Green Manures: Effect of Termination Strategy and Organic Phosphorus Fertilizer on Subsequent Crop

Prepared for Montana Organic Association
2007 Annual Conference

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www.montanaorganicassociation.org

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Objectives

- Discuss nutrient dilemma facing organic farmers
- Show Montana research results on the effect of green manures on subsequent yields and nutrient availability
- Discuss recommendations based on different goals

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

How many of these 14 can be ‘grown’ (and won’t need to be replaced with fertilizer)?

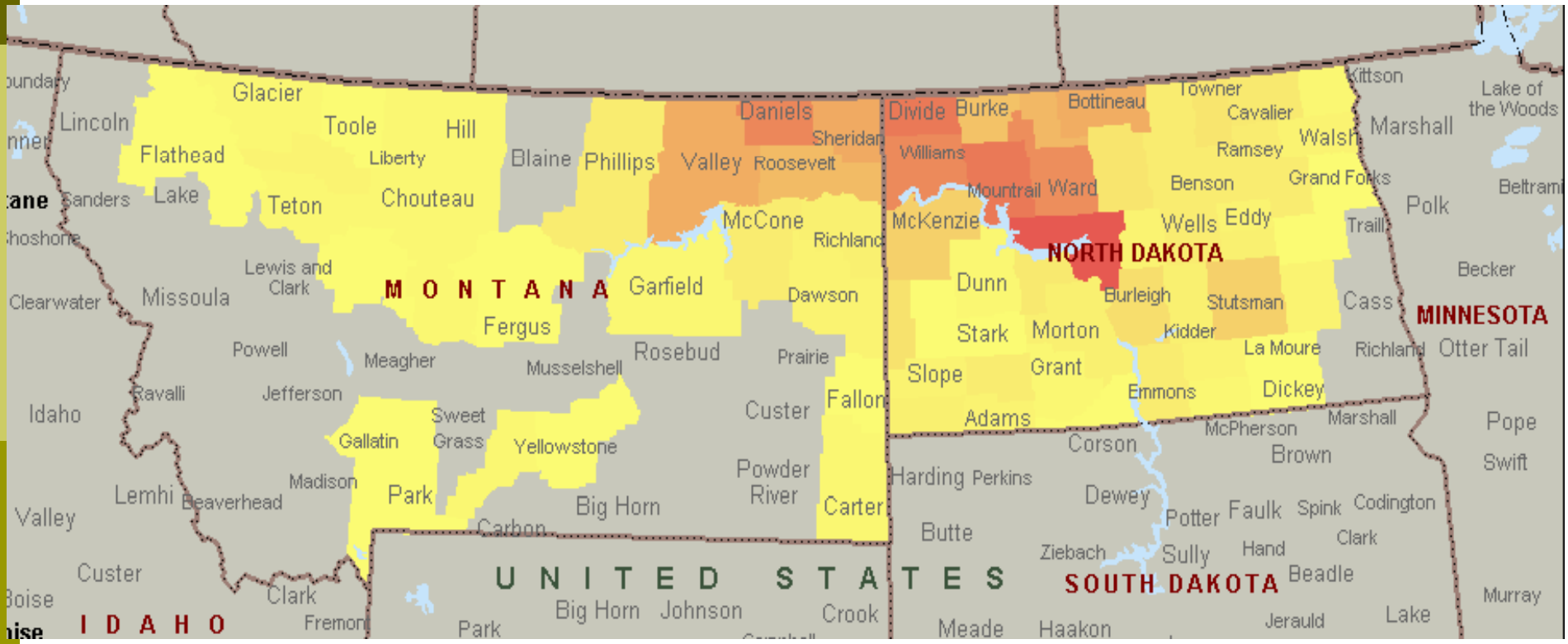
Green Manures (ex: alfalfa, clover, pea, buckwheat)

- Positive: Replenish N supply w/ N fixation
- Positive: May increase P availability?
- Negative: No immediate economic benefit
- Negative: Use soil water, especially perennial legumes

Questions asked by organic farmers and Perry Miller

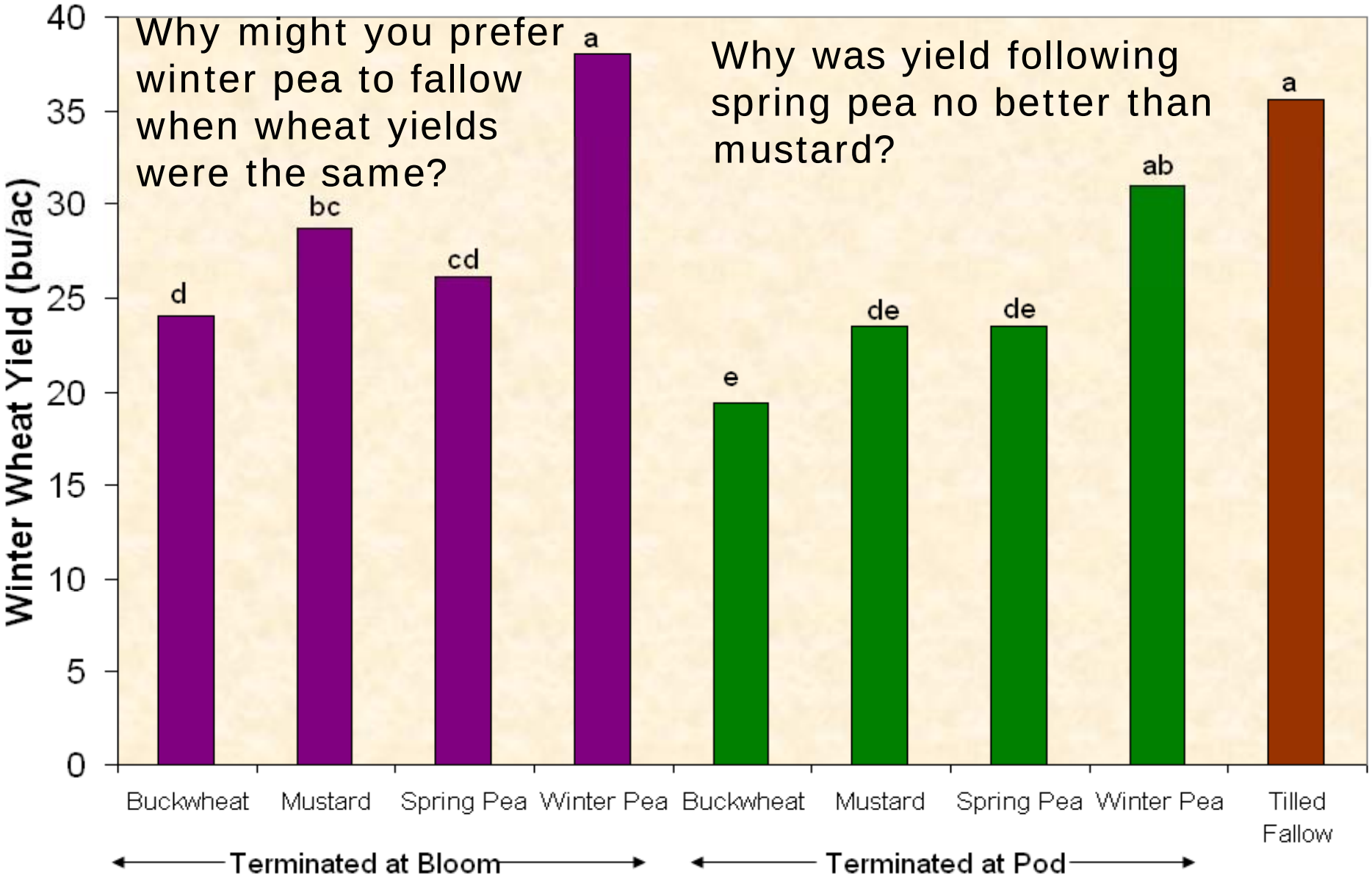
- Where can annual legumes be grown in Montana and can they supply enough N for subsequent small grain crop?
- What annual legumes work best for organic farmers?
- What termination times produce highest yield for subsequent crop?

Dry Pea Production Area

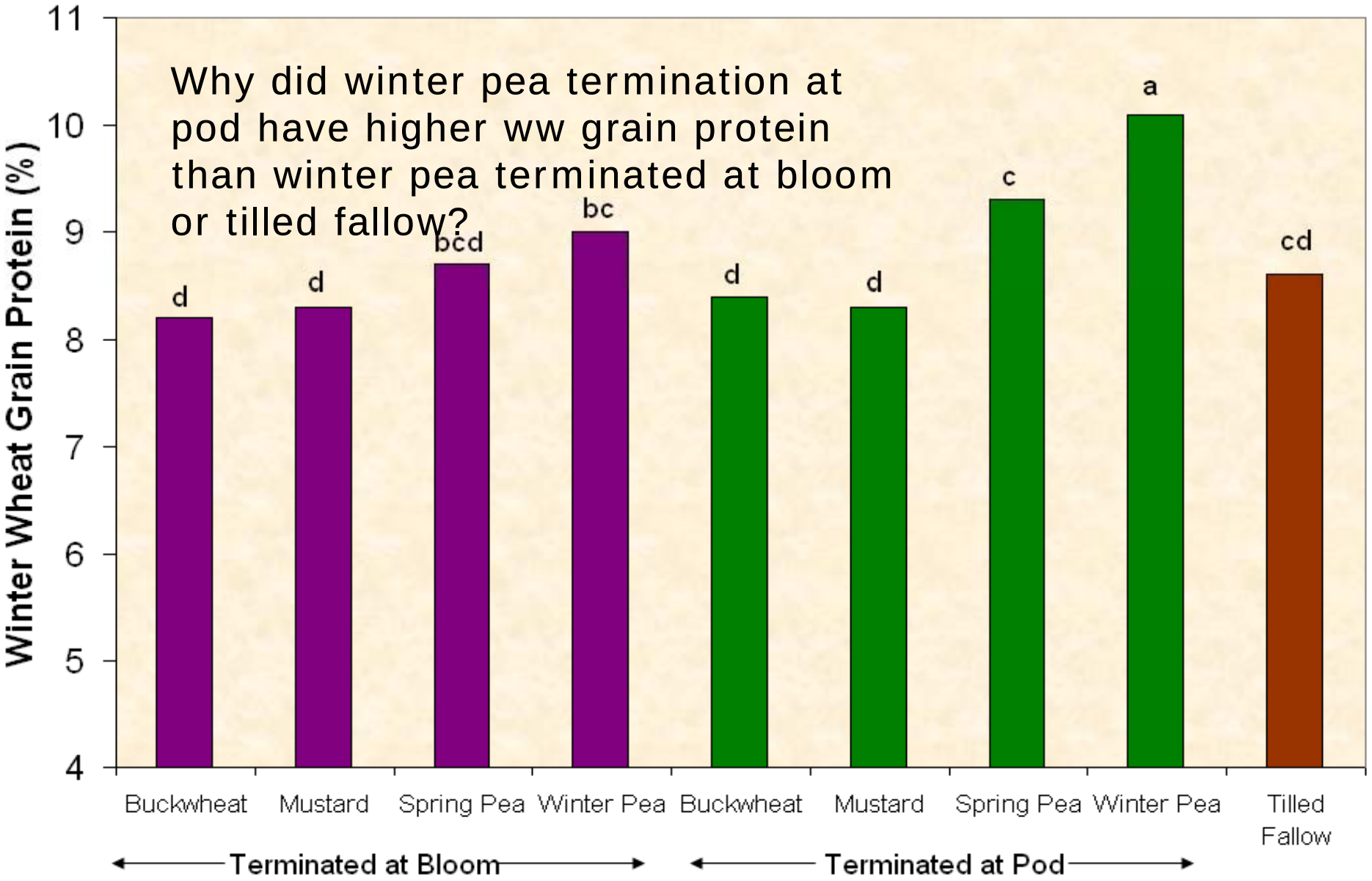


Study Sites: Big Sandy (Quinn's) and Bozeman (Post Farm)

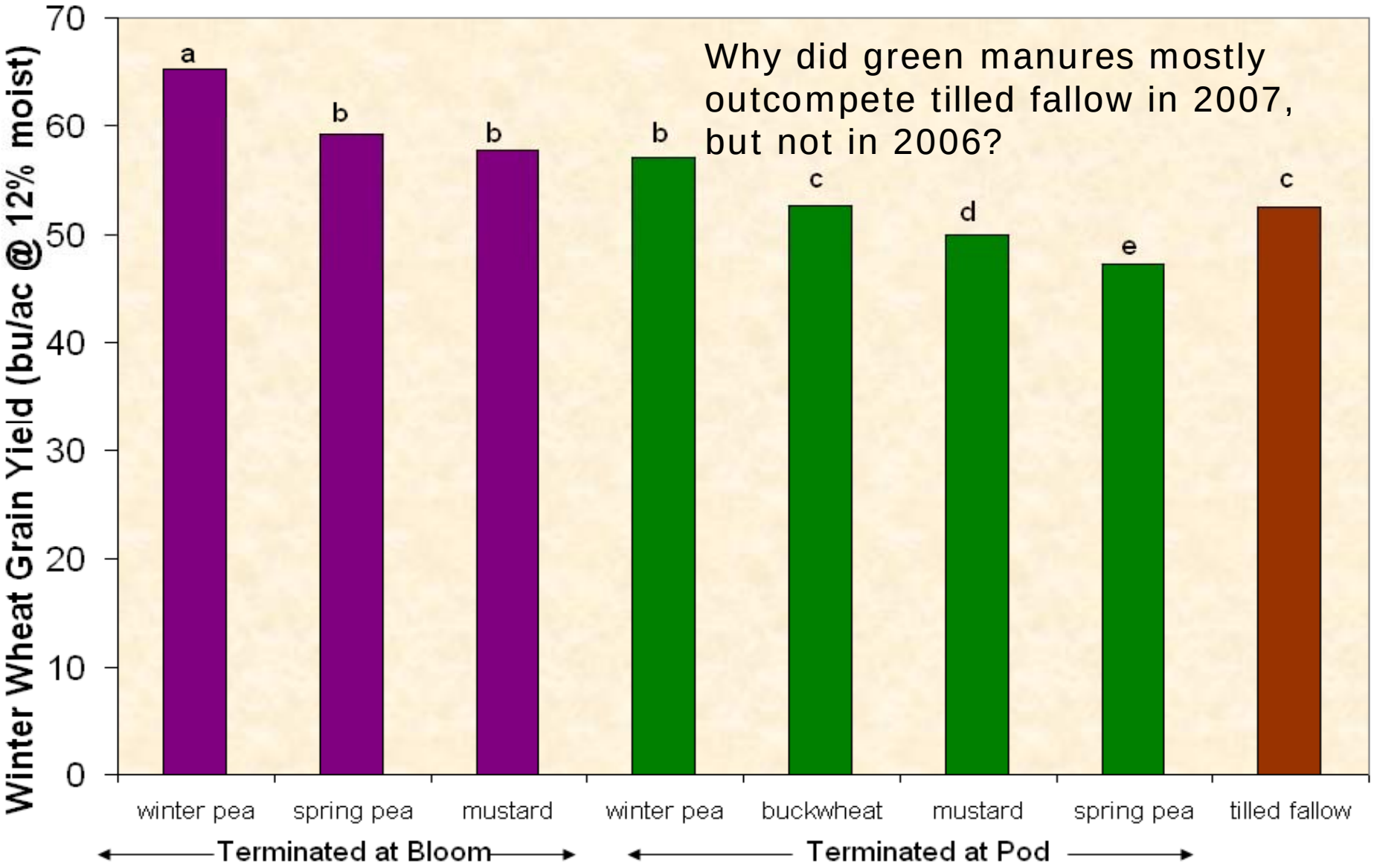
Effect of Green Manure and Termination Timing on Winter Wheat Yields at Big Sandy: **2006**



Effect of Green Manure and Termination Timing on Winter Wheat Protein at Big Sandy: **2006**



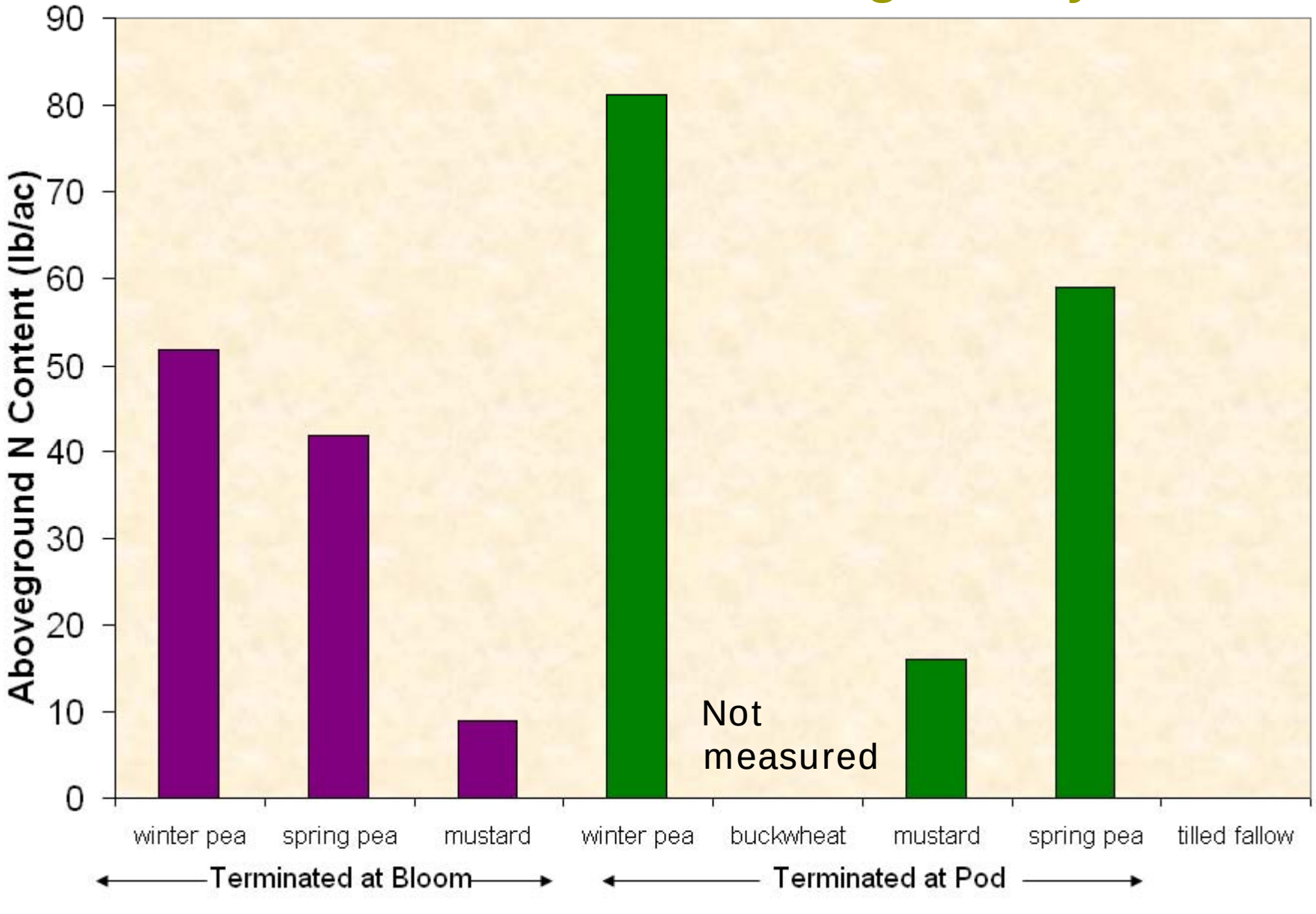
Effect of Green Manure and Termination on Winter Wheat Grain Yield at Big Sandy: **2007**



WW yield was higher when green manure terminated at bloom

- Why might you want to terminate at pod anyway?

Effect of Green Manure and Termination on Green Manure N content at Big Sandy: **2006**



Other Big Sandy 2007 Findings

- Pryor yields were higher than Northstar yields (58 vs 49 bu/ac)
- Yields for different row spacings (5 vs 10 in.) were identical (though middle row wasn't packed)
- Yields for different seeding rates (20 vs 40 seeds/sq. ft.) were almost identical (53 vs 54 bu/ac)

Questions on Big Sandy Results?

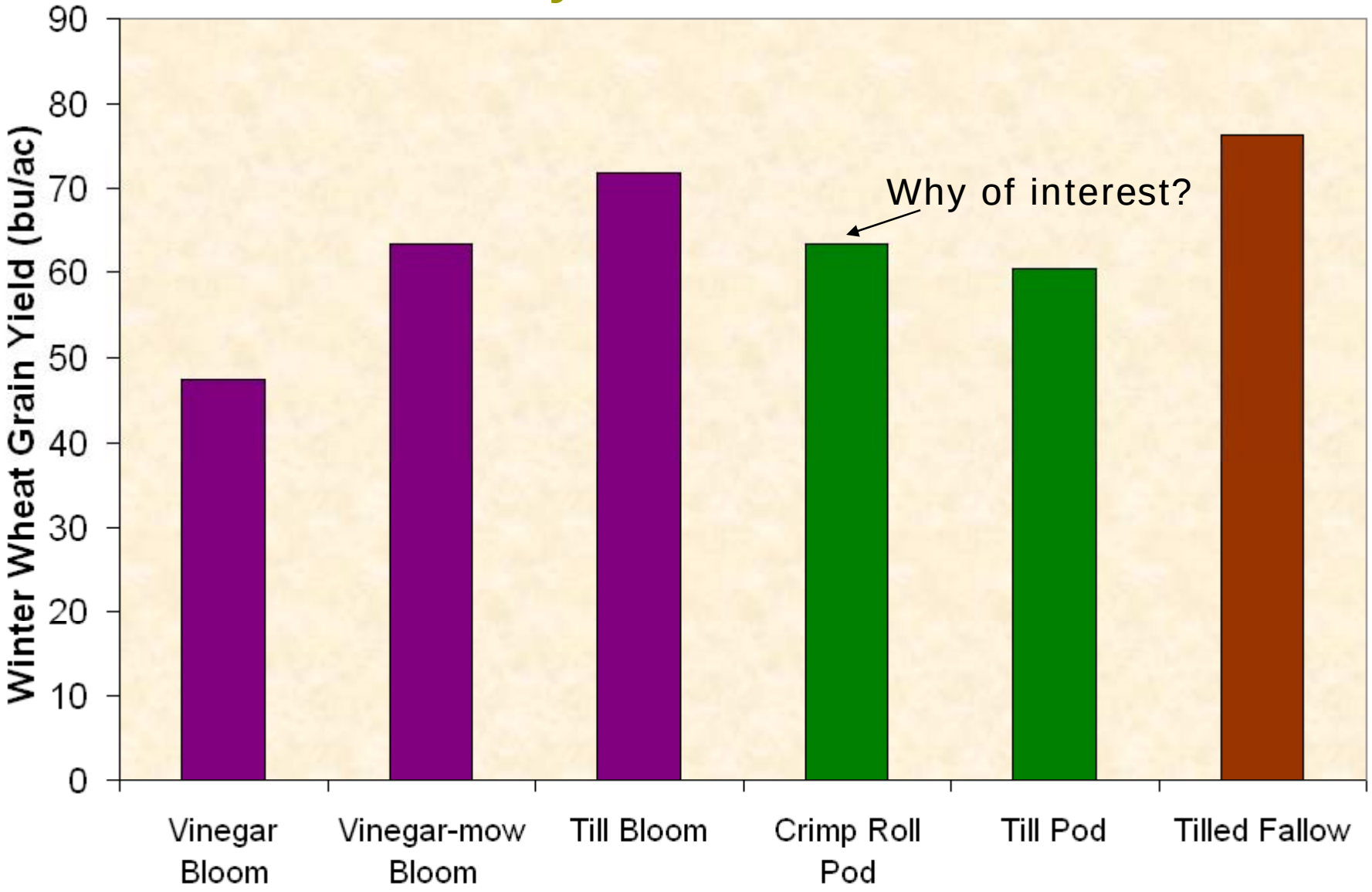
Bozeman - 2006

- Some results similar: Winter wheat following WP bloom and tilled fallow had the highest yields (~ 70 bu/ac).
- Some results different: Winter wheat yields did not differ between bloom and pod when data averaged by crop. Why?
- Focus was on termination strategies: vinegar, vinegar-mow, “crimp” rolling (no-till)

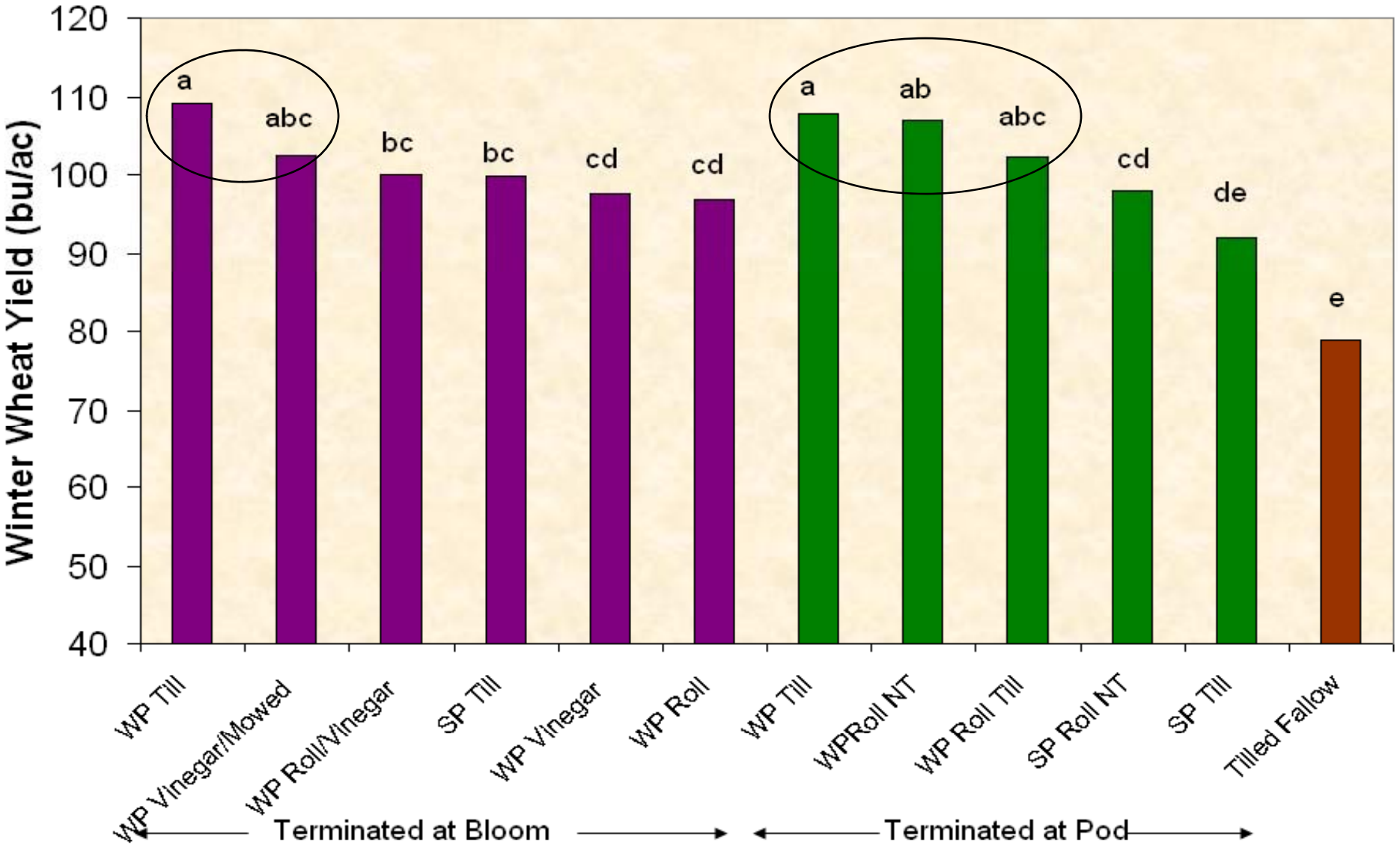
Crimp roller

- Crimps without cutting
- Downside: Would need a no-till disc seeder to seed through residue
- Effective at pod, but not at bloom

Effect of winter pea termination method on winter wheat yield



Effect of termination timing and method on winter wheat yield at Bozeman (2007)



Questions so far?

Phosphorus can not be ‘grown’, needs to be eventually replaced

- In short term, green manures may be able to make P more available
- In long term, organic P fertilizers such as rock phosphate, bone meal, or manure will need to be added.
- Only about 50-100 years of P left in Montana soils at typical removal rates. Yields will suffer well before this point.

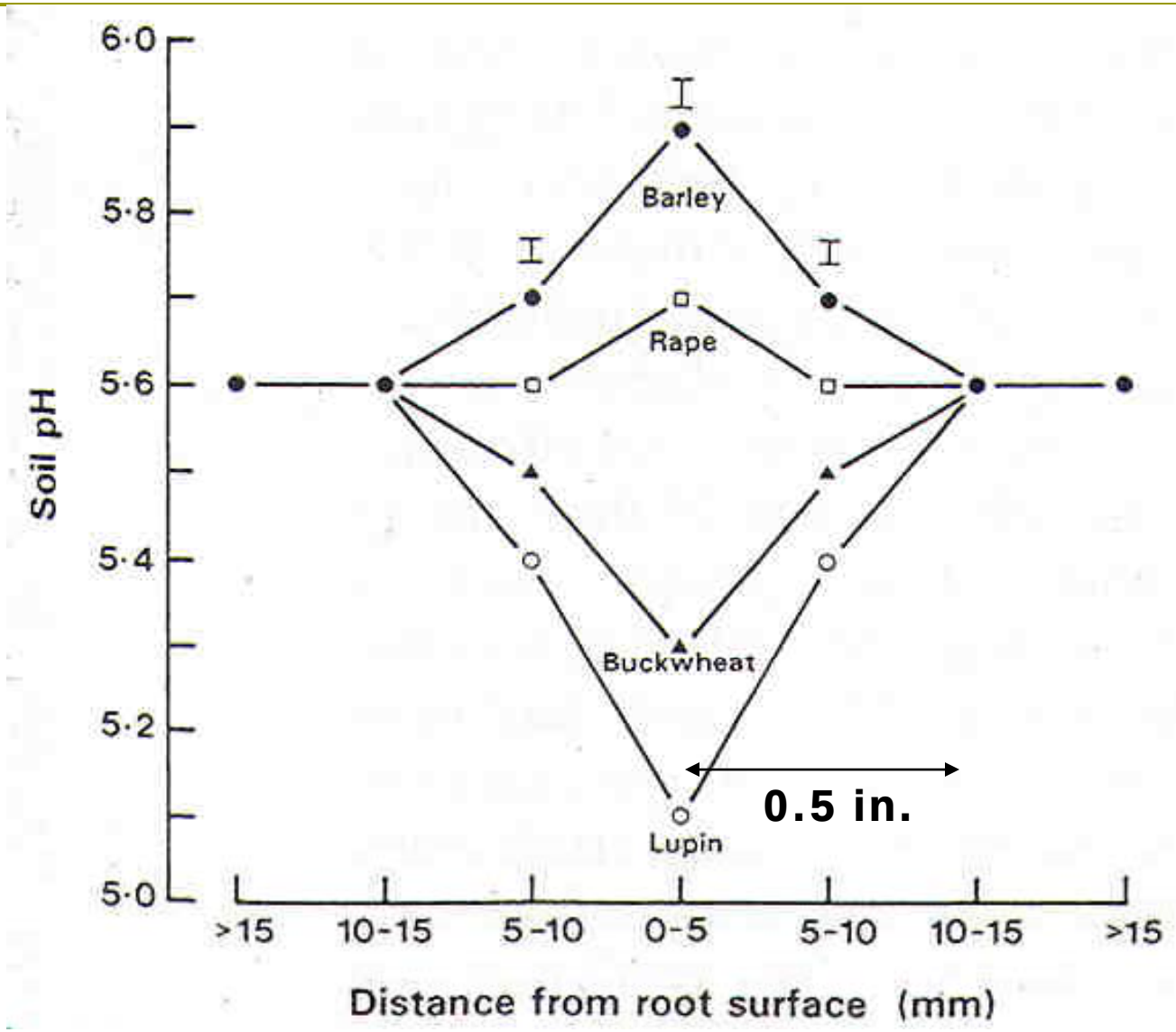
Crop Species that Acidify Rootzone

Buckwheat

Legumes

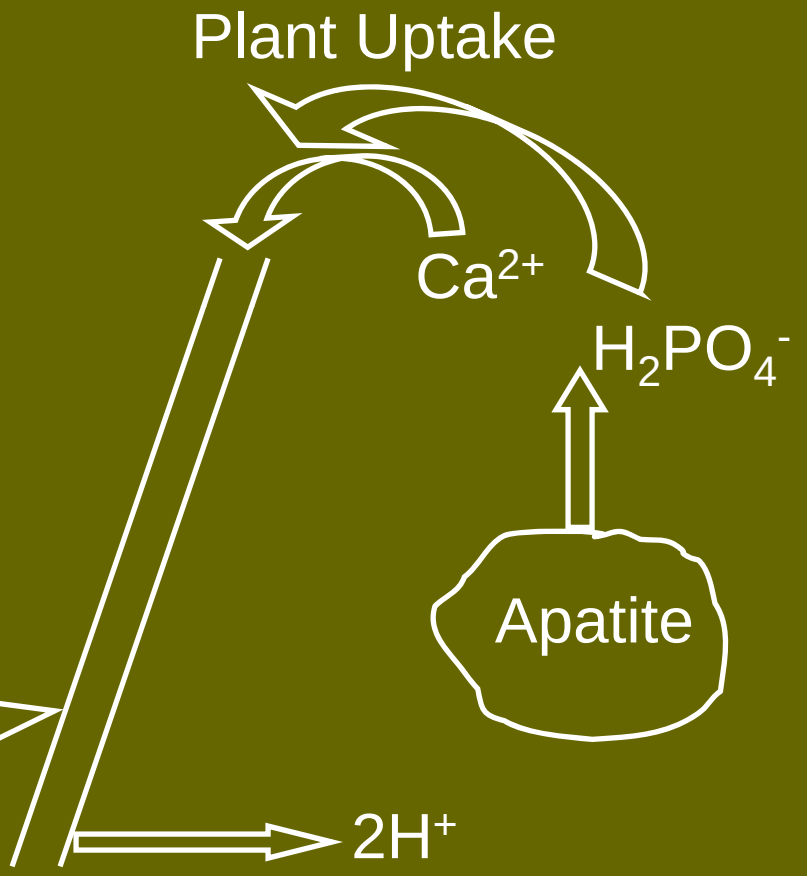
Some Mustards

Rootzone pH of four crops



Mechanism for Acidification of the Rhizosphere

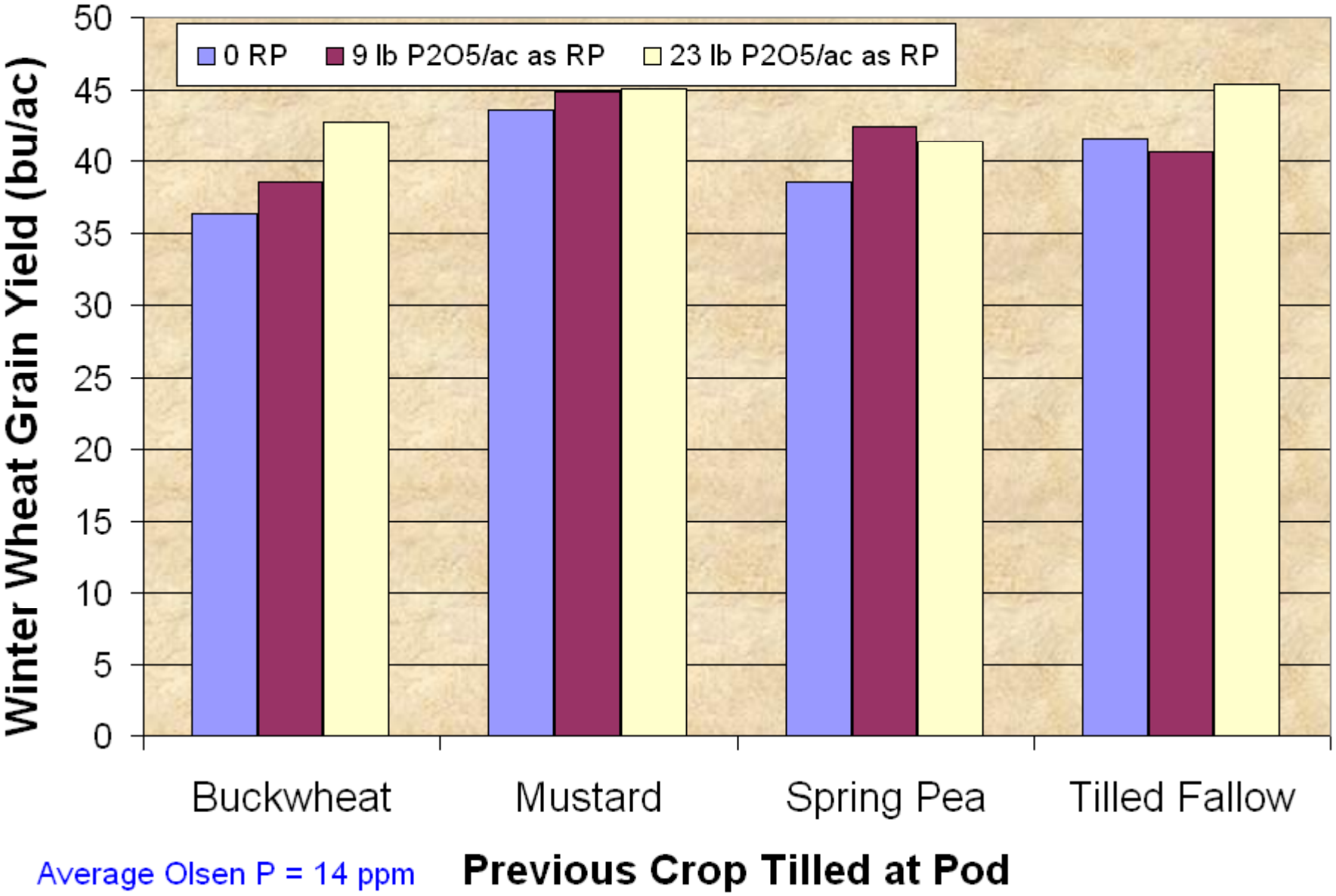
Rhizosphere



Rock Phosphate Dissolves

Questions so far?

Effect of green manure crop and rock phosphate on subsequent winter wheat grain yield, Big Sandy: 2007



Summary

- Replacing fallow with an annual legume increased wheat yields in moist years
- Winter wheat yields were consistently the highest following winter pea terminated at bloom
- If your goal is to increase soil N levels, terminating at pod is recommended, though short term yields will be less
- Crimp rolling of green manures may reduce tillage
- Rock phosphate may improve yields, especially when used with buckwheat or pea, though likely not economical at moderate to high Olsen P levels

Questions?

For more Information:

Soil Fertility Website:
http://landresources.montana.edu/soilfertility

Cropping Systems Website:
http://scarab.msu.montana.edu/CropSystems

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