Canola Soil Fertility Management

Image by Sophia Flikkema

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Great Falls MT

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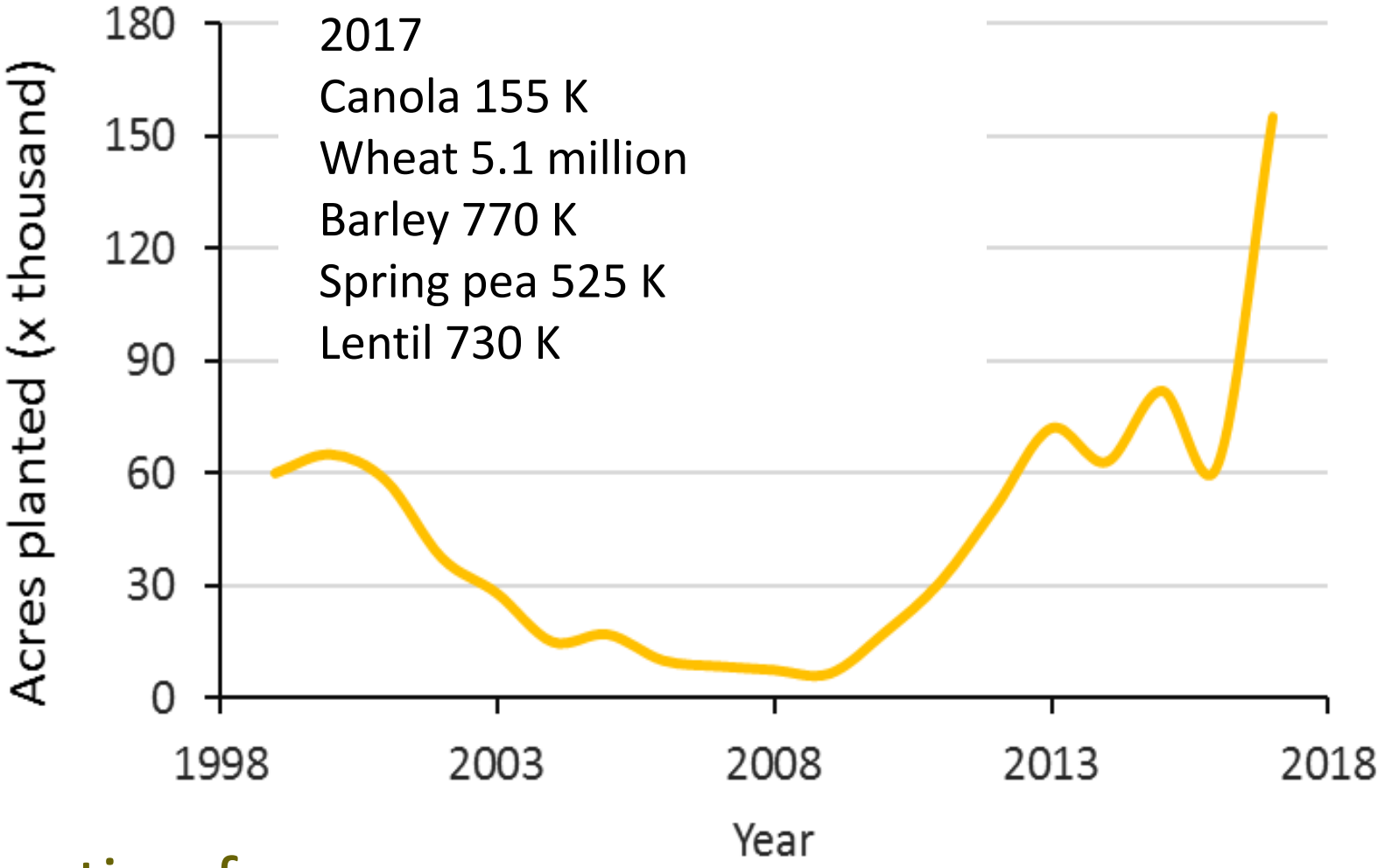
Acres canola planted in MT

Source: National Ag Stat Service



Question for you:

Why are there relatively few acres of canola in MT?

Objectives

I will discuss the following:

1. Nutrient considerations for canola in rotation
2. How canola needs differ from small grains
3. Soil fertility management using the right rate, source, timing and placement

Soil nutrient considerations for crop rotations that include canola

Nutrient	Consideration
Nitrogen (N)	Canola residue provides more N than wheat residue, so more important to soil test for residual soil N after canola
Phosphorus (P)	Canola and alfalfa are good P scavengers, deplete P for next crop
Potassium (K)	Canola leaves behind high K residue
Sulfur (S)	Canola is a good scavenger, depletes S for next crop
Other	Canola can reduce P, copper (Cu) and zinc (Zn) uptake by subsequent mycorrhizal crops (e.g., flax, legumes, small grains to a lesser extent)

Canola relative yields after other crops

Based on research at Mandan, ND, average over 4 rotations

	Crop to be grown			
Residue	SW, Barley	Pea, Lentil	Canola	Sunflower, Safflower
SW, Barley	1.00	1.19	1.09	1.81
Pea, Lentil	1.02	1.00	1.16	2.04
Canola	0.99	1.00	1.00	1.67
Sunflower, Safflower	0.95	0.99	1.00	1.00
Average	0.96	1.05	1.04	1.67

Adapted from Tanaka et al., 2005 and 2007, by K. McVay

Questions?

On to *deficiencies and fertilizers*

Plant symptoms – once symptoms appear, yield may already be compromised

Boron

R. Karamanos

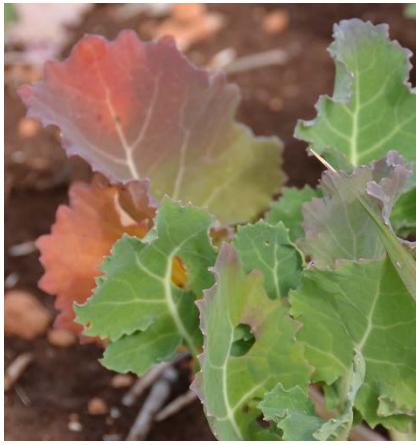
Nitrogen

GRDC Canola Guide

Sulfur

Gov. W. Aust., T. Potter

Phosphorus



IPNI, El Gharous

Potassium

IPNI, Roberts

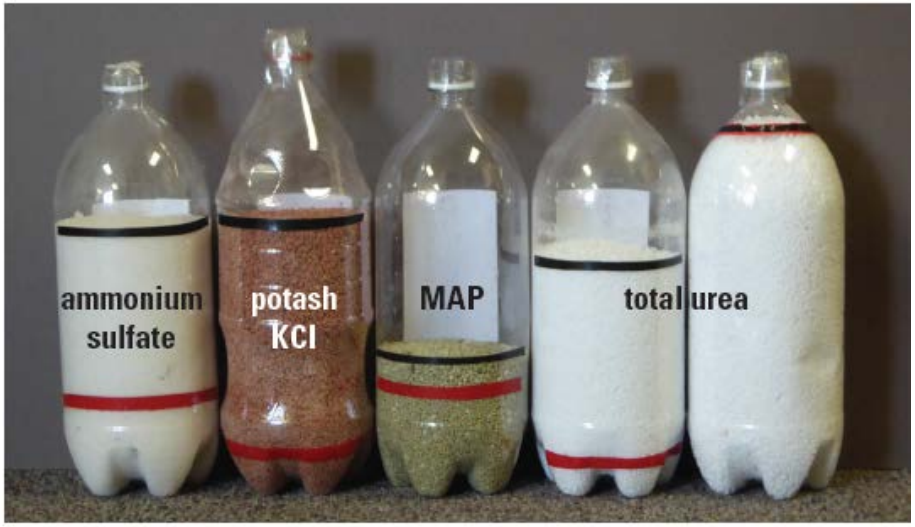
Sulfur

R. Karamanos

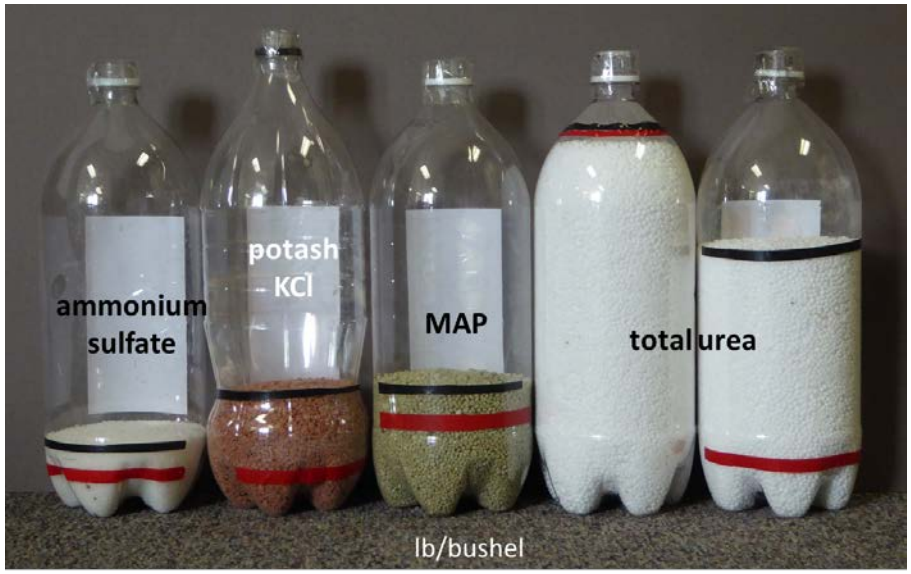
Fertilizer nutrients removed by bushel of seed and total plant uptake (per bu)

Plant uptake per bu.

Removed by a bu.



canola



wheat

Which one is canola (vs wheat)?

N is yield dependent, P, K, and S are not.

Canola needs more S and K/bu but also leaves more behind.

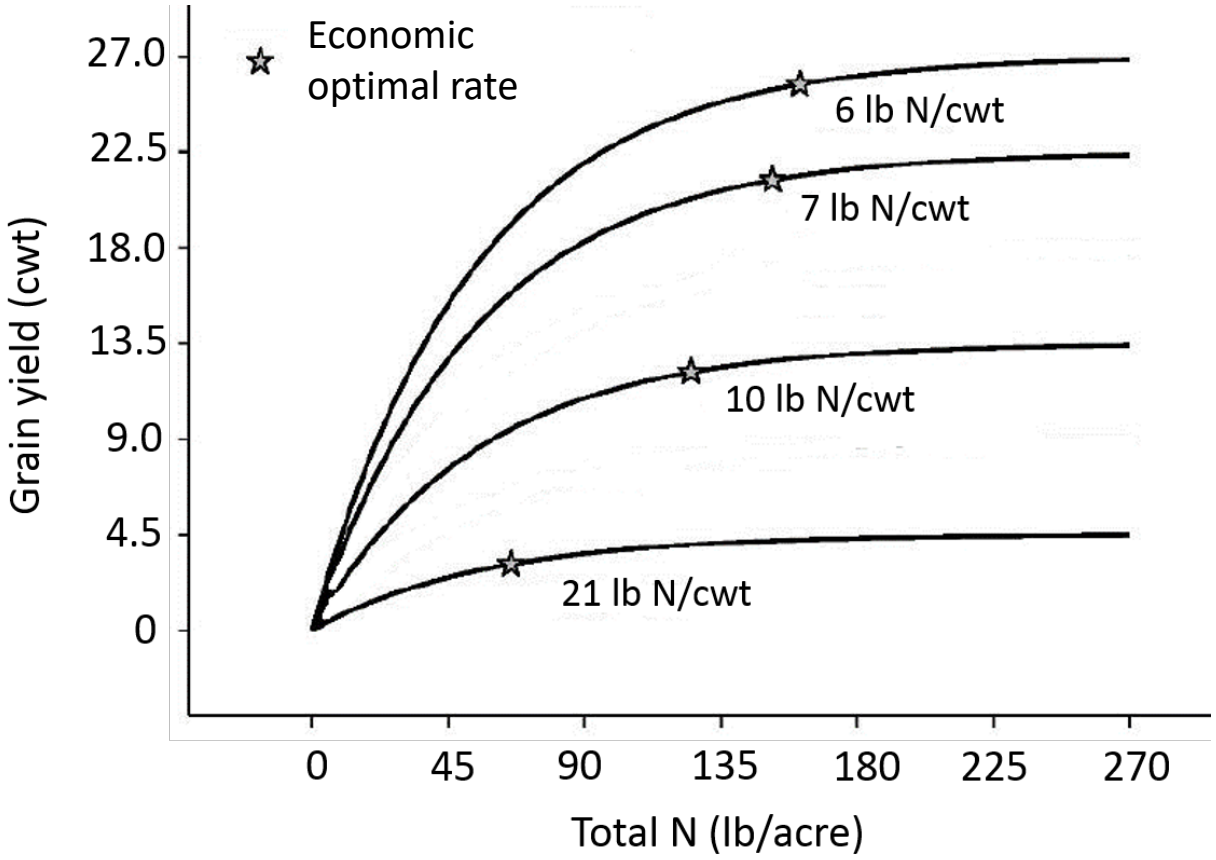
Start with a realistic yield goal

- Use MSU's NARC canola variety trials (http://agresearch.montana.edu/narc/varietytestingreports/variety_testing_reports_by_year.html), or successful local producers' experience
- Having ability for in-season N application allows conservative yield estimate for pre-plant rate
- Canola requires 2.9 to 3.5 lb available N to produce a bushel of seed:

  (soil nitrate + fertilizer) ≈ 3.25 lb/bu ≈ 6 lb/cwt

N, water, and yields

- N use and optimum lb N/bu depends on yield
- Canola can access deep water (and nitrate) unless restricted by hard soil
- As yields become limited, lb avail N/bu goes up
- Economic optimal rate: ~ 120 – 140 lb avail N/ac for typical MT yields



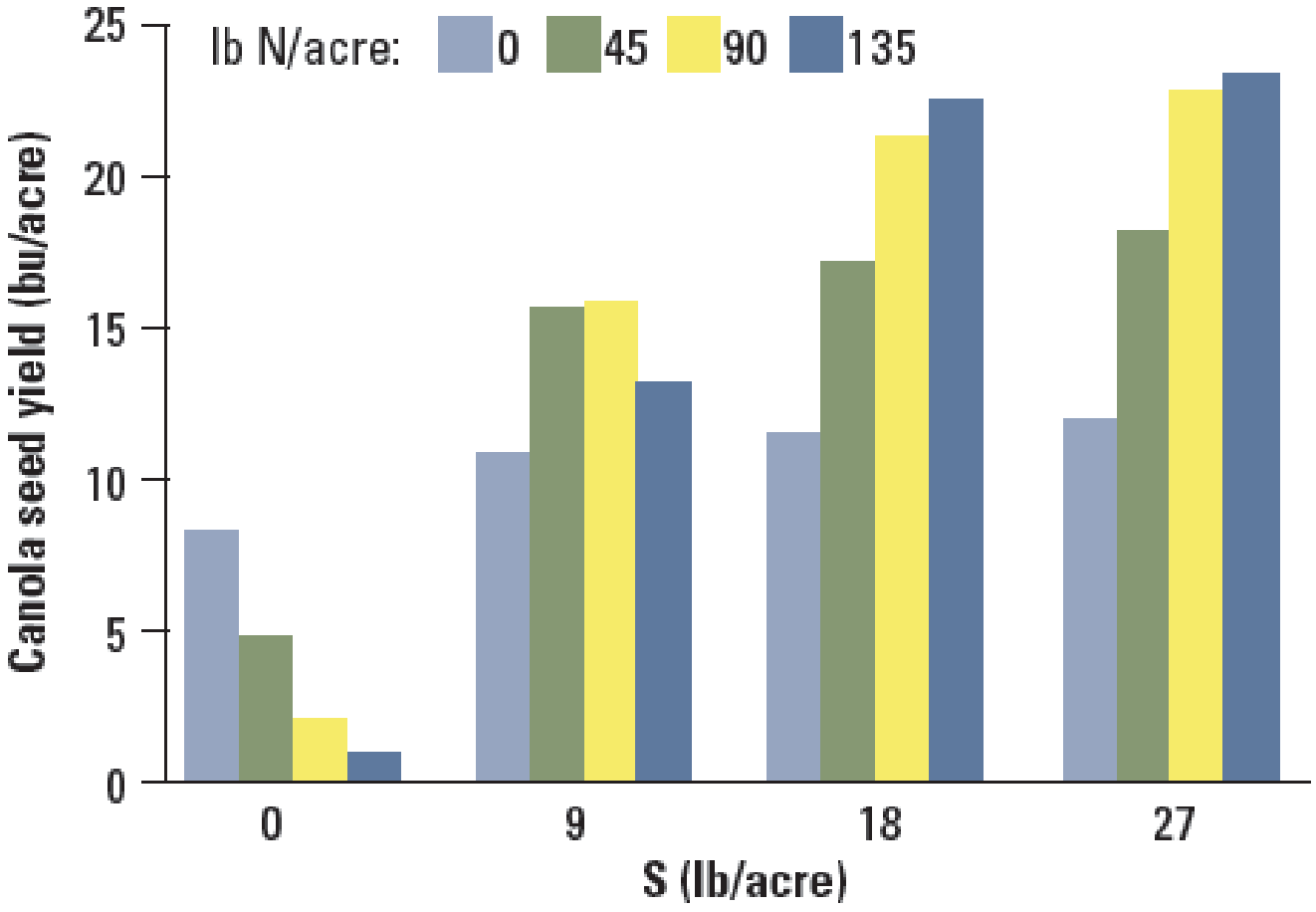
Pan et al., Crops & Soils 2017

S for canola

S deficiency image by R. Karamanos

- Base S rate on field history, crop appearance, response to test strips, tissue & soil testing.
- S varies greatly across a field but if <20 lb S/acre (to 2 ft. depth) then likely limiting
- 18-20 lb S broadcast at seeding or 9 lb S/acre w/seed (BEWARE – very sensitive to seed placed fertilizer)
- 0.5 lb S/bu yield potential as 8-0-0-9, 21-0-0-24, or 12-0-0-26 (amm thiosulfate) as an in-season rescue through rosette (Janzen and Bettany, 1984)

Canola can only respond to N if S is not limiting; S helps most when N is sufficient



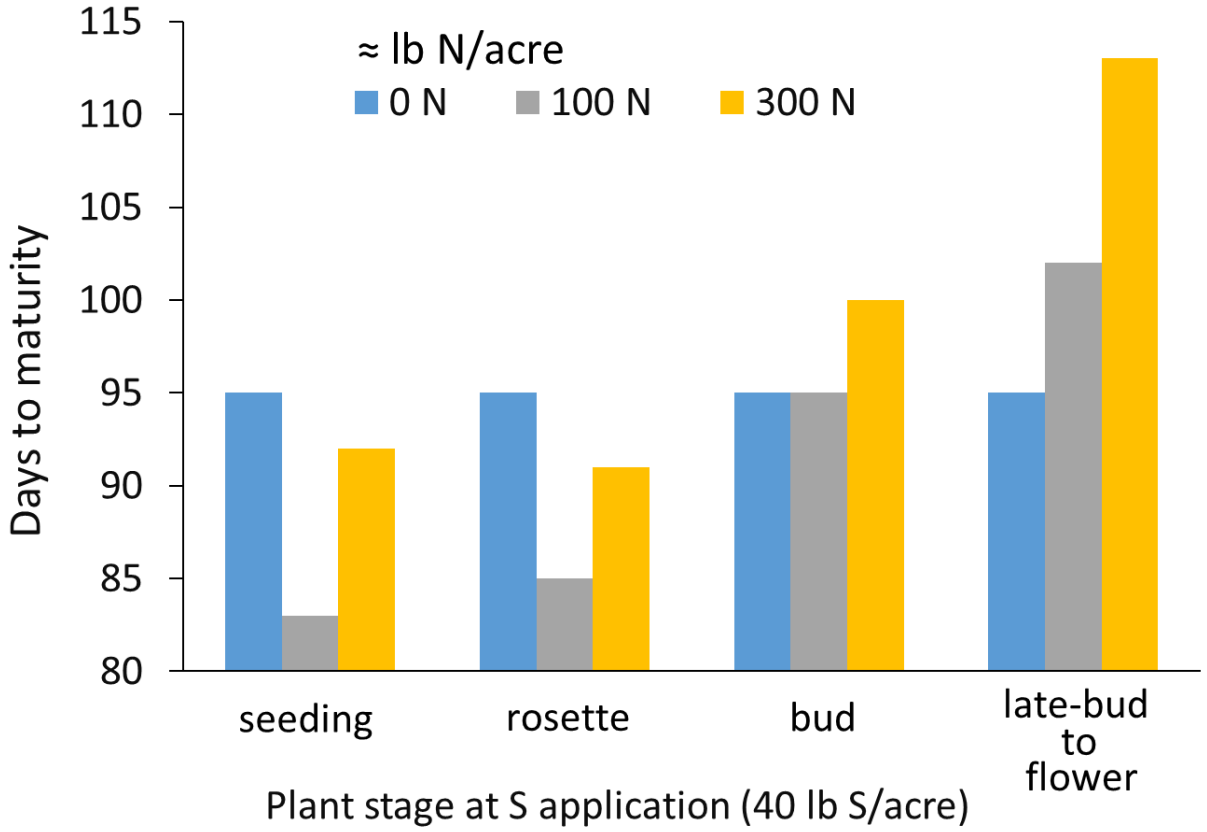
N:S of 7:1 only helpful if both are deficient, otherwise irrelevant

(Karamanos et al., 2007)

Open pollinated variety, N and S broadcast and incorporated just prior to seeding. Malhi et al., 2007

Can soil fertility affect canola maturity?

- Starter P important for an early start
- Excess N slows maturity, especially in dry years or with delayed seeding

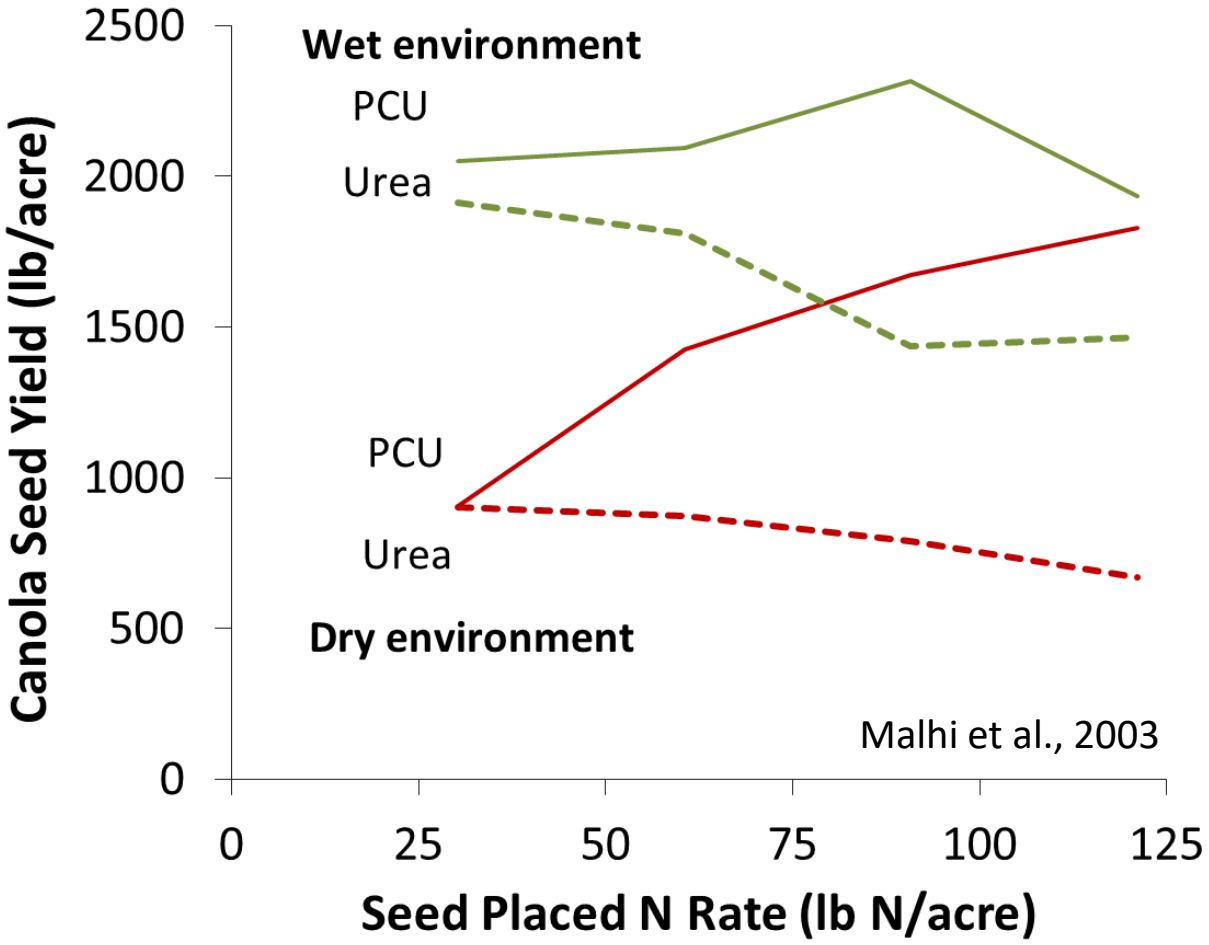


- Sufficient S needed before elongation stage for earlier maturity, insufficient or late S extends flowering period and reduces yield

(Janzen & Bettany, 1984, greenhouse study)

Questions?

On to *source, timing and placement*



Other N sources

- Polymer coated urea
- Legumes

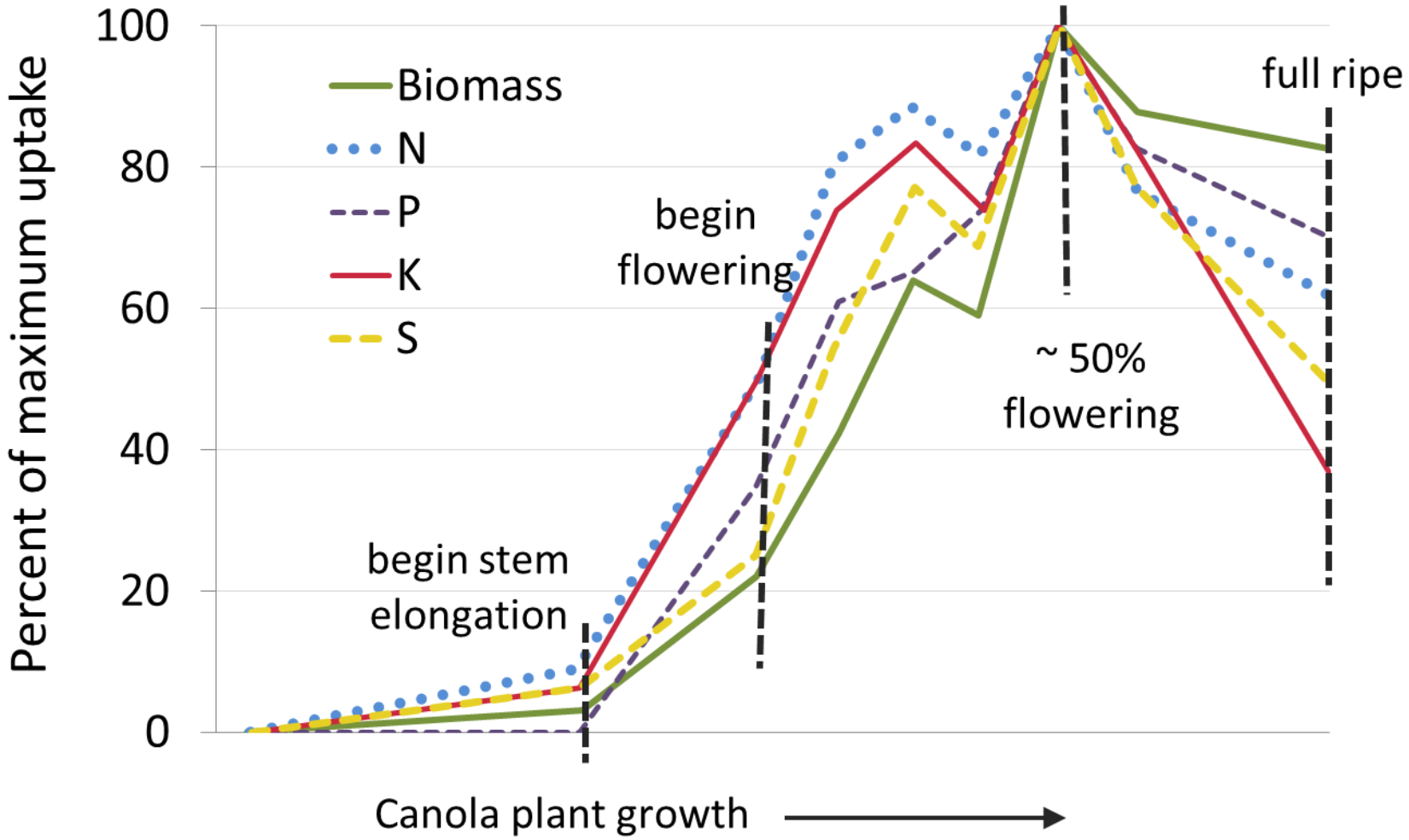
- Polymer coated are safer seed-placed than urea
- PCU release is too slow in cool, dry conditions to provide enough N early on – consider blending

S source and timing to benefit seed yield

	2-plus years prior	Prior crop	Fall	Spring, before or at seeding
Sulfate – on soil surface or incorporated				
Elemental-S incorporated				
Rapid release elemental-S				

 ideal  not ideal but may benefit yield  not recommended

Fertilizer needs to become ‘plant available’ but not be lost from system.



Application timing depends on source.

Karamanos 2013

Application generalizations

N: Ideally split application, 50 to 65% of N at seeding, remainder adjusted to current production potential by 5- to 6-leaf stage.

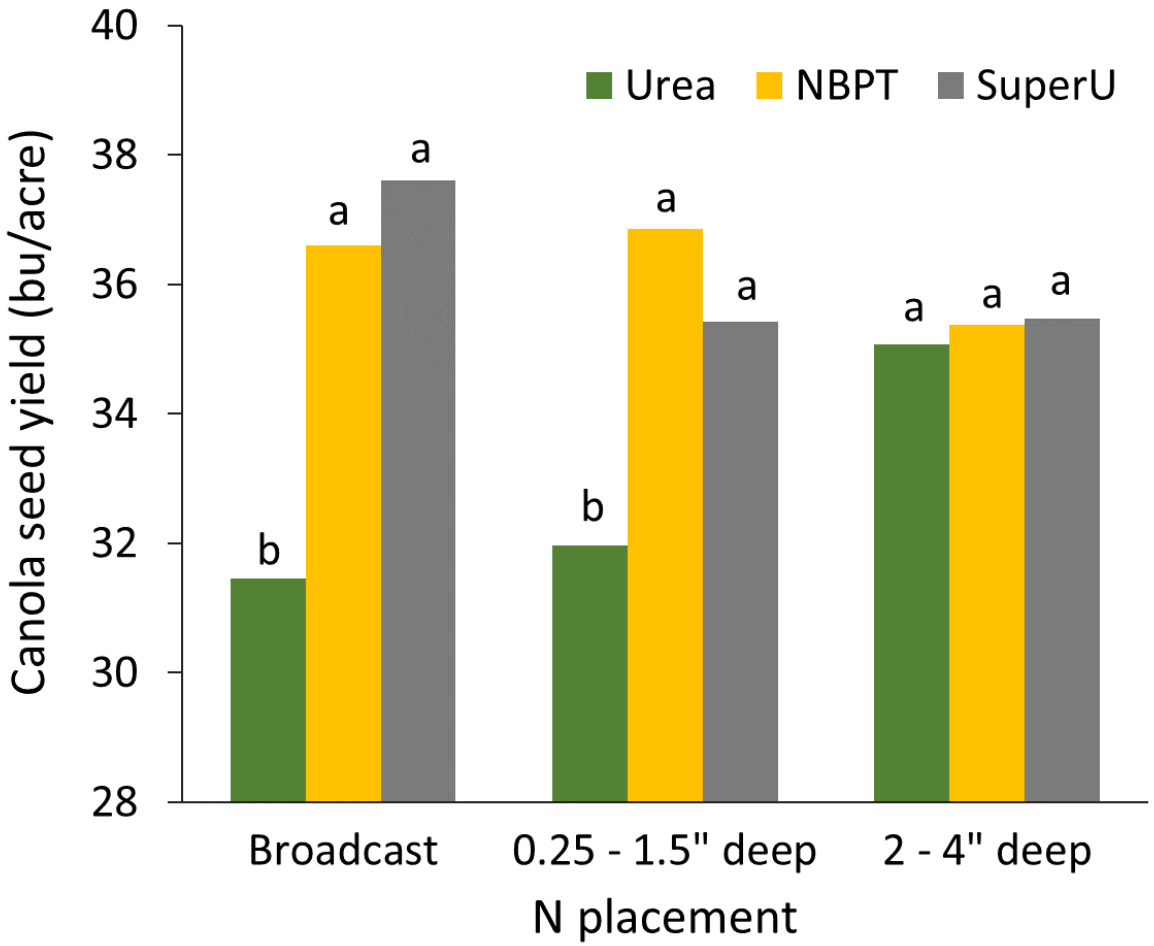
S: Rescue broadcast or foliar up to early flowering, followed by rain/irrigation. Foliar after 5th leaf emergence to minimize leaf burn.

P and K: before or at seeding

Placement: N

To minimize volatilization loss:

- side or pre-plant band >2” deep prior to packing
- early-spring broadcast with incorporation
- if seeder can’t place N deep, consider NBPT (e.g., Agrotain®)
- 28-0-0, 32-0-0 better subsurface than surface band

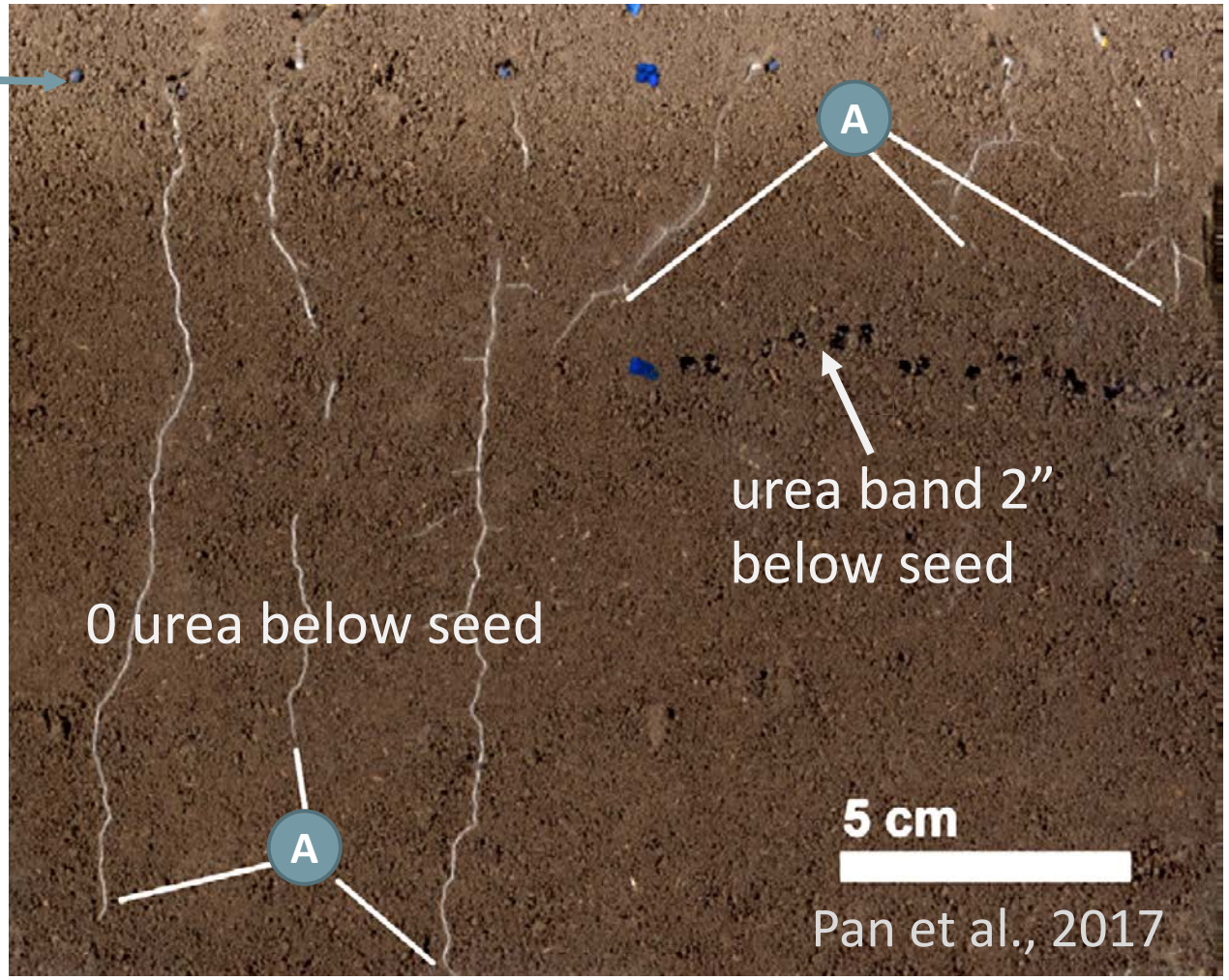


Dick, Nebo, Holzapfel, Tenuta, unpub data, western prairie provinces courtesy Karamanos

To avoid toxicity to root growth, avoid seed row or directly below seed row See Crops & Soils Magazine, May-June 2017

canola seed row

"A" points to end of canola roots

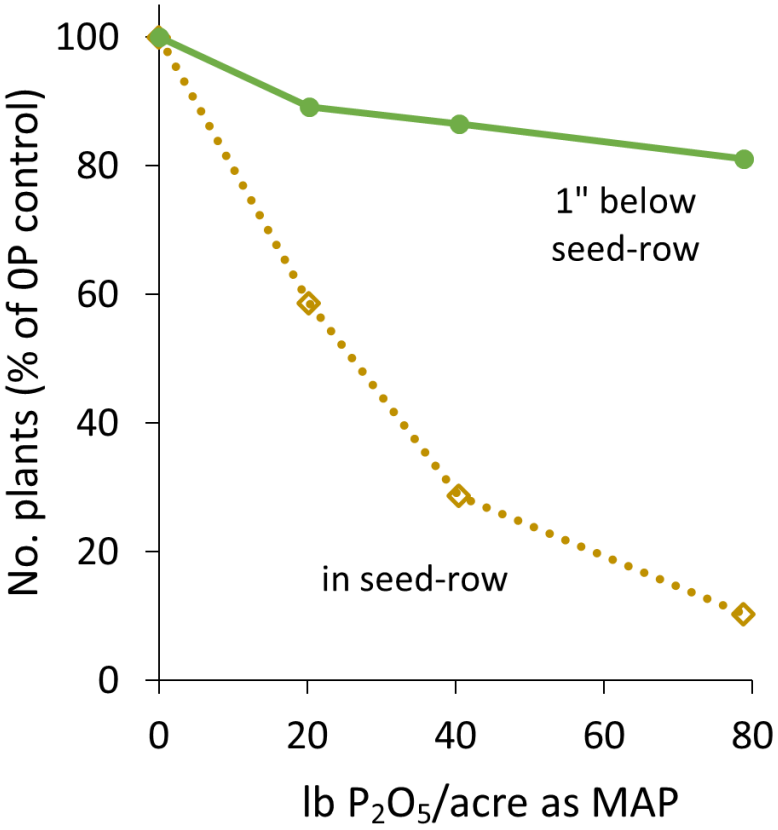


(Wheat creates early lateral roots to avoid fertilizer band so less sensitive than canola)

Seed-placed guidelines

Seed row safe rates depend on source and seed bed conditions

- heavy clay soil >> coarse
- high SOM >> low SOM
- high moisture >> dry soils
- low pH >> high pH



Nyborg & Henning 1969, AB and BC

Equipment

Use wide openers, or put fertilizer in knife and seed in fertilizer slot

Use SDSU/IPNI online safe seed-placed rate calculator

Micronutrients

- A combination of deficiency symptoms, soil testing, and tissue testing may be best approach at identifying deficiencies. This is NOT an exact science.
- Micronutrient deficiencies are exception, not rule
- Cool wet conditions cause deficiency – likely disappear when weather warms (unless get very high yields)
- Too much of some micros (e.g. B) can hurt yield more than not enough
- The main challenge is even distribution of a very small quantity – consider foliar application

Summary

- Use soil tests
- Ensure nutrients are available before stem elongation
- Adjust N in-season to reflect the growing season
- Need adequate S to ensure N response
- Low rates of seed-placed or side-banded P and S promote a healthy start
- Beware of seed-placed fertilizer toxicity
- Consider pulse crop rotation before canola

For more information and this presentation see MSU Soil Fertility Website
http://landresources.montana.edu/soilfertility/

Soil Nutrient Management for Canola (EB0224) – under 'Extension publications'

Canola: Nitrogen & Sulfur Management and *Canola: P, K, & Micronutrient Management* – both under 'Soil Scoop'

Canola Council of Canada *Canola Encyclopedia*
http://www.canolacouncil.org/canola-encyclopedia/

Safe seed-placed fertilizer rate calculator: SDSU and IPNI Online Fertilizer Damage Tool
http://seed-damage-calculator.herokuapp.com/

QUESTIONS?

Image by K. Olson-Rutz