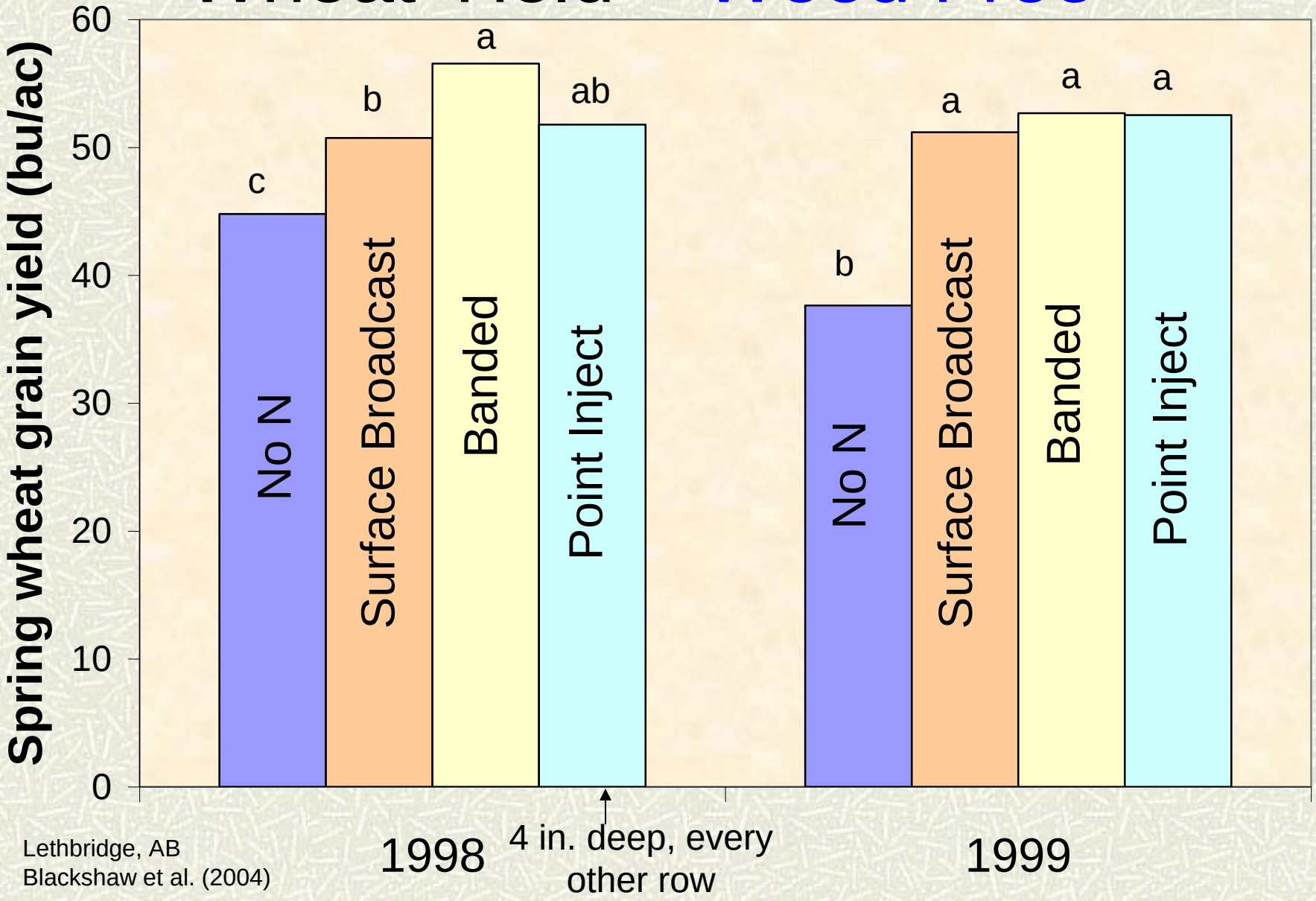
Effect of placement method on economic return in Wyoming



Effect of 28-0-0 placement on sucrose yield in Wyoming (2007)

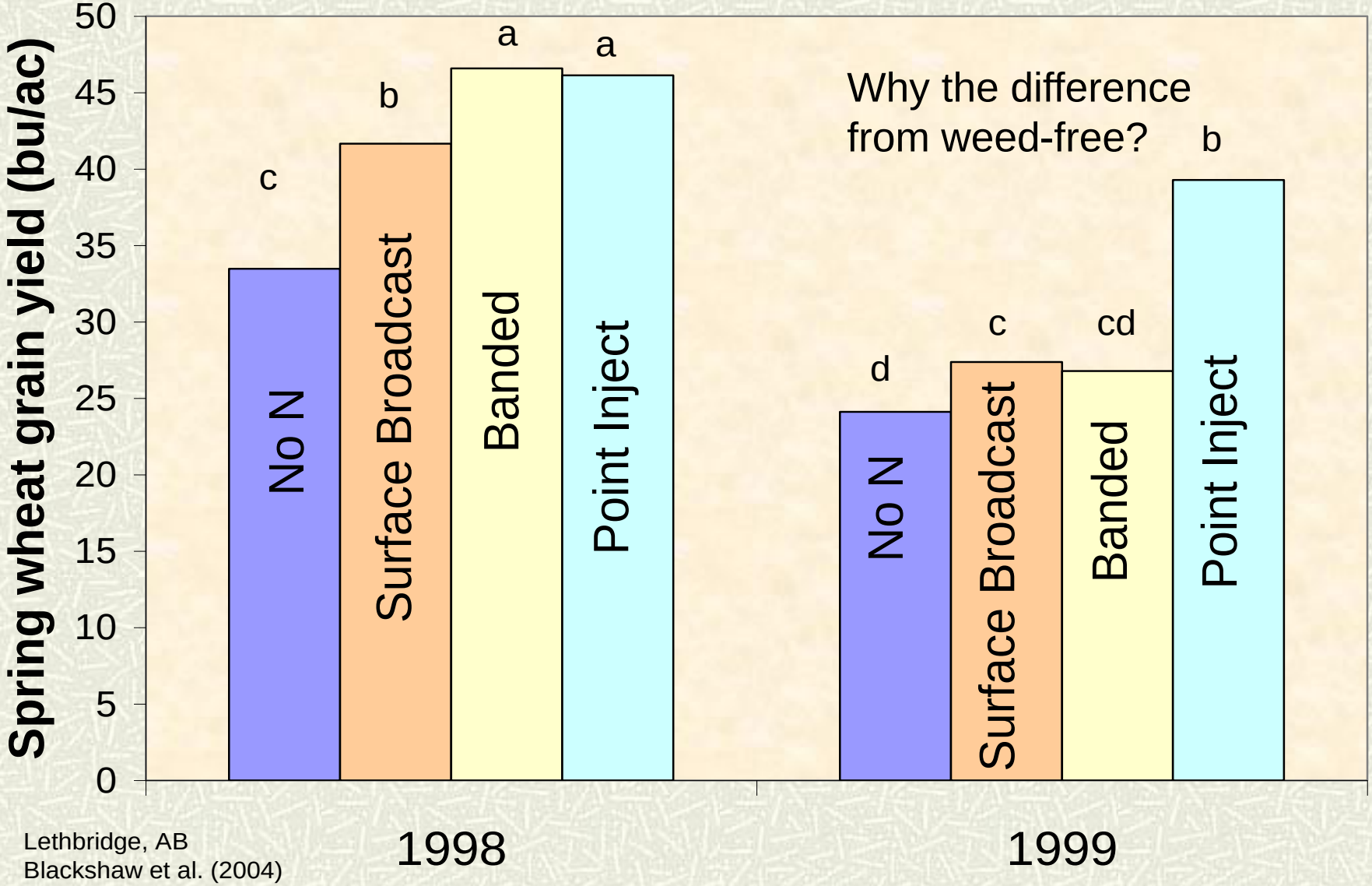


Effect of Placement on Spring Wheat Yield – Weed Free



Lethbridge, AB
Blackshaw et al. (2004)

Effect of N Placement on Spring Wheat Yield-With Wild Oats



Lethbridge, AB
Blackshaw et al. (2004)

Enhanced Efficiency Fertilizers

- Two major types:
  slow release (ex: ESN, NSN, NRG)
  urease inhibitors (ex: Agrotain)
- Should you consider using them?

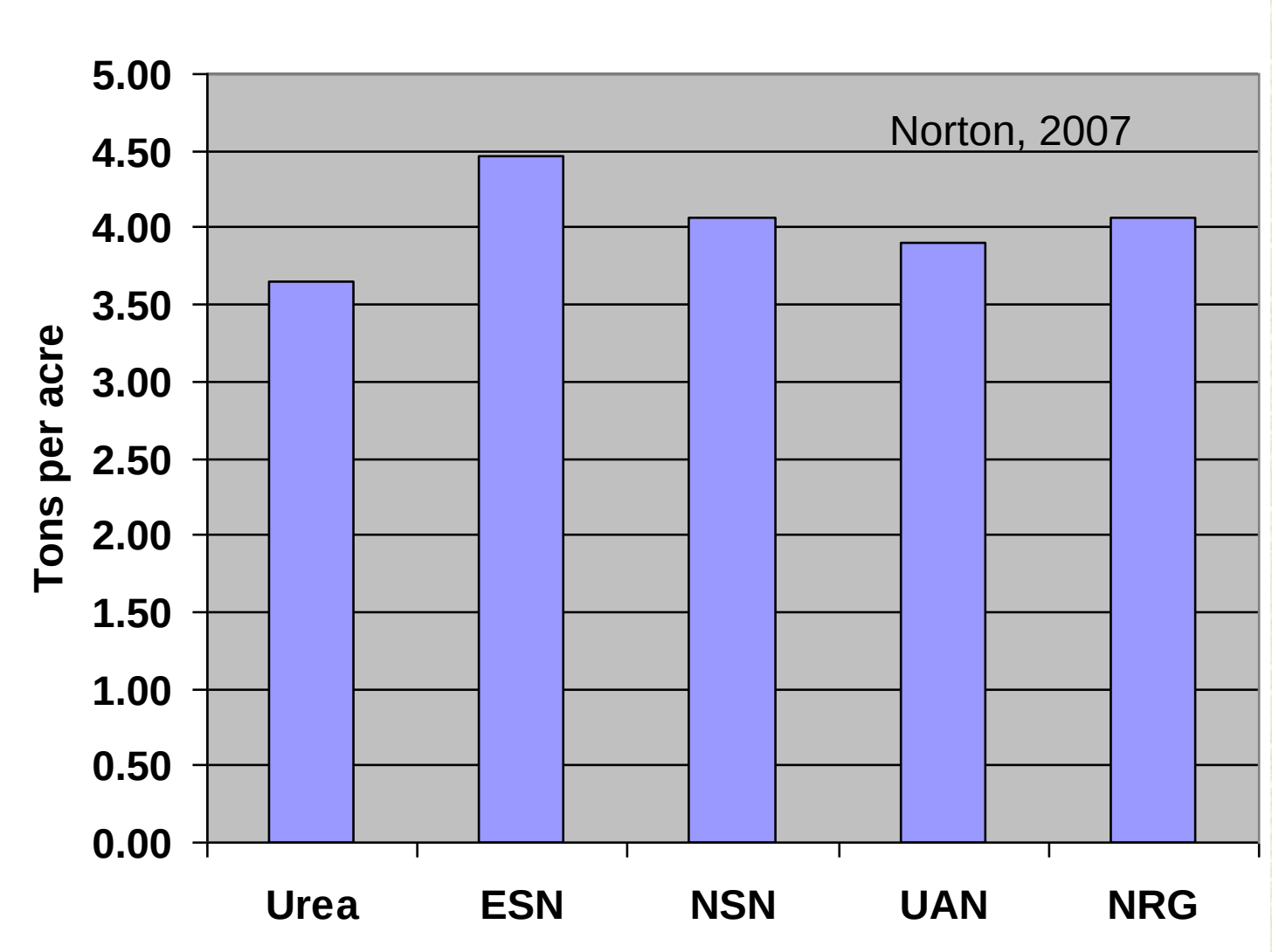
  Yes: on warm season, irrigated crops

  Maybe: on cool season crops

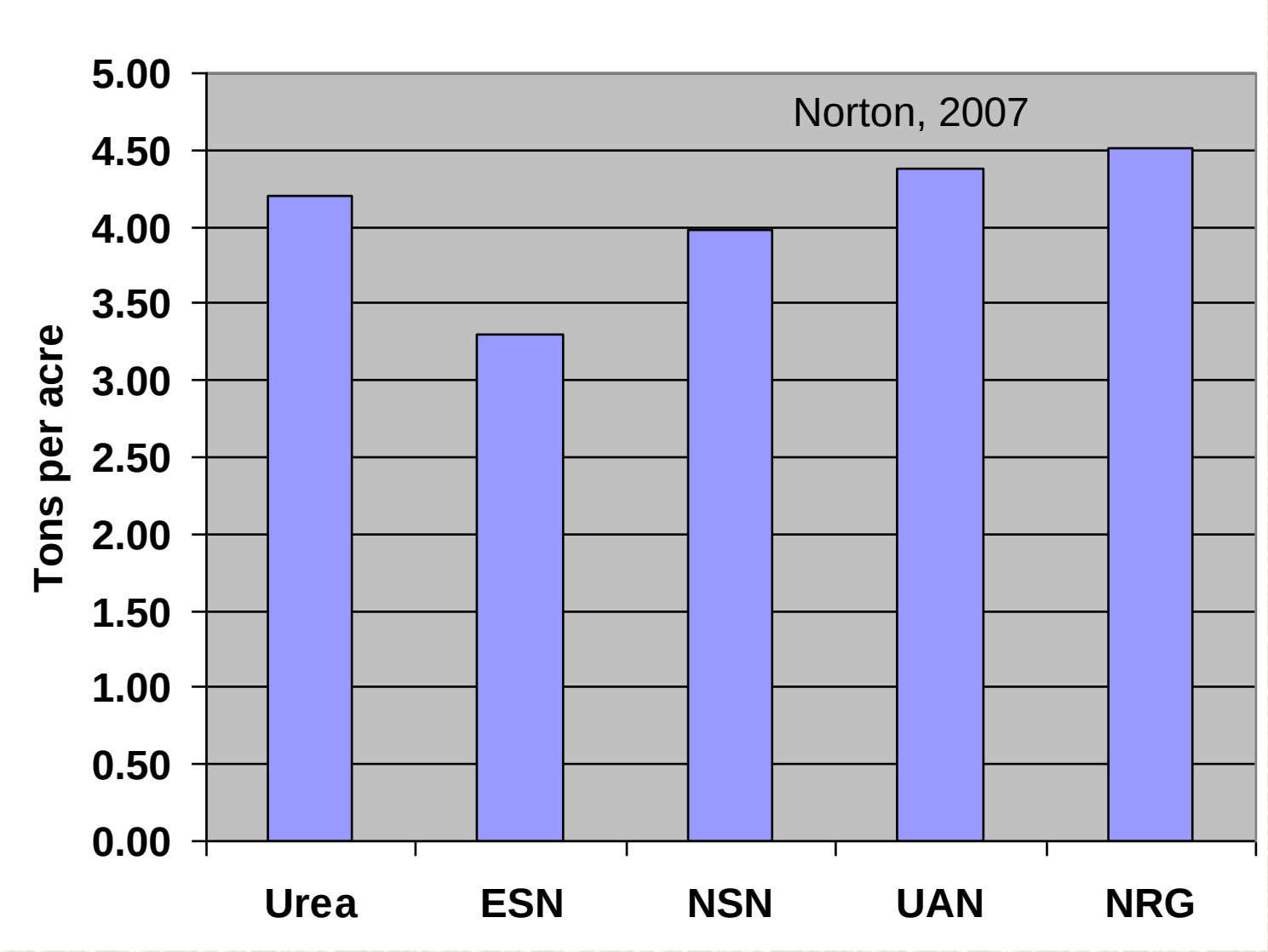
  Downside-N release often occurs too late to match N uptake and could decrease sucrose content or increase malt barley protein

  Upside-can apply ~2 – 4x as much slow release product as urea directly with small grain seeds

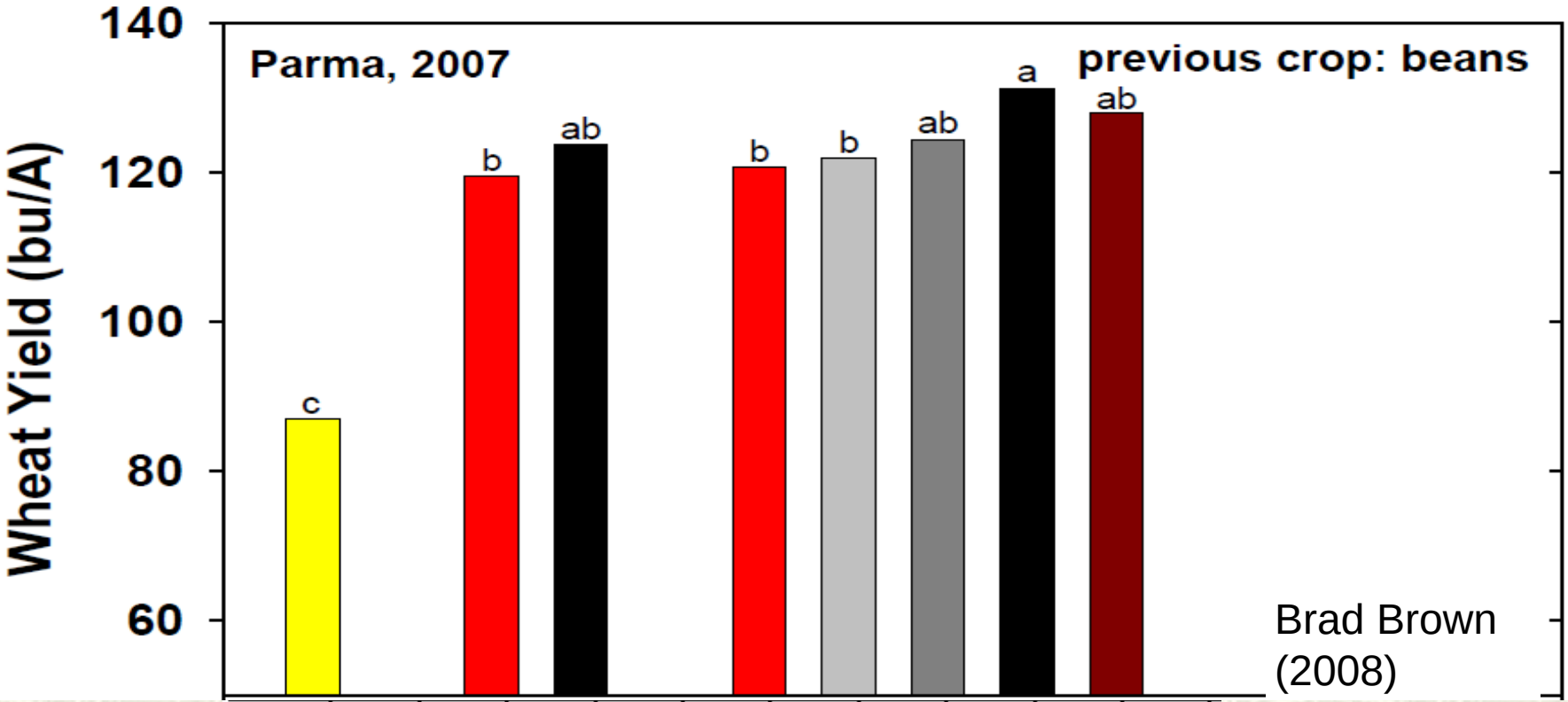
Effect of N source (pre-plant broadcast) on sucrose yield in Wyoming (150 lb N/ac)



Effect of N source using a split application on sucrose yield in Wyoming (150 lb N/ac)

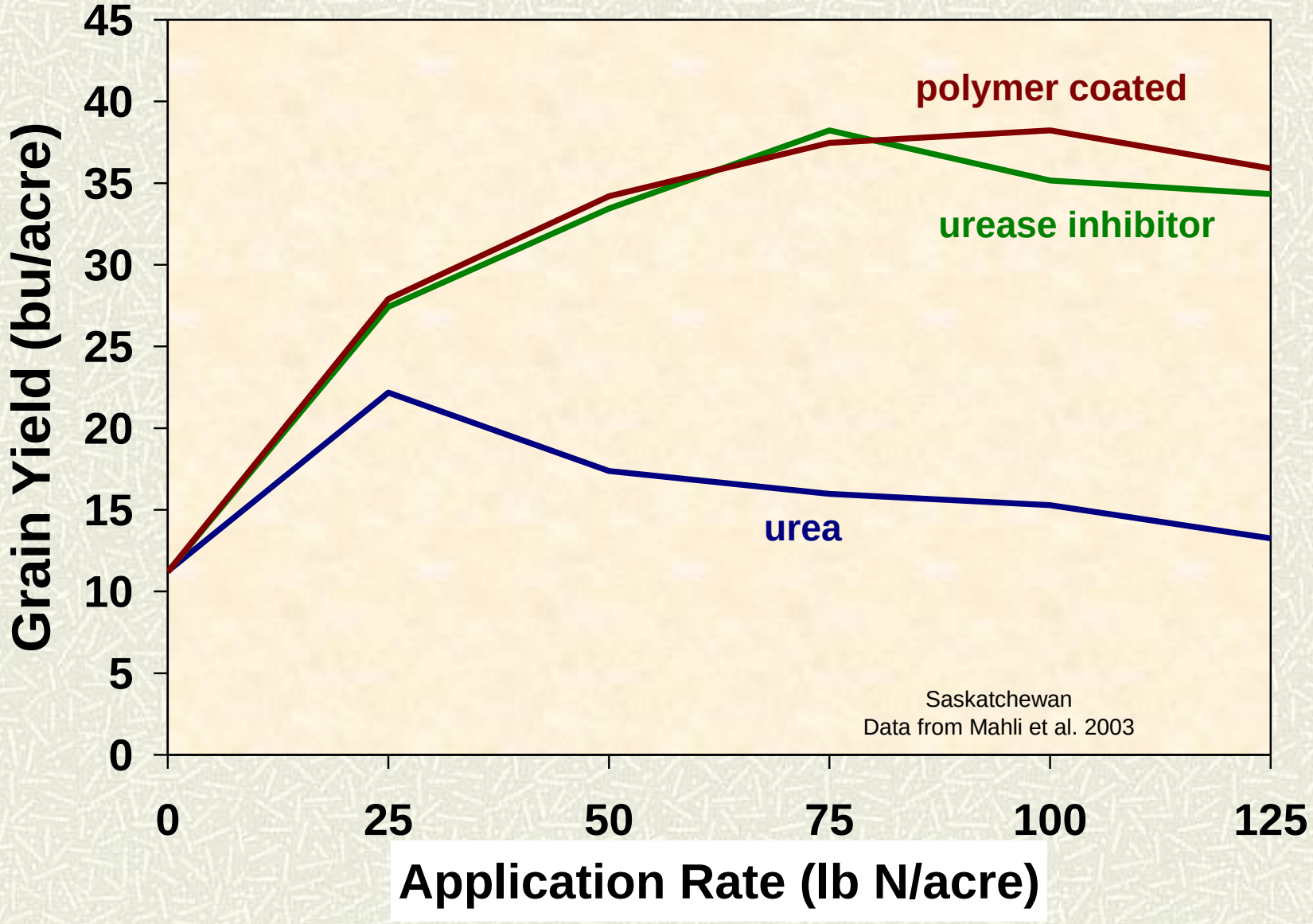


Effect of ESN and urea on irrigated spring wheat grain yield



Brad Brown (2008)

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



Foliar Application/Fertigation

- Some N can be absorbed through leaves
- However, most foliar applied N ends up being washed off and taken up by roots:

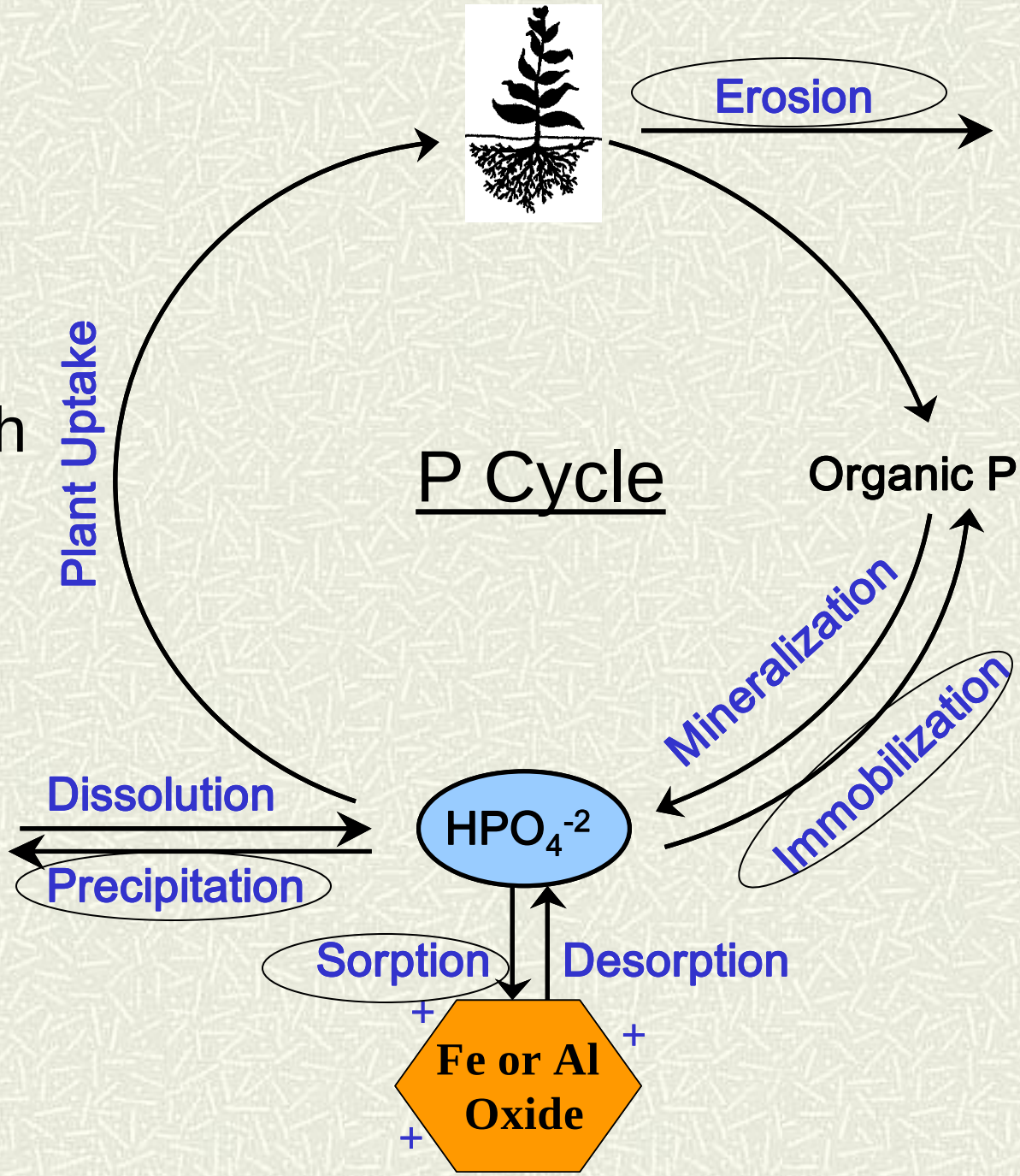
  -Only 8-11% of foliar applied liquid urea was taken up by leaves, whereas 37-67% of soil-applied N was taken up by plant in same study (Rawluk et al., 2000).
- Risk of burn if > ~ 20 lb N/ac (crop dependent). Yield losses at higher rates (40-60 lb N/ac).

Questions on Nitrogen?

Phosphorus

Movement of P is largely through erosion/runoff, NOT leaching. Why?

P binds strongly to soil



Banding vs Broadcast Phosphorus

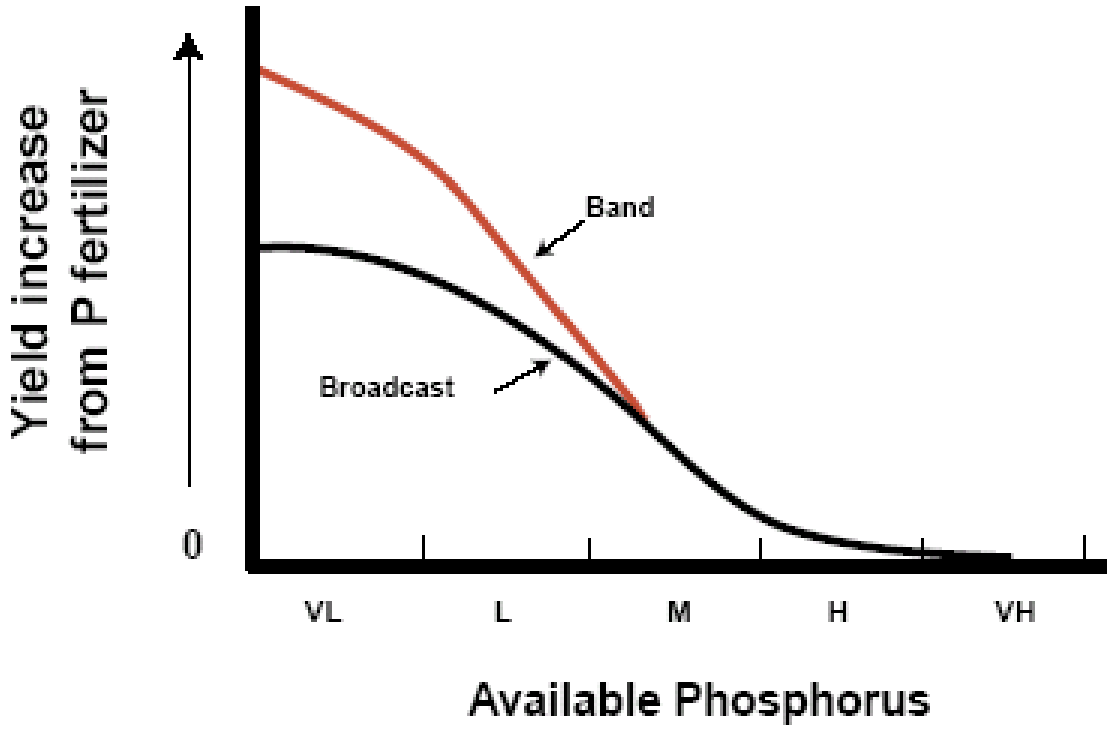
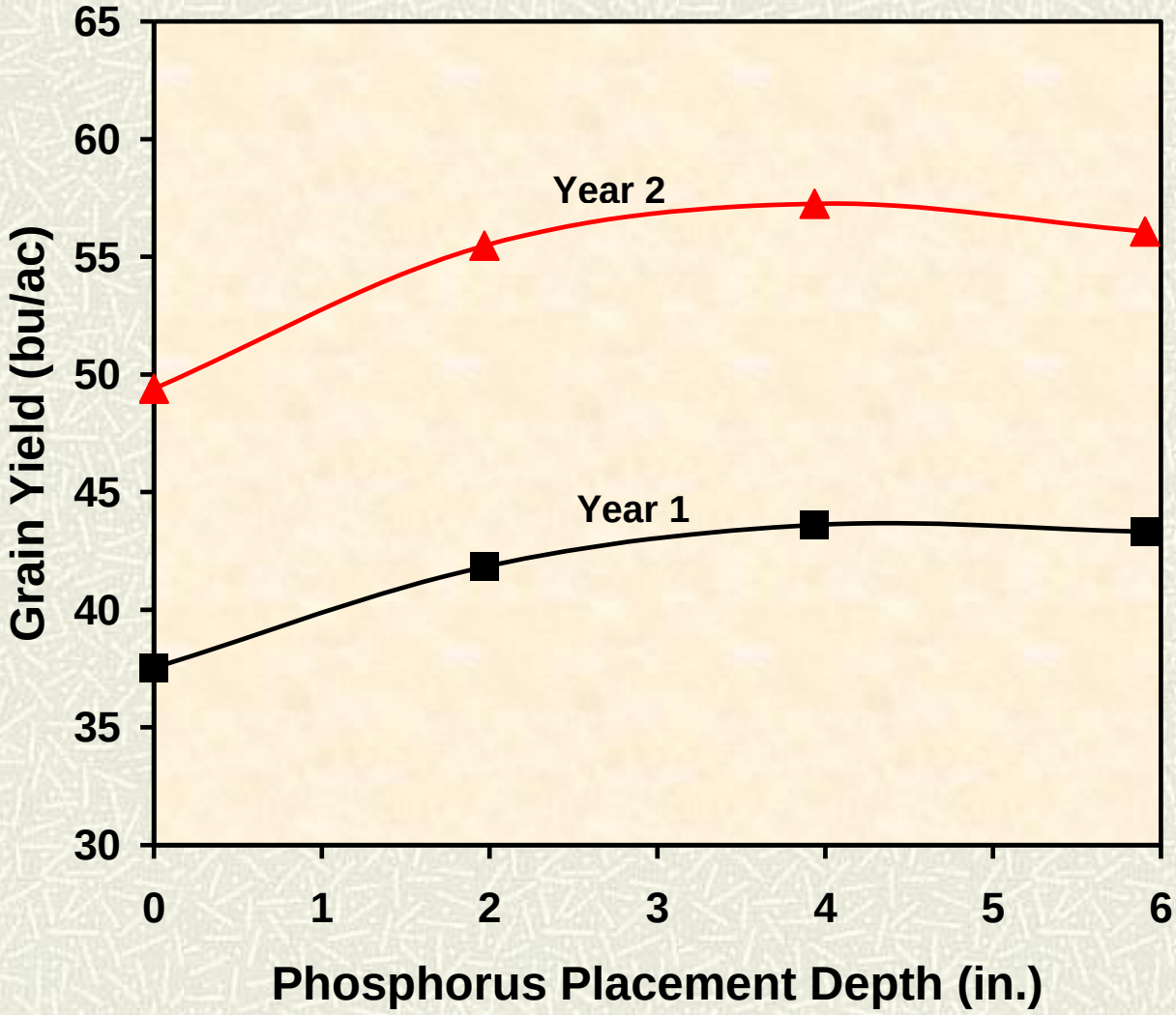


Figure 7. The advantages of P banding are greatest when STP levels are very low (VL) to low (L). From Randall and Hoeft (1988).

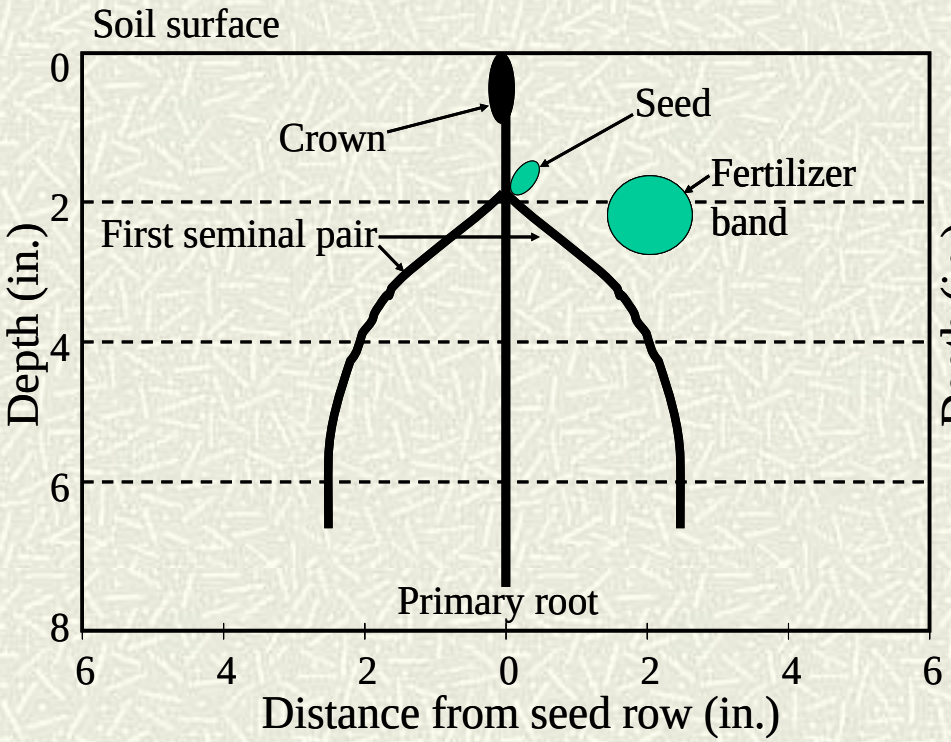
Banding P is much more effective than banding N, because P is much more immobile in the soil.

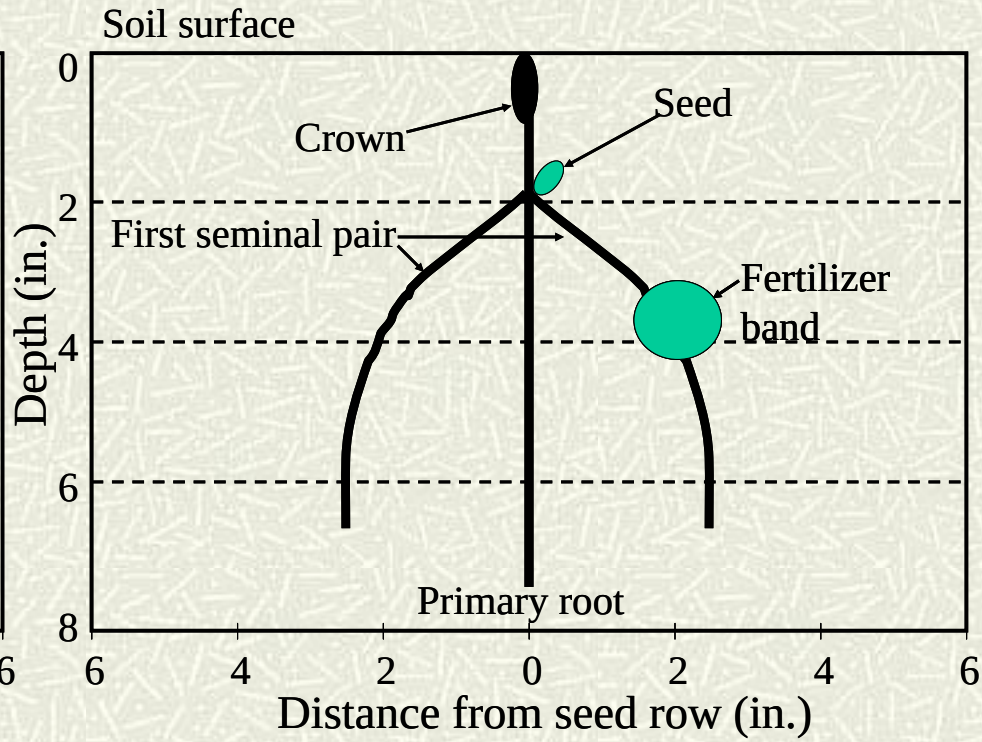
Effect of P banding depth on winter wheat grain yield



McConnell et al. 1996

Effect of P banding depth on small grains





QUESTIONS?

Conclusions

- Banding or injecting N often produces higher crop yields and lower weed density.
- Fertigation and foliar application allow for in-season N application, but do not result in much foliar uptake.
- Enhanced efficiency fertilizers (EEFs) have not produced consistently higher yields but more research is needed.
- More EEF can be placed with the seed than conventional fertilizer, possibly saving a fertilizer pass and fuel costs.
- Phosphorus should be banded near the seed to optimize yields especially if soil test is < ~12 ppm.

For additional information

- Soil Fertility Website:

  http://landresources.montana.edu/soilfertility

QUESTIONS?