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Oilseed Fertilizer Management: It's Not Your Father's Wheat

Rich Koenig, WA State Univ.

Dept. of Crop and Soil Sciences and WSU Extension

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Acknowledgments

- ***WA State Biofuel Cropping Systems Initiative***
- ***WSU Agricultural Research Center***

- ***On behalf of the Team***
  - ***Bill Pan, Karen Sowers, Lauren Young, Kristy Borrelli (Faculty and staff)***
  - ***Ashley Hammac, Tai McClellan, Isaac Madsen, Taylor Beard (Graduate students)***
  - ***Many undergraduates***

Relevance

- Fertilizer is an important part of the oilseed energy balance and LCA
- Importance of fertilizer nitrogen (N)
  - Energy
    - For canola, energy (BTUs) required to produce fertilizer N = 10 to 20% of the canola biodiesel energy value
  - Fate of N
    - N cycling in residue has important implications in field
    - N in canola seed and meal important post-harvest
      - >95% of N in canola seed remains in the meal

Overview

- Emphasis on canola
- Review existing literature
- Research to answer important nitrogen (N) management questions
  - Efficiency of N use
  - Improved fertilizer management
  - N cycling
- Implications and take-home messages

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Initial Foray – Review Existing Literature

Canola Growth, Development, and Fertility

WASHINGTON STATE UNIVERSITY EXTENSION FACT SHEET • FS045E

Synopsis

The purpose of this guide is to summarize current information on canola growth and fertilizer requirements. Canola is a relatively new crop to the Pacific Northwest and little fertility research has been conducted in this region. The information contained in this guide is intended to serve as a reference until the results of ongoing, local research are available. Canola is distinct from wheat in terms of growth habit, nutrient uptake, and nutrient removal in the seed. According to published research and fertilizer recommendations, canola requires more nitrogen and sulfur than wheat to achieve the same yields. Soil test-based requirements for phosphorus and potassium are similar to wheat, but boron requirements are higher. Because canola plant residue is higher in nitrogen and phosphorus than wheat straw, cycling of nutrients from residue to the subsequent crop may be an important rotational benefit of canola.

Canola Nitrogen (N) Use

	Canola	Soft white wheat (9% protein)	Dark northern spring wheat (14% protein)
	---------- Pounds of nitrogen [N] per 100 lbs of seed ----------		
Uptake by the plant	5.8	2.3 (1.35 lb/bushel)	3.2 (1.8 lb/bushel)
Removal in the seed	3.4	1.6 (1.0 lb/bushel)	2.5 (1.5 lb/bushel)
Difference *(left in field)*	2.4	0.7	0.7
Recommendation*	5 to 11	4.5 (2.7 lb/bushel)	6.0 (3.6 lb/bushel)

*from various university fertilizer guides for canola and WSU guides for wheat

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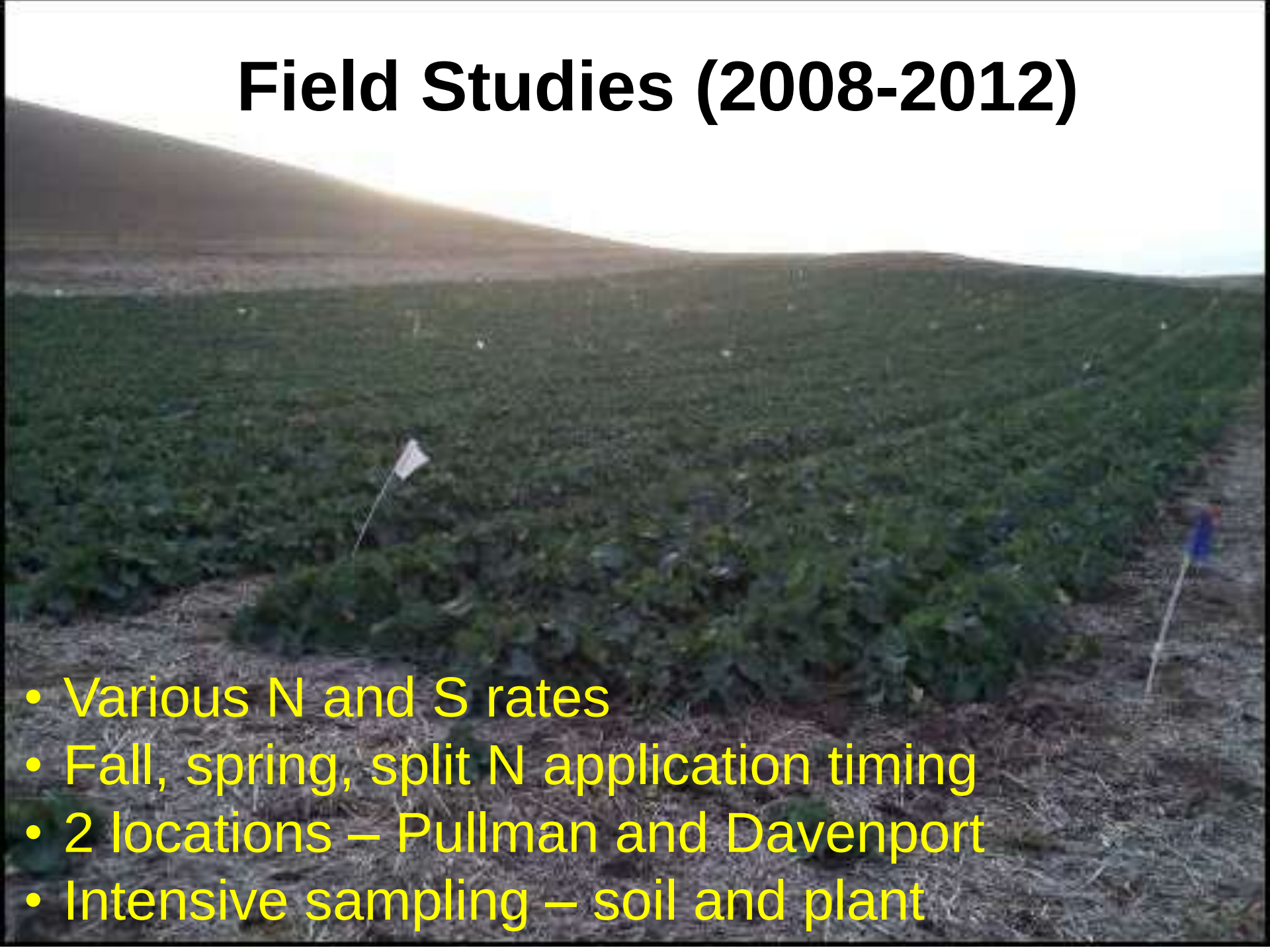
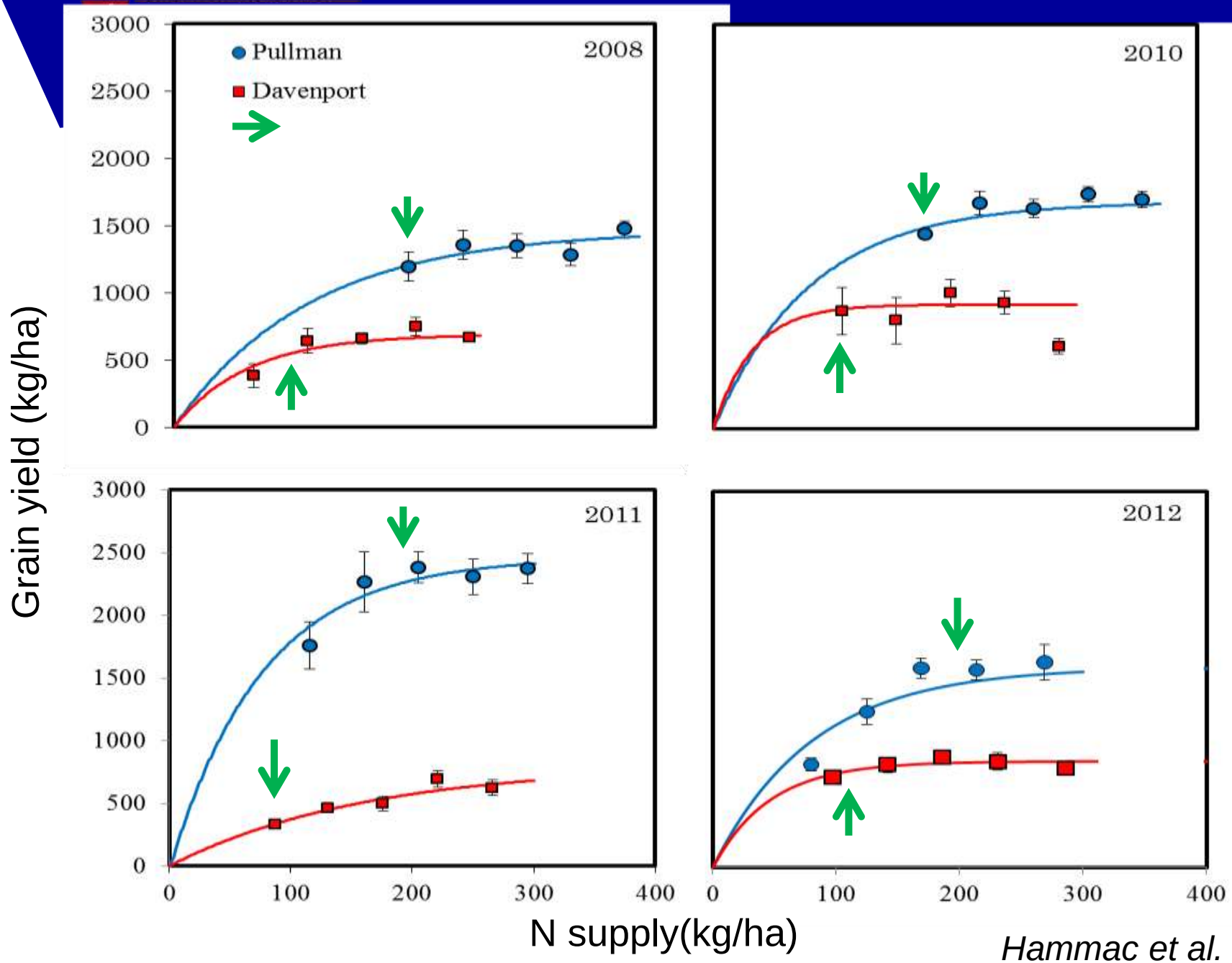
Field Studies (2008-2012)

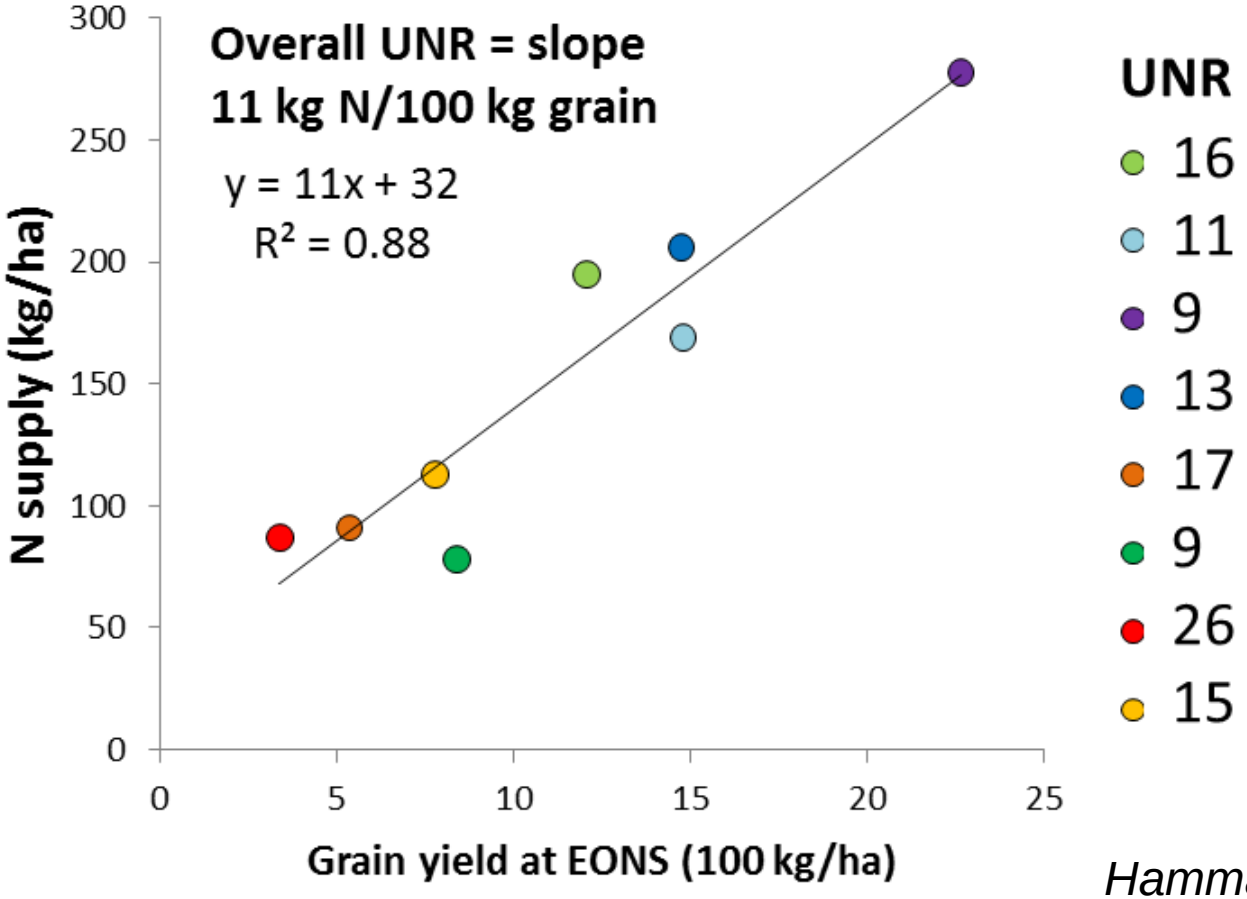


- Various N and S rates
- Fall, spring, split N application timing
- 2 locations – Pullman and Davenport
- Intensive sampling – soil and plant



Hammac et al. poster

Determined Unit N Requirement (UNR) (basis for N Recommendation)



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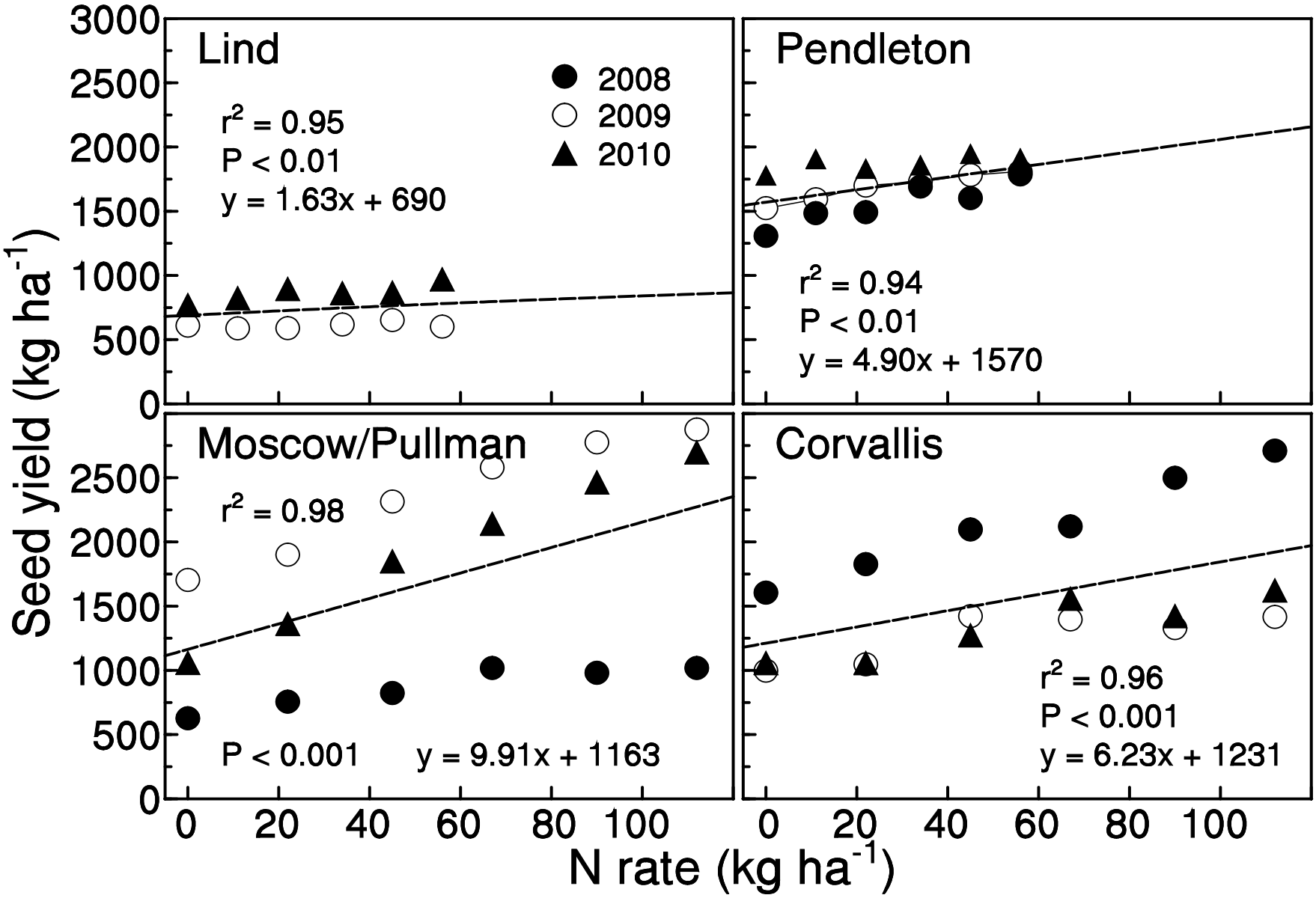
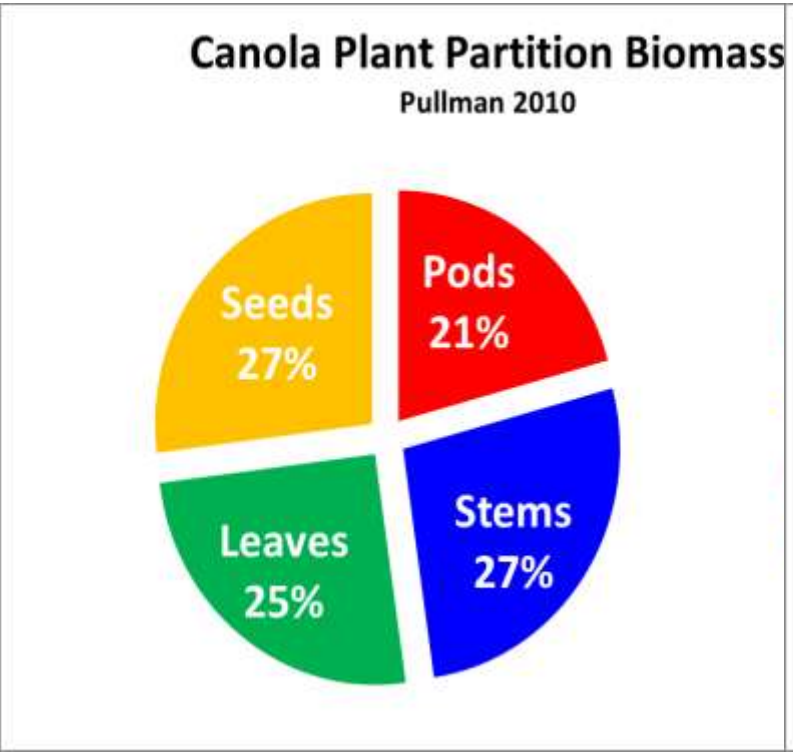
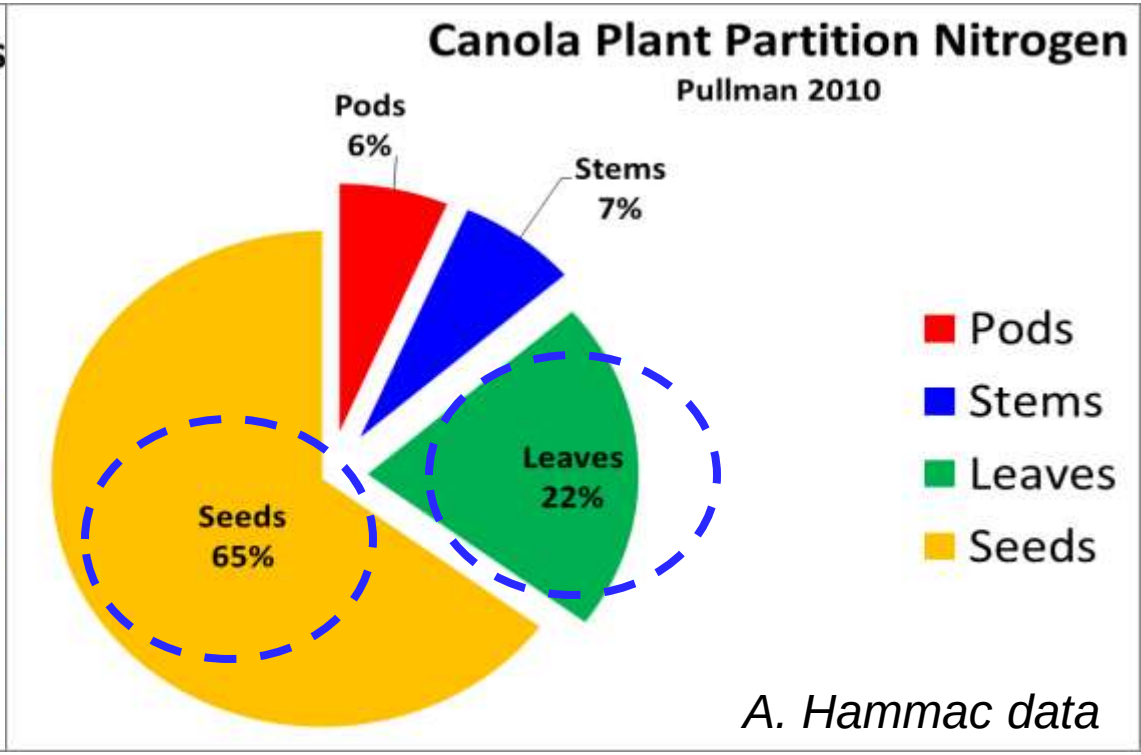


Camelina seed yield response to applied nitrogen at four locations over three years (Schillinger et al. *in review* [Sun Grant project]).

Dry Matter and Nitrogen Partitioning in Canola





A. Hammac data

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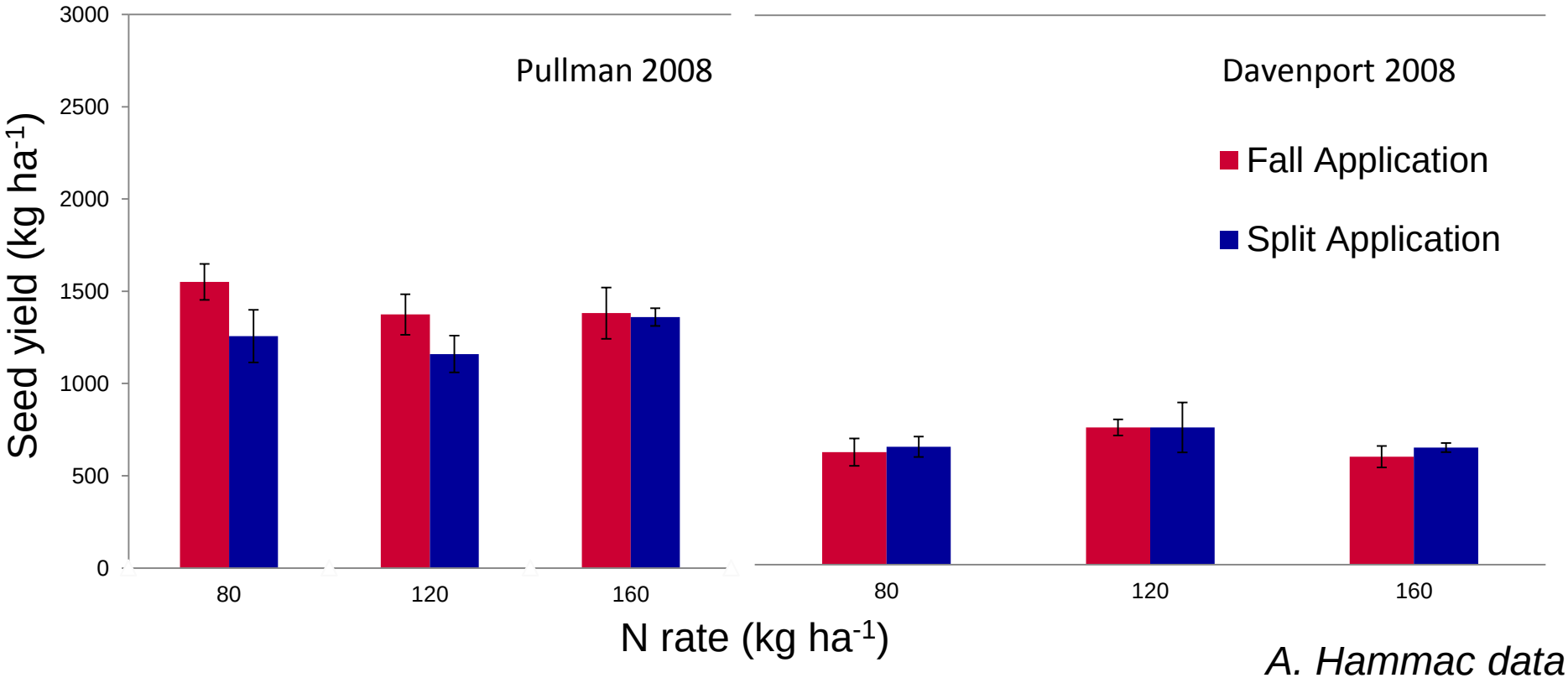
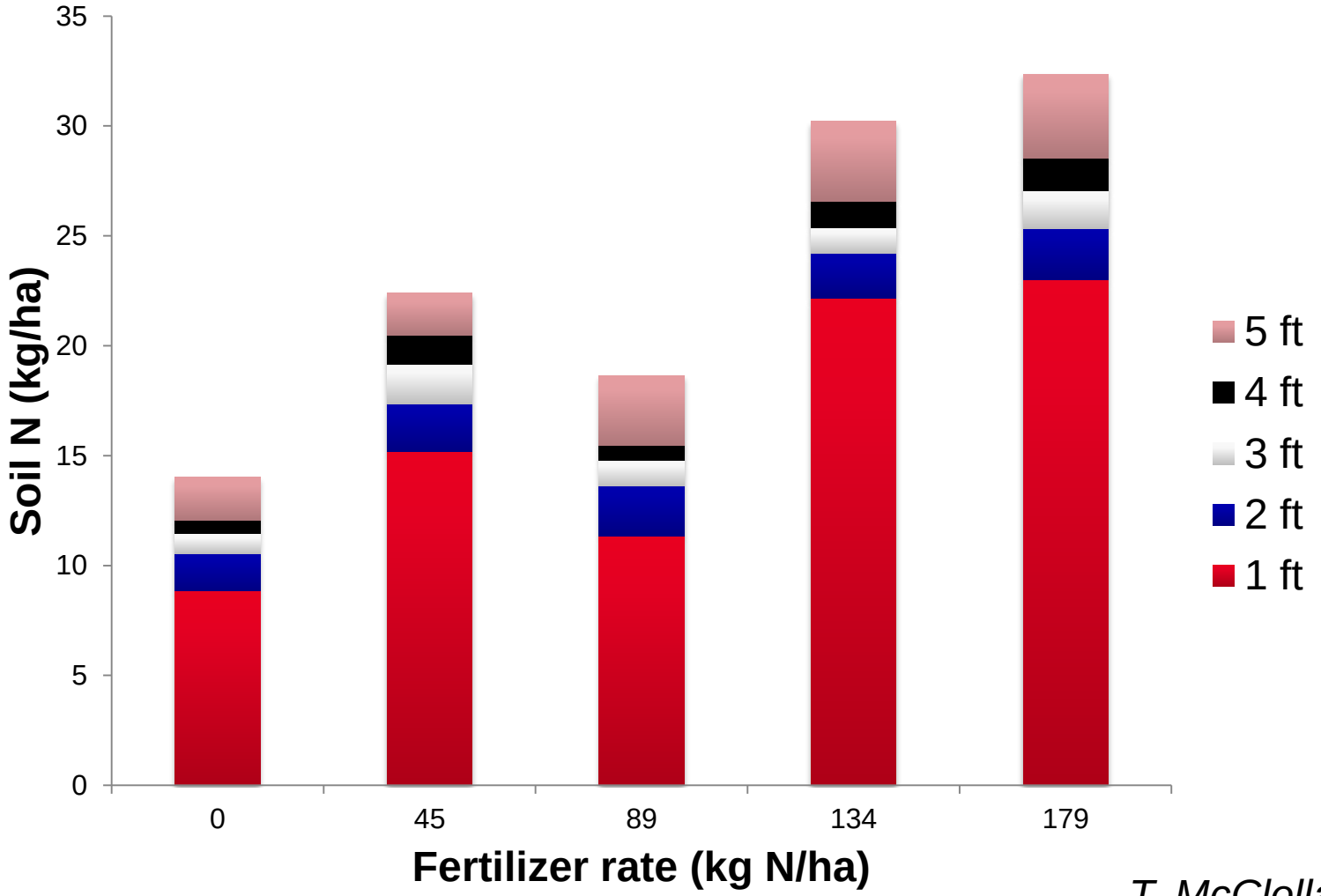
Little Response to Application Timing



A. Hammac data

Little Post-Harvest Residual Soil N



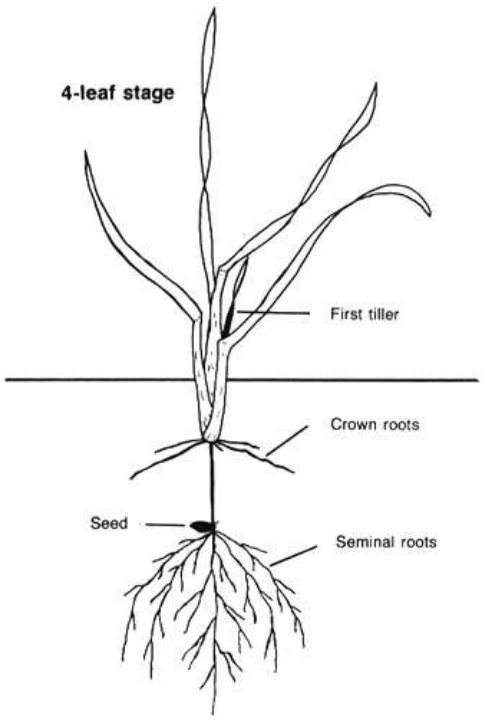
T. McClellan data

Fate of Canola Residue N?

- To be determined (by Tai)
- Where is the residue (leaf) N and when will this become available to the next crop?

Banded Urea: Ammonium Toxicity on Root Meristem

$CO(NH)_2 + H+ + 2H_2O = 2NH_4^+ = 2\ NH_3 + 2H^+$



Images by L. Graves, CSS undergraduate student

A. Hammac image

Root Interactions with Banded Urea

I Madsen, 2012

Take-Home Messages (Canola)

- Dialing in on regional unit N supply requirement
- Some flexibility in managing application timing
- Very efficient at recovering nutrients from soil
  - Potential to lower grower input costs
  - Potential to lower environmental impact
- Fate of residue N TBD
- Fertilizer placement is key
  - Banding below the seed is not advised

Questions

Image from K Sowers