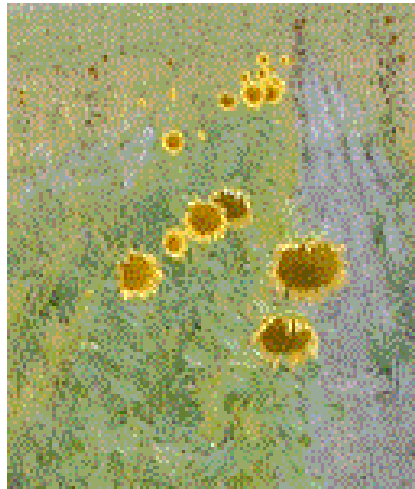


NUTRIENT MANAGEMENT OF OILSEED CROPS

CCA and Dealer Training
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Southern Ag Res Center, Huntley



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Goals

- Present influence of N rate and tillage on oilseed yields
- Present P, K and S rate recommendations
- Discuss different nutrient source options
- Present ideal fertilizer timing and placement

Questions

- How many of you have clients that have grown safflower in the last 3 years?
- Sunflower?
- Canola?

Nitrogen

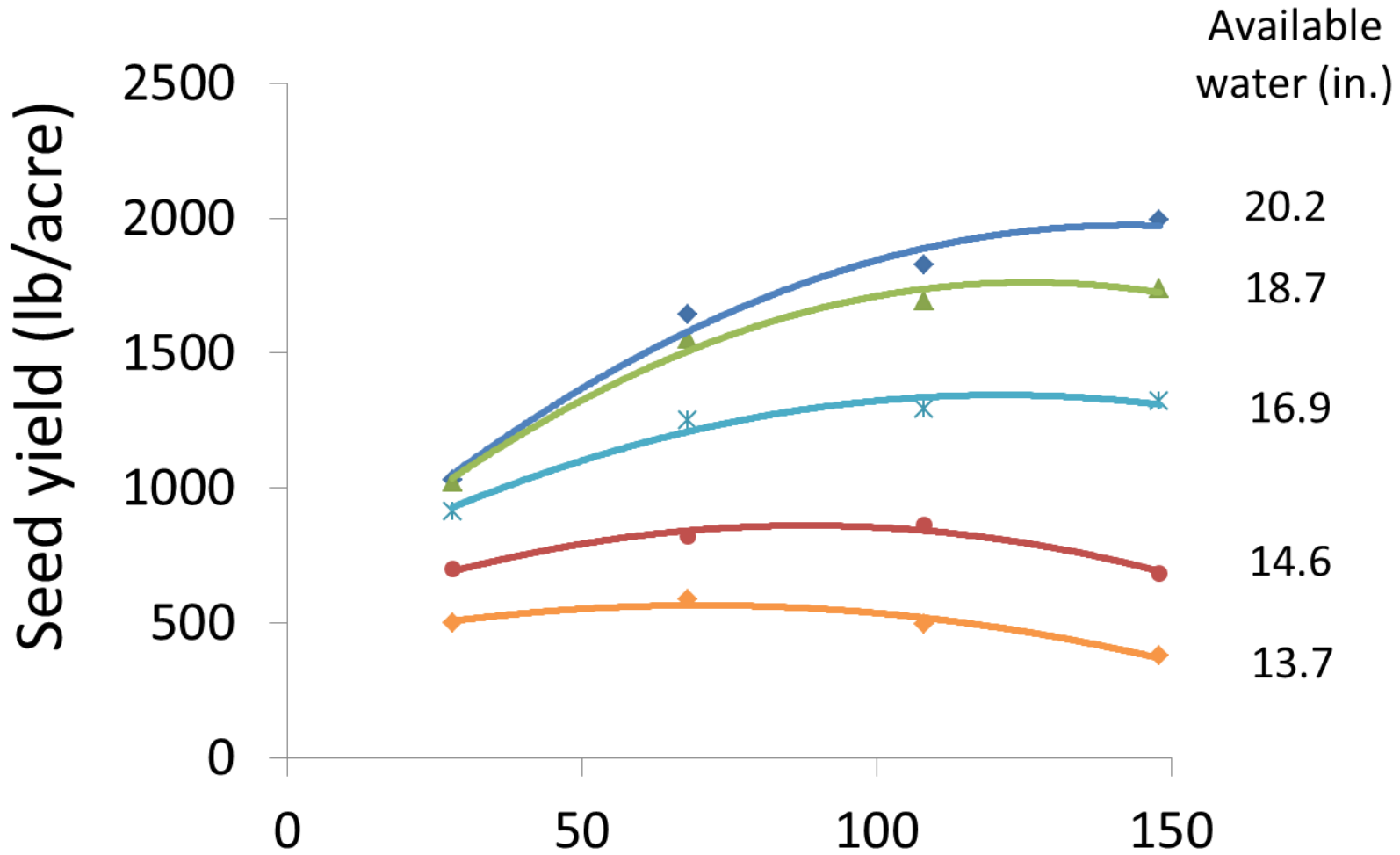
- N rate is based on yield potential and soil test N
- Adjust rates for the previous crop and different areas of a field
- MT soils provide 15-20 lb nitrate-N/acre for each full percent soil organic matter (SOM) above 2%
- N rate can be reduced by about 40 lb following alfalfa and 10 to 20 lb N/acre following annual legume
- N broadcast onto small grain stubble in no-till may need additional 10 lb N/acre per 1000 lb stubble (up to 40 lb N/acre) for several years

Available-N guidelines for oilseeds (EB0161)

Crop	Available N (lb N/lb seed)	Available N (lb N/cwt)	Available N (lb N/bu)
Sunflower	0.045	4.5	1.06
Safflower	0.065	6.5	2.9
Canola	0.05	5.0	2.5

- High yielding varieties of canola tend to need less N/cwt, especially at higher N rates (Brandt et al., 2007).

N and Water Effect on Safflower Yield

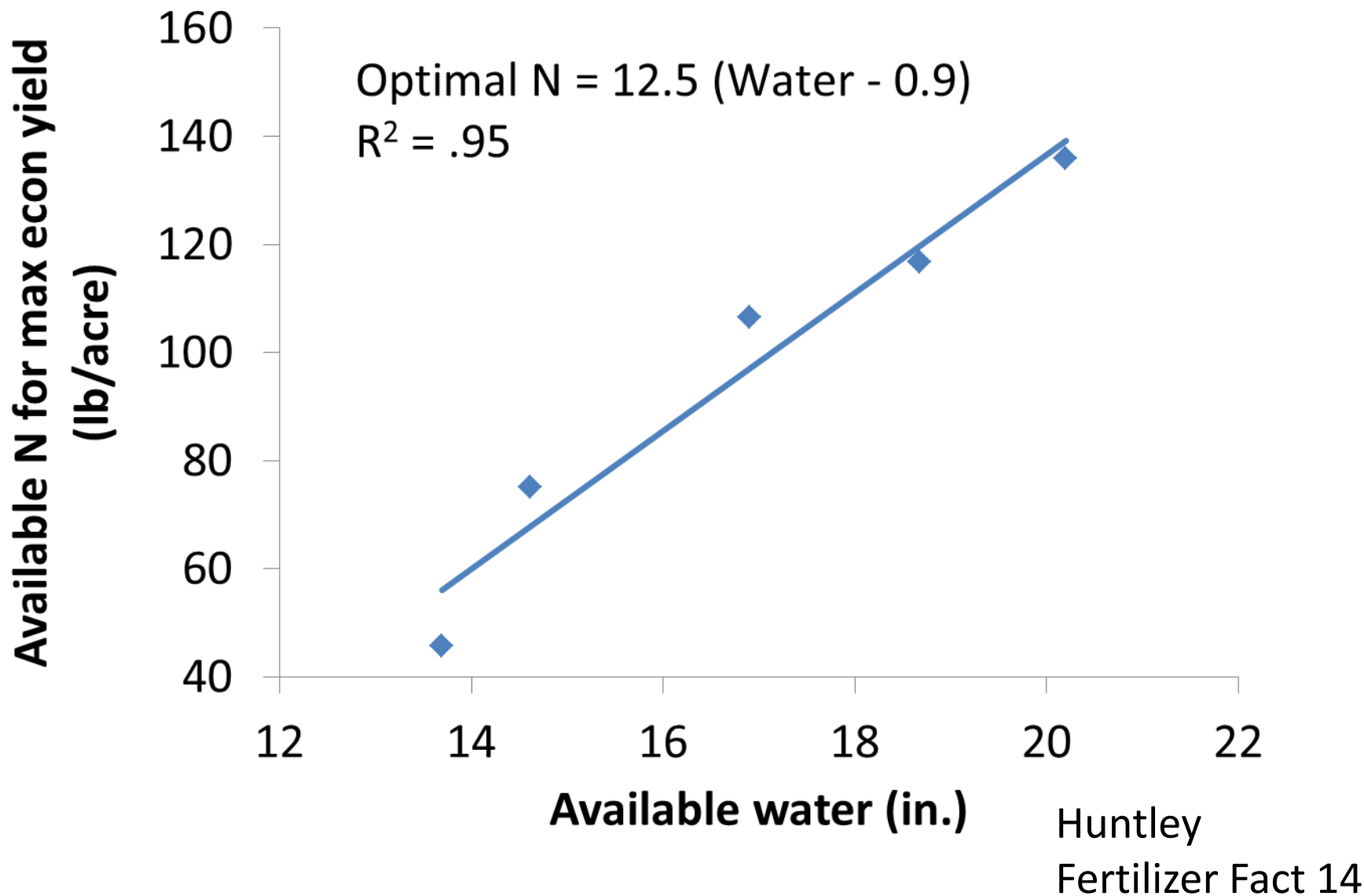


Total available N (lb/acre)

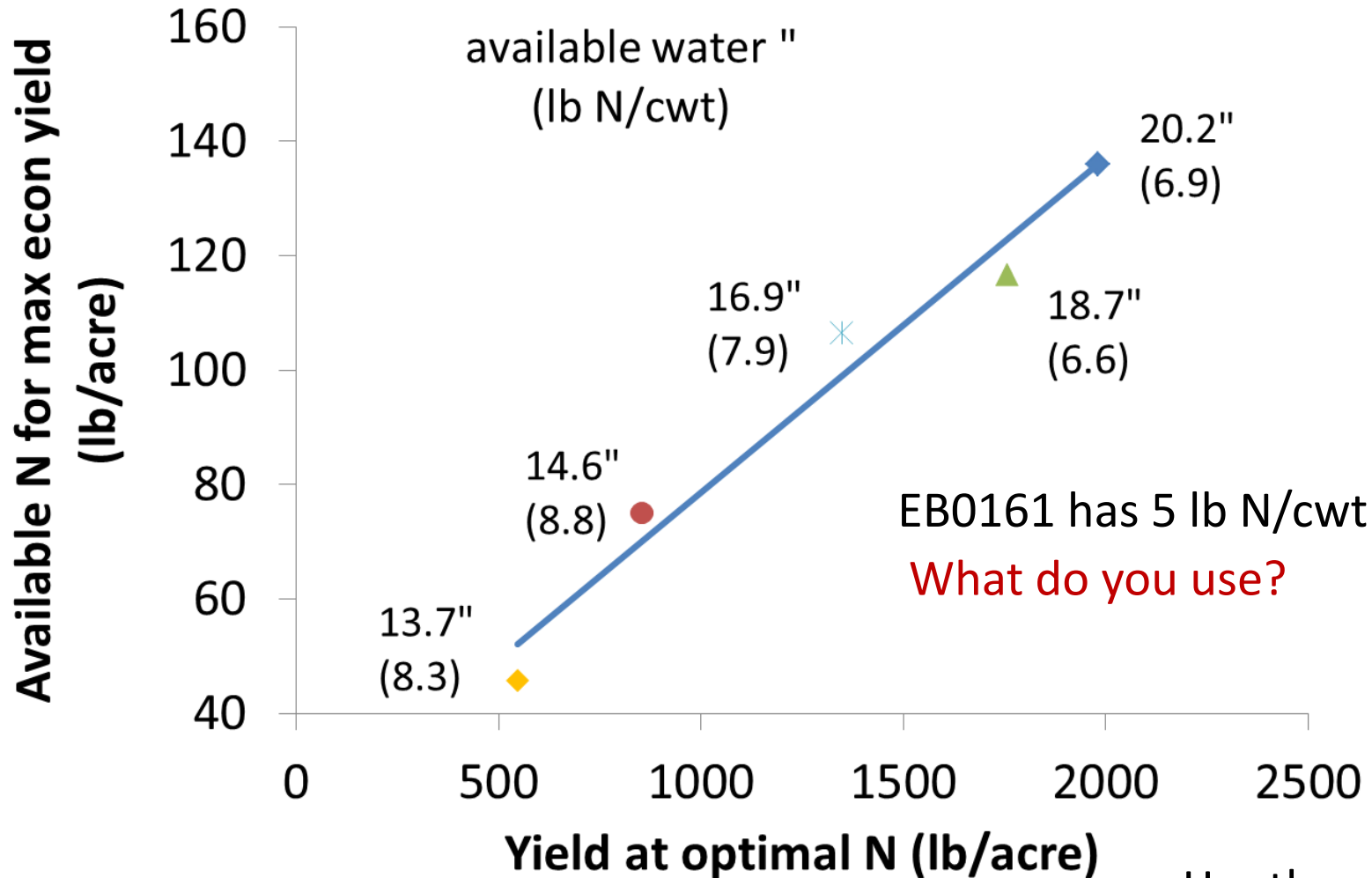
Huntley

Fertilizer Fact 14

Economic N for Safflower Yield at Different Water Availability



lb N/cwt safflower for max net revenue

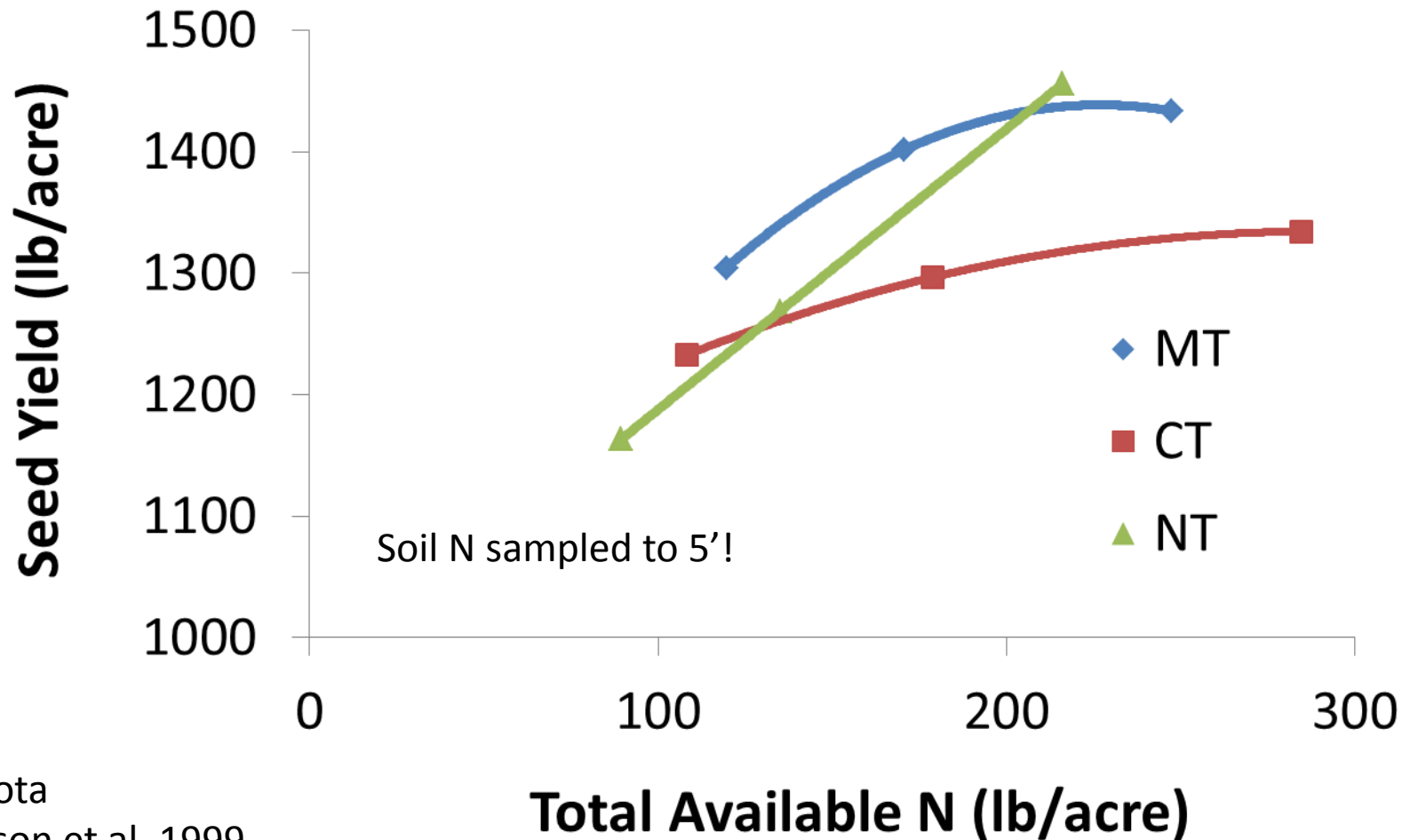


N for safflower (Fertilizer Fact 14)

- 8 - 11 inch of water needed to produce the first lb of safflower seed. Yield increased ~2 cwt with each additional inch water
- Safflower N for max. return (optimum N levels)
 - 50 lb/acre at 13 in. available water
 - Increase N 12.5 lb/acre for each additional inch of water
- N levels above the optimum frequently depressed seed yields
- Variety selection exerted a greater effect on safflower seed oil content than water or N

Sunflower yield response to total available N and tillage

NT had lower residual N than MT and CT



Optimum available N rate from ND study:
~7-12 lb N/cwt (sampled to 5'!)

MSU guideline: 4.5 lb N/cwt (based on 2' sampling).

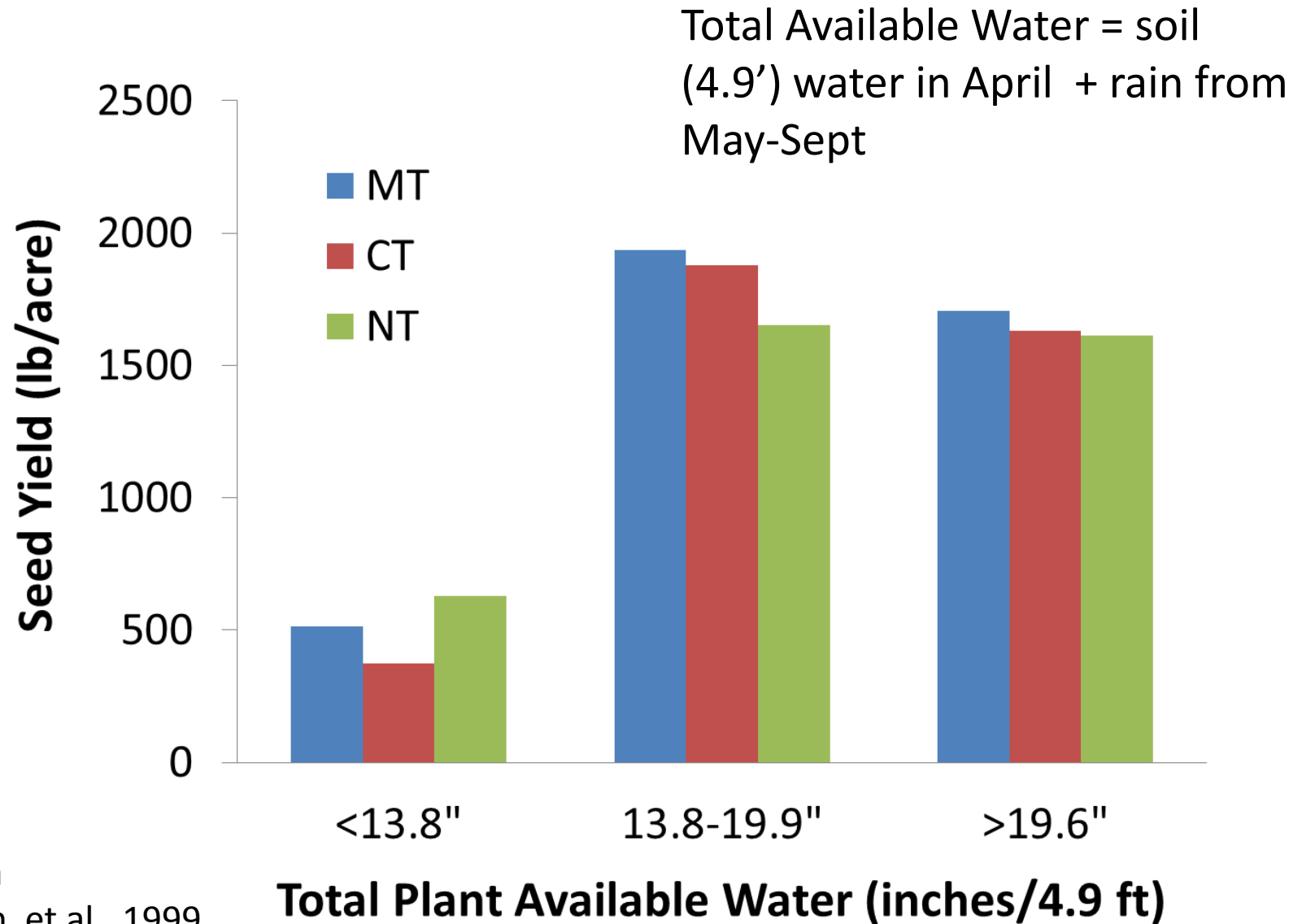
Suggests MSU recommendation relies heavily on deep, unsampled N, OR deep N wasn't used in ND study.

What about sunflower N removal?

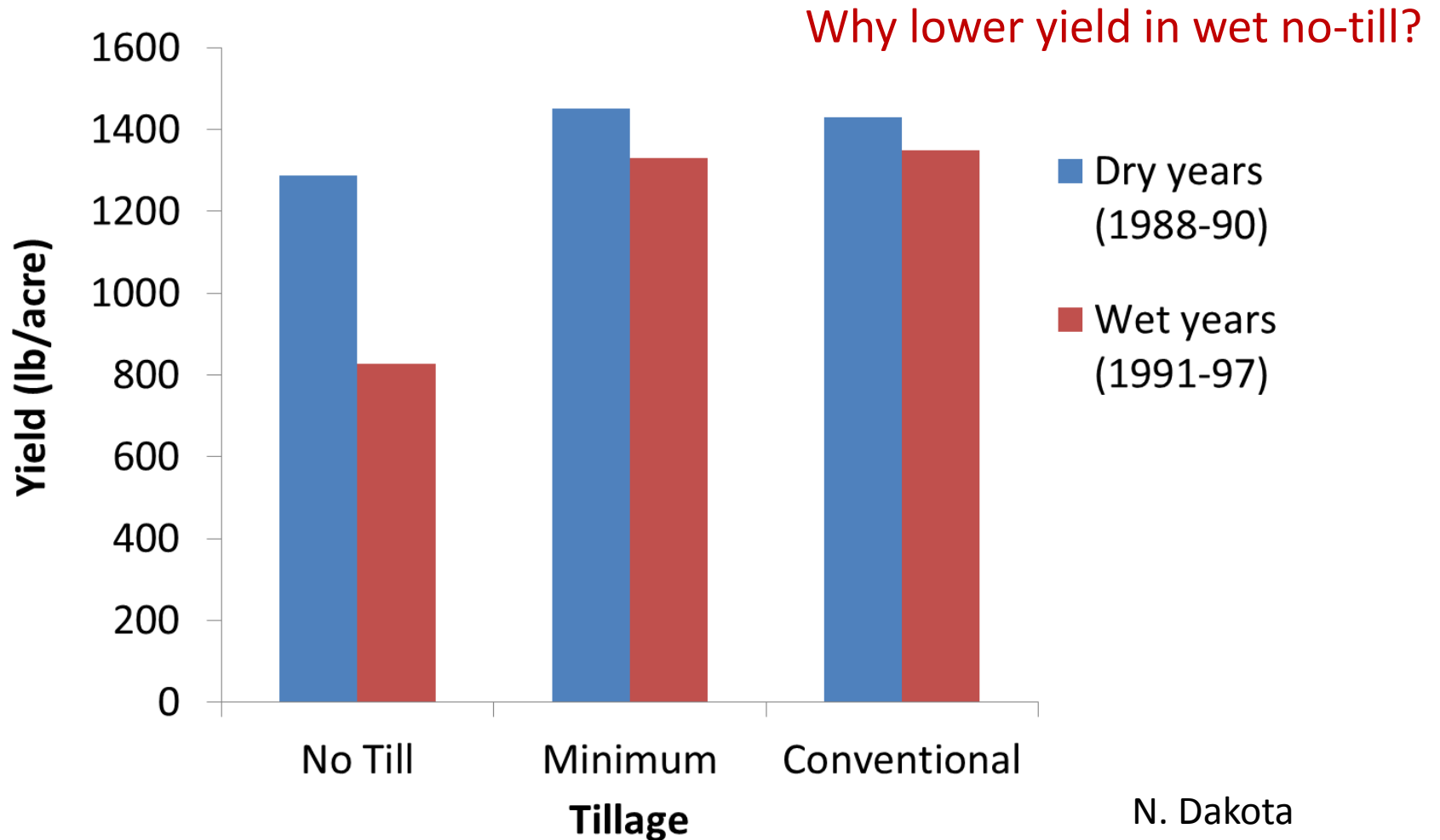
1.06 lb N/bu = ~4 lb N/cwt

Conclusion: Actual sunflower available N need is likely closer to 7 lb N/cwt, but if only sample to 2', 4.5 lb N/cwt is likely sufficient IF there is some deep nitrate. So consider soil and crop rotation (e.g. more likely sufficient N on crop fallow than recrop)

Available water, tillage and sunflower yield



Tillage and sunflower in dry and wet years



N. Dakota
Schatz et al., 1999

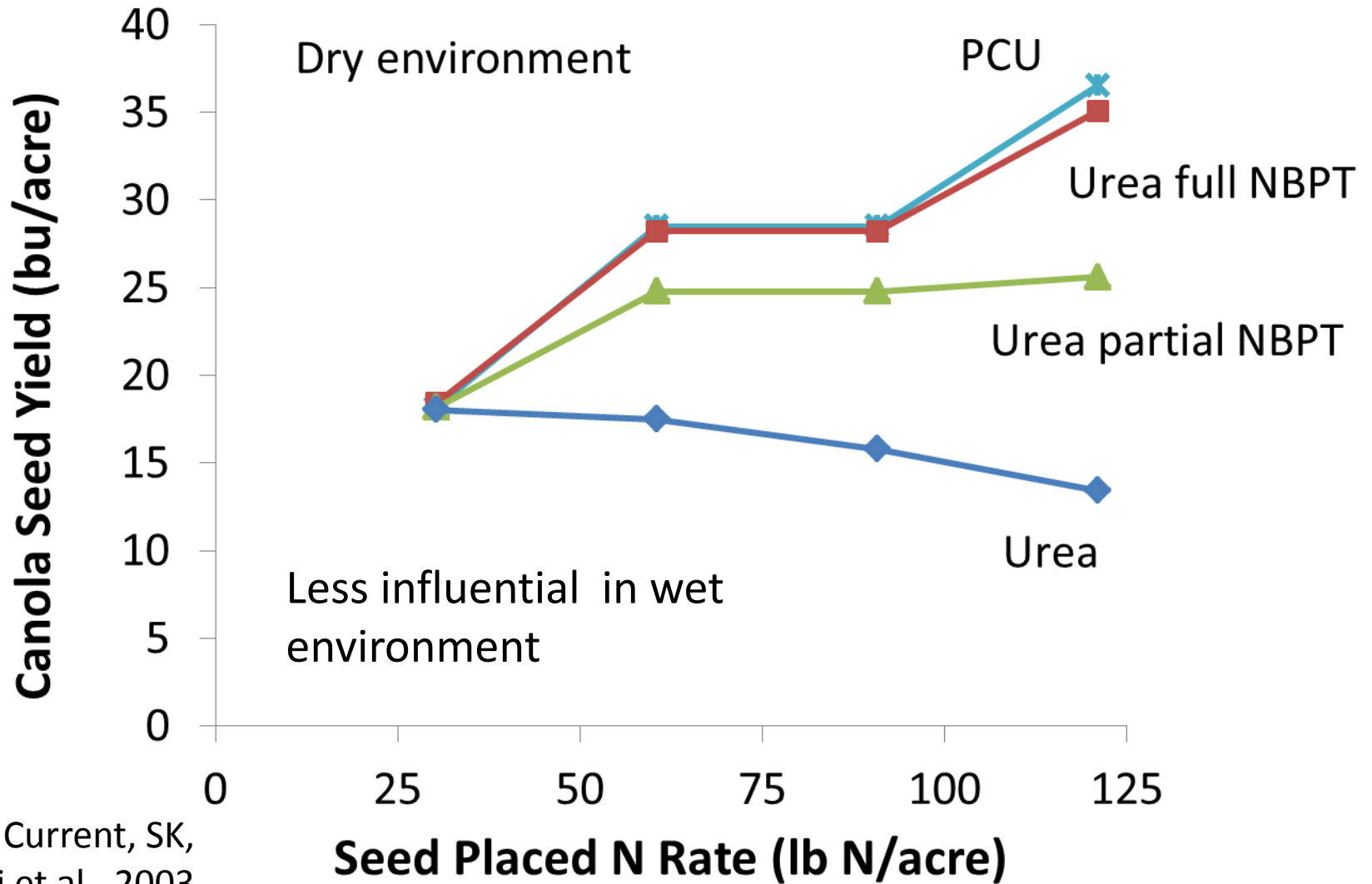
Source

- Legumes in rotation are an excellent N source
- EEFs (e.g., polymer coated, NBPT-Agrotain[®], Avail[®]) have not shown consistent increase in yield.
- Can perhaps eliminate a spring fertilizer application

Seed-placed N

- Canola is easily damaged by seed-placed fertilizer.
- Safe seed-placed N rates depend on the soil type, soil moisture, opener width and row spacing.
- Ammonium sulfate (21-0-0-24) and urea (46-0-0) have similar safe seed-placed rates. Anhydrous ammonia (82-0-0) is not safe seed-placed (Canola Council of Canada Canola Encyclopedia)
- PCU and NBPT increase safe rates by ~2-4 fold

EEFs increase safe seed-placed rate on canola



Swift Current, SK,
Malhi et al., 2003

Sulfur on canola

- Canola can only respond to N if sufficient S
- If all fertilizer N is supplied with ammonium sulfate, then likely the field will receive enough S.

Sulfur

- S is critical for efficient use of N
- Canola has high demand for S early in season
- 18 lb S/acre broadcast at seeding of dryland canola = adequate
- N:S of 7:1 benefits yield if both are deficient, but ratio not important if S is sufficient
- Elemental S must be applied at least a year before oilseed crop to provide enough S. Sulfate is preferred (except in high leaching fields).

P fertilizer guidelines for canola, safflower & sunflower

Crop	Olsen P soil test level (ppm)				
	0	4	8	12	16*
	P fertilizer rate (lb P ₂ O ₅ /acre)				
Canola	45	40	35	30	25
Safflower	50	40	30	20	10
Sunflower	35	30	25	20	15

*With P>16 ppm consider using crop removal rates:

Canola 2.3 lb P₂O₅/cwt

Safflower 1.25 lb P₂O₅/cwt

Sunflower 1.14 lb P₂O₅/cwt

(EB0161)

P on Safflower

- From Canadian production manual
- Dryland soils with low soil P: 27-36 lb P_2O_5 /acre with seed
- Dryland soils testing adequate in P: 13-18 lb P_2O_5 /acre with seed for starter effect
- Irrigated 22-31 lb P_2O_5 /acre with seed
- Max 36 lb P_2O_5 /acre with seed

P and S on canola

- Canola good scavenger of P and S, so those not needed higher by higher yielding varieties – however, might deplete P and S for next crop.

K fertilizer guidelines for canola, safflower & sunflower

Crop	K soil test level (ppm)					
	0	50	100	150	200	250*
	K fertilizer rate (lb K ₂ O /acre)					
Canola	45	40	35	30	25	20
Safflower	65	55	45	35	25	15
Sunflower	55	50	45	40	35	30

With K>250 ppm consider using crop removal rates:

Canola 1.2 K₂O/cwt

Safflower 3.8 lb K₂O/cwt

Sunflower 0.85 lb K₂O/cwt

(EB0161)

Questions?



Placement - Based largely on canola research

N – side band, pre-plant band, early spring broadcast with incorporation (tillage or $> \frac{1}{2}$ inch water). Sub-surface banding increased yields by 5% over surface band (Holzapfel et al., 2007)

P – build up in prior rotation, or place in rooting zone to safe rates (no DAP for sunflower) with remainder side banded at seeding or pre-plant sub-surface band

K – broadcast in fall or winter before planting or band below and to side of seed row. Do not seed-place more than ~ 10 lb $N+K_2O/ac$.

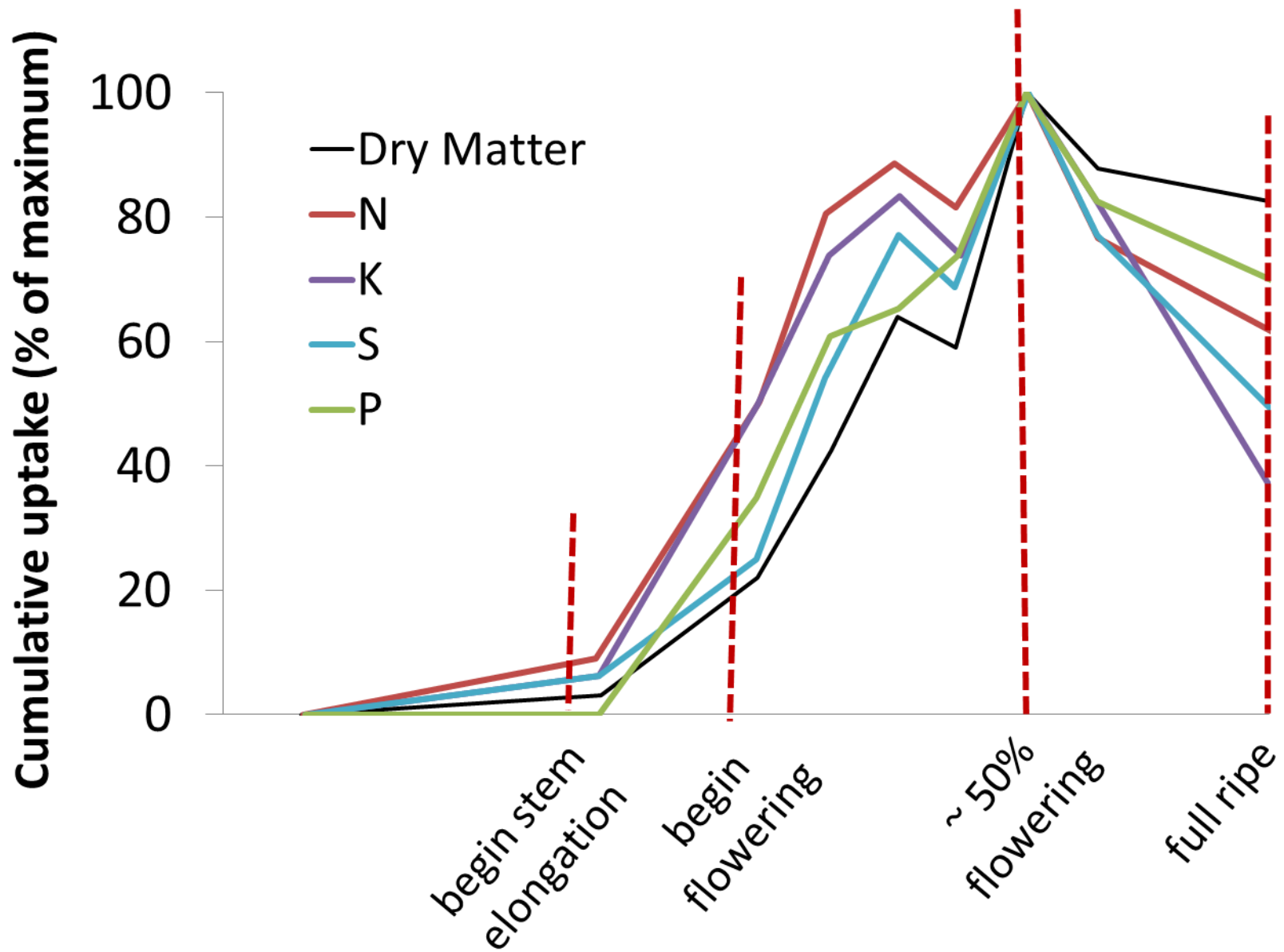
S – seed-place, subsurface band at or before seeding, or broadcast and incorporate before seeding



Timing

- Mobile nutrients N & S: apply in early spring
- Less mobile nutrient P & K: build up in soils in prior rotation or prior to seeding, add a low rate near the seed at seeding

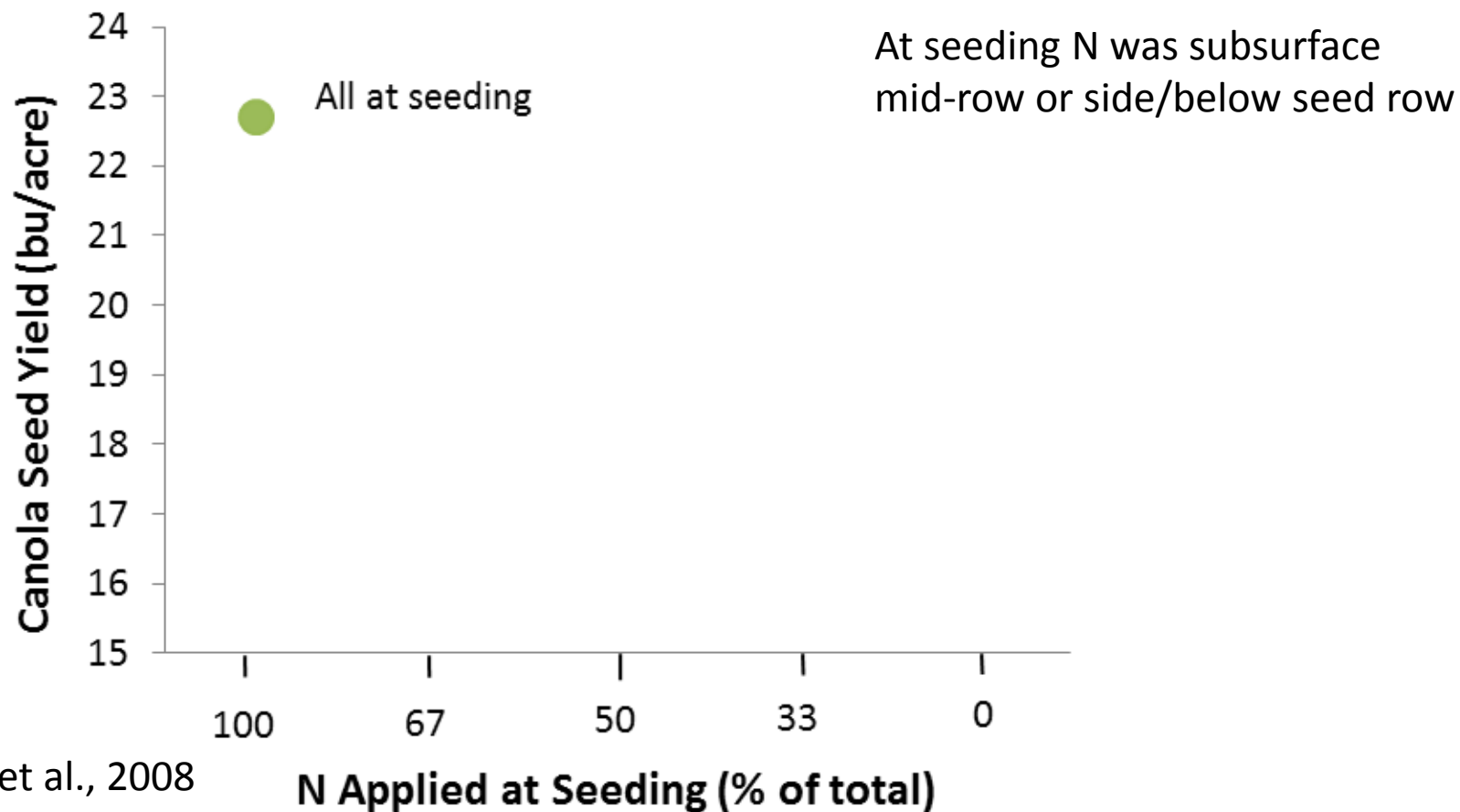
Timing – Canola example. Nutrients must be available BEFORE rapid growth



Optical sensors for N mgmt. on canola

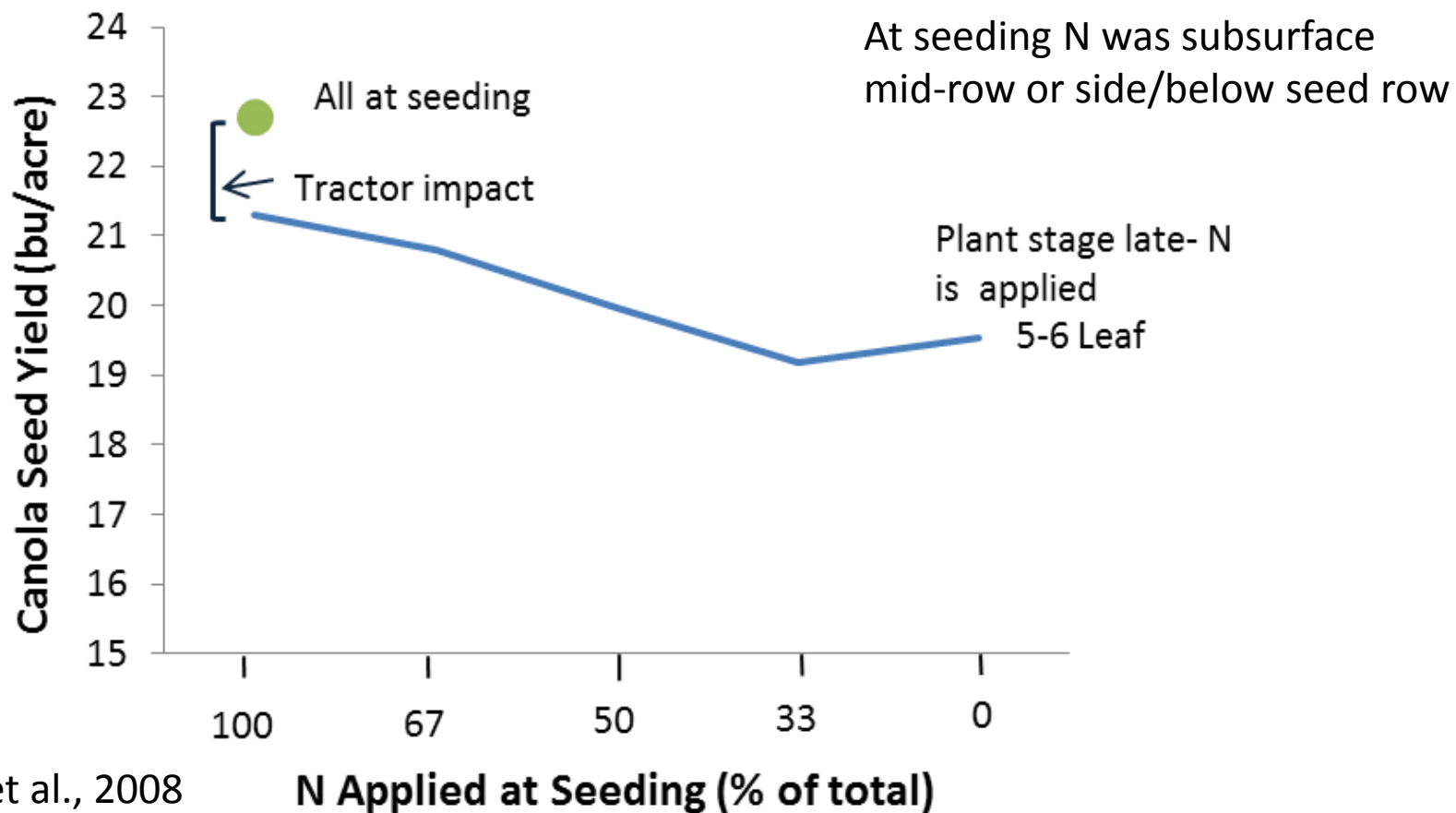
- Optical sensors, such as GreenSeeker, are a form of tissue testing for N management.
- The optimum window for using N sensor technology to recommend top-dressed N fertilizer is from approximately the 6-leaf stage (HB2.6) to the start of flowering (HB4.1; Holzapfel et al., 2009a).
- Based on SK studies, sensor-based N management resulted in a 30 lb N/acre reduction in fertilizer use with no drop in seed yield (Holzapfel et al., 2009b).

Amount and timing of split N application on canola



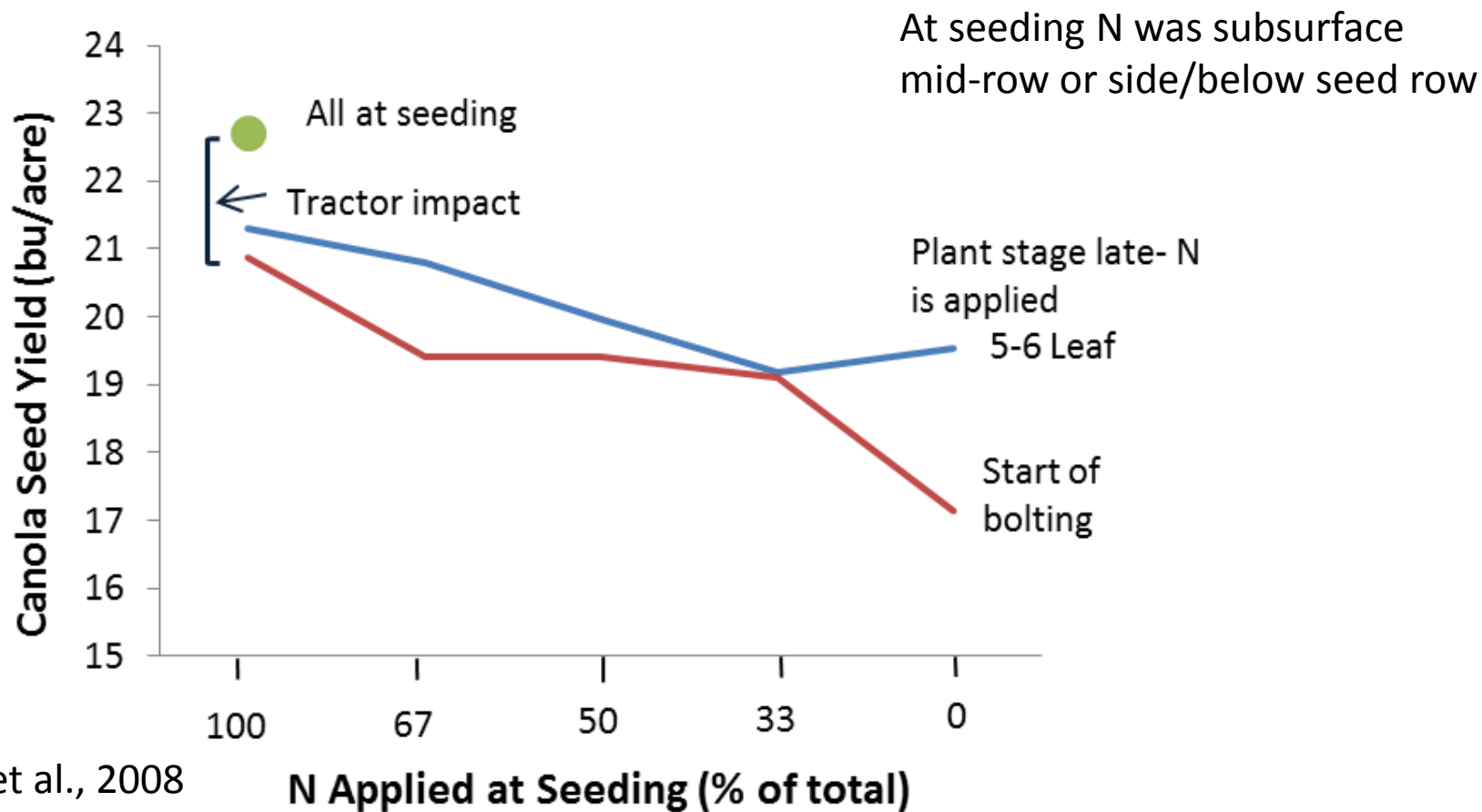
Lafond et al., 2008
Saskatchewan

Amount and timing of split N application on canola



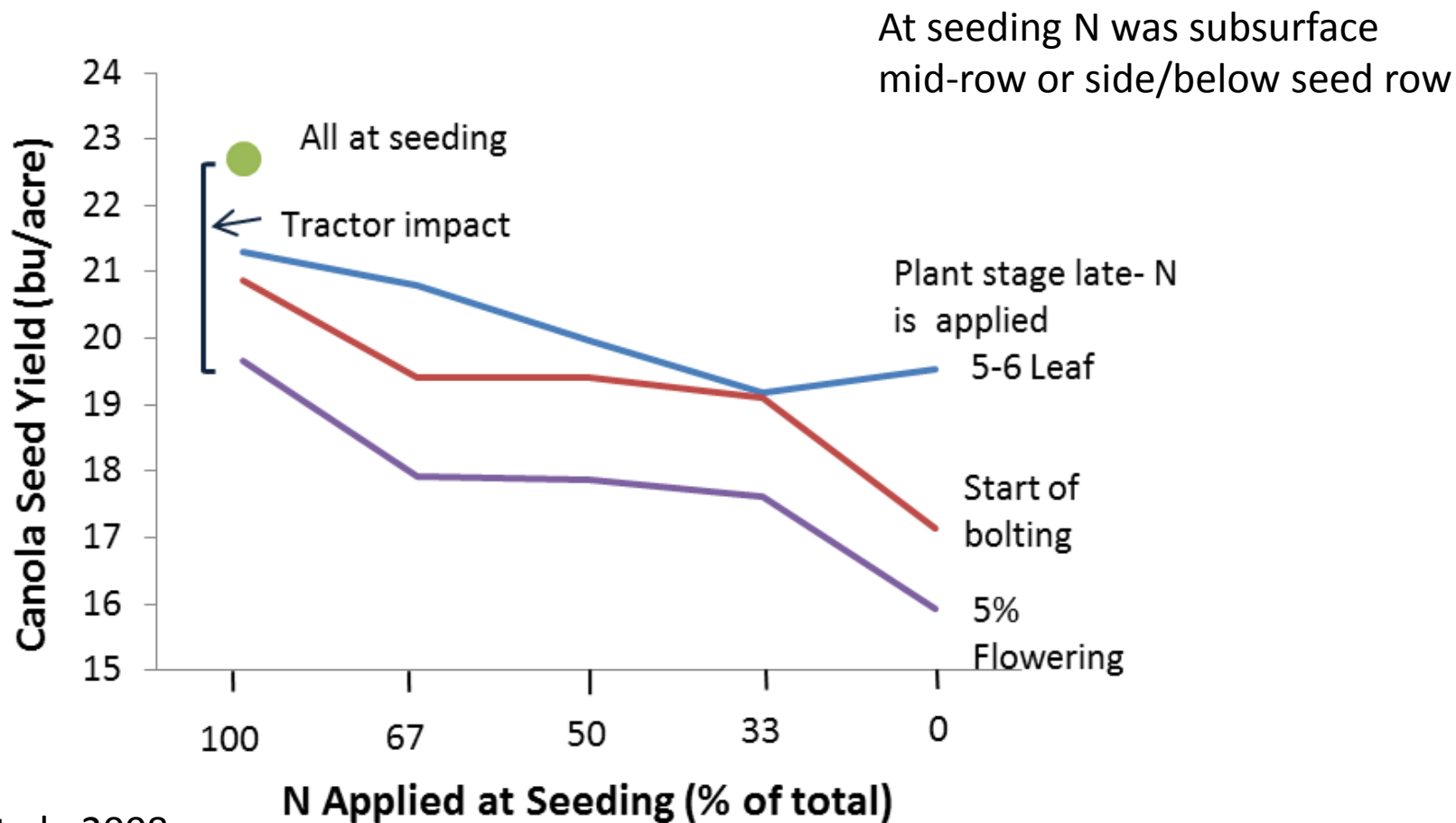
Lafond et al., 2008
Saskatchewan

Amount and timing of split N application on canola



Lafond et al., 2008
Saskatchewan

Amount and timing of split N application on canola



Summary

- Deep rooting of safflower, sunflower, and canola make N needs highly dependent on deep soil N.
- Deep rooting can decrease yield of subsequent crop(s).
- Oilseeds are as, or more, sensitive than small grains to seed-placed fertilizer
- Compared to cereals, oilseeds have lower K needs, similar P needs, and higher S needs (canola mainly)

For more information



Fertilizer Fact 14

<http://landresources.montana.edu/fertilizerfacts>

Soil Fertility Website

<http://landresources.montana.edu/soilfertility/>

We have a canola nutrient management guide in draft form that should get published this coming winter.



Questions?