

How much fertilizer N
should you apply?

Laura L. Van Eerd

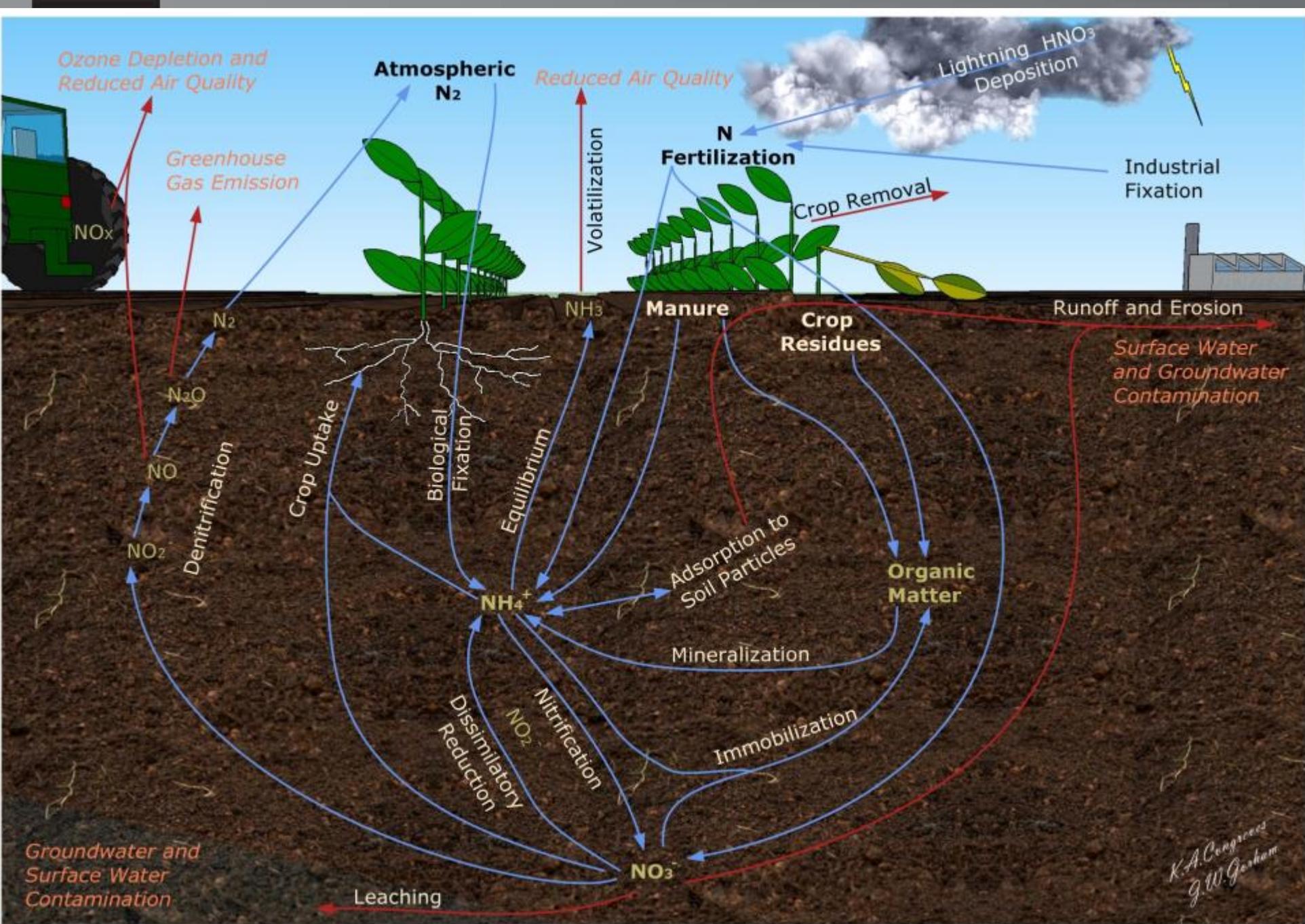
University of Guelph Ridgetown Campus



@LauraVanEerd

lvaneerd@uoguelph.ca

http://www.ridgetownc.com/research/profile_lvaneerd.cfm



N Cycle

What is the N credit of legume cover crops?

Other

Living

Other

Other

How does yield affect soil N?

113, 156, 174 bu/ac

Why Red Clover (legume) cover crop?

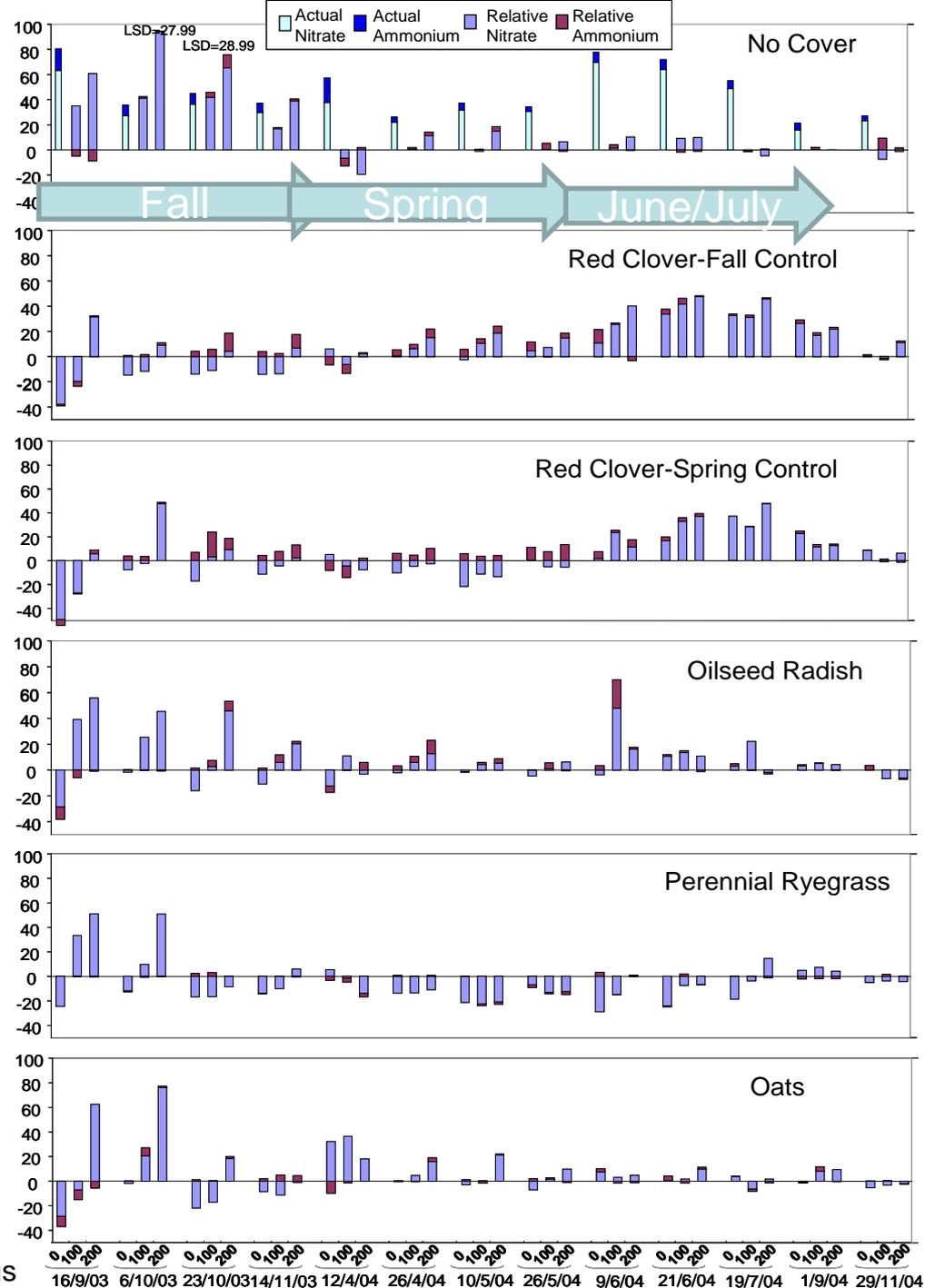
Impact of cover
crops on soil nitrate
levels.

Red Clover
mineralization
matches crop
uptake

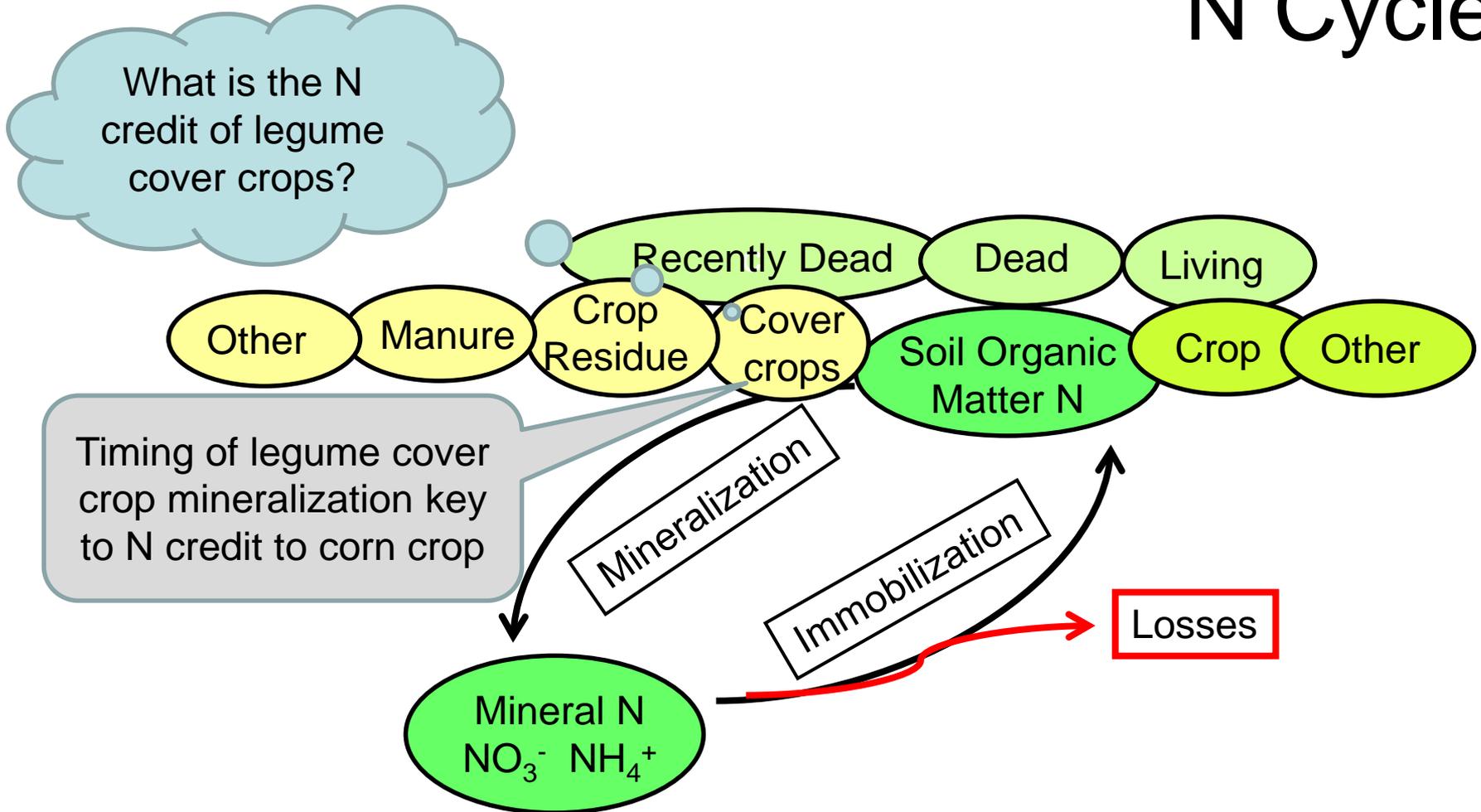
Serran, 2006 Thesis

Thilakarathna et al. 2015. Agron. J. 107:1595

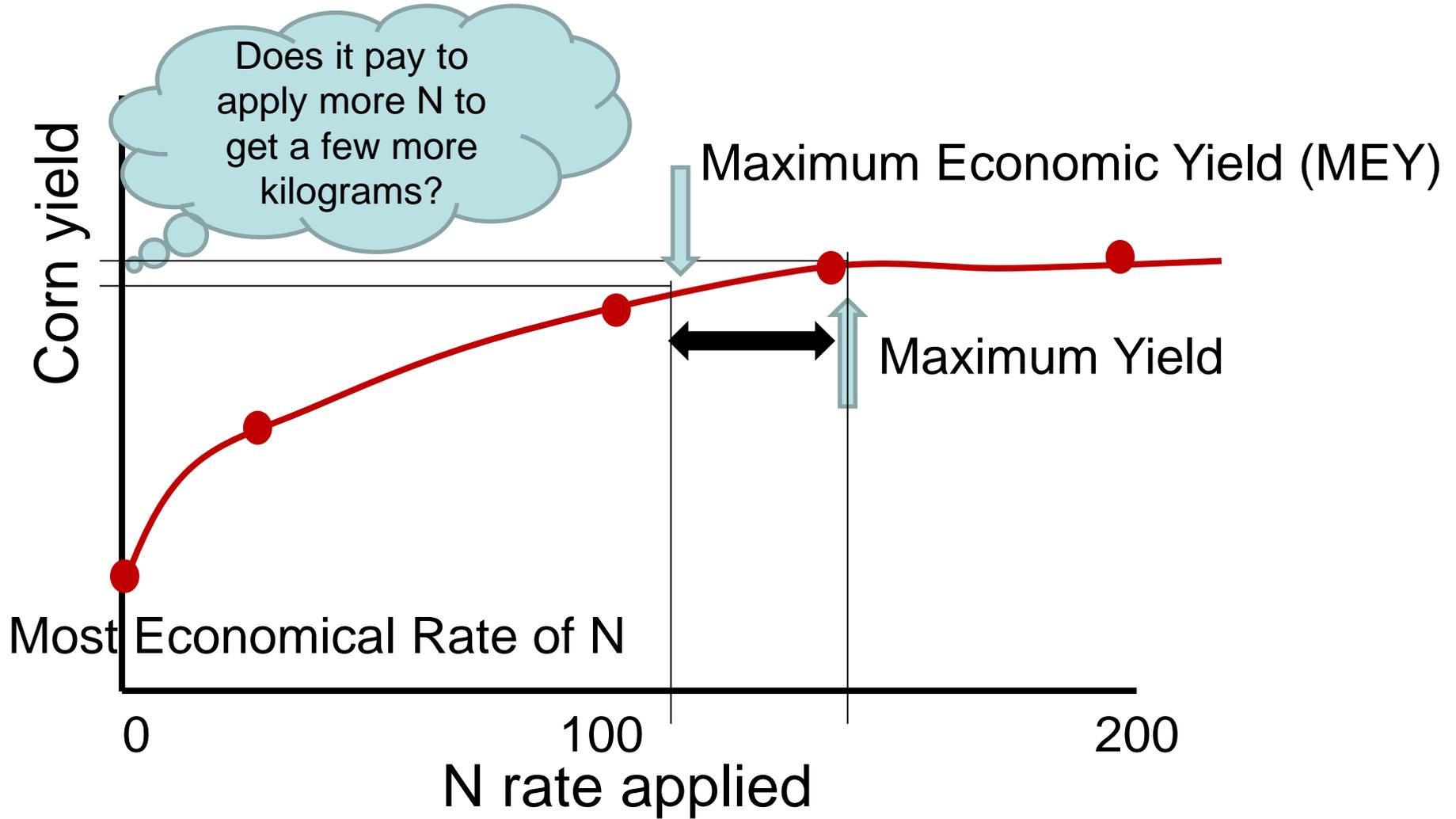
Similar to Vyn et al. Agron. J. 92: 915–924



N Cycle

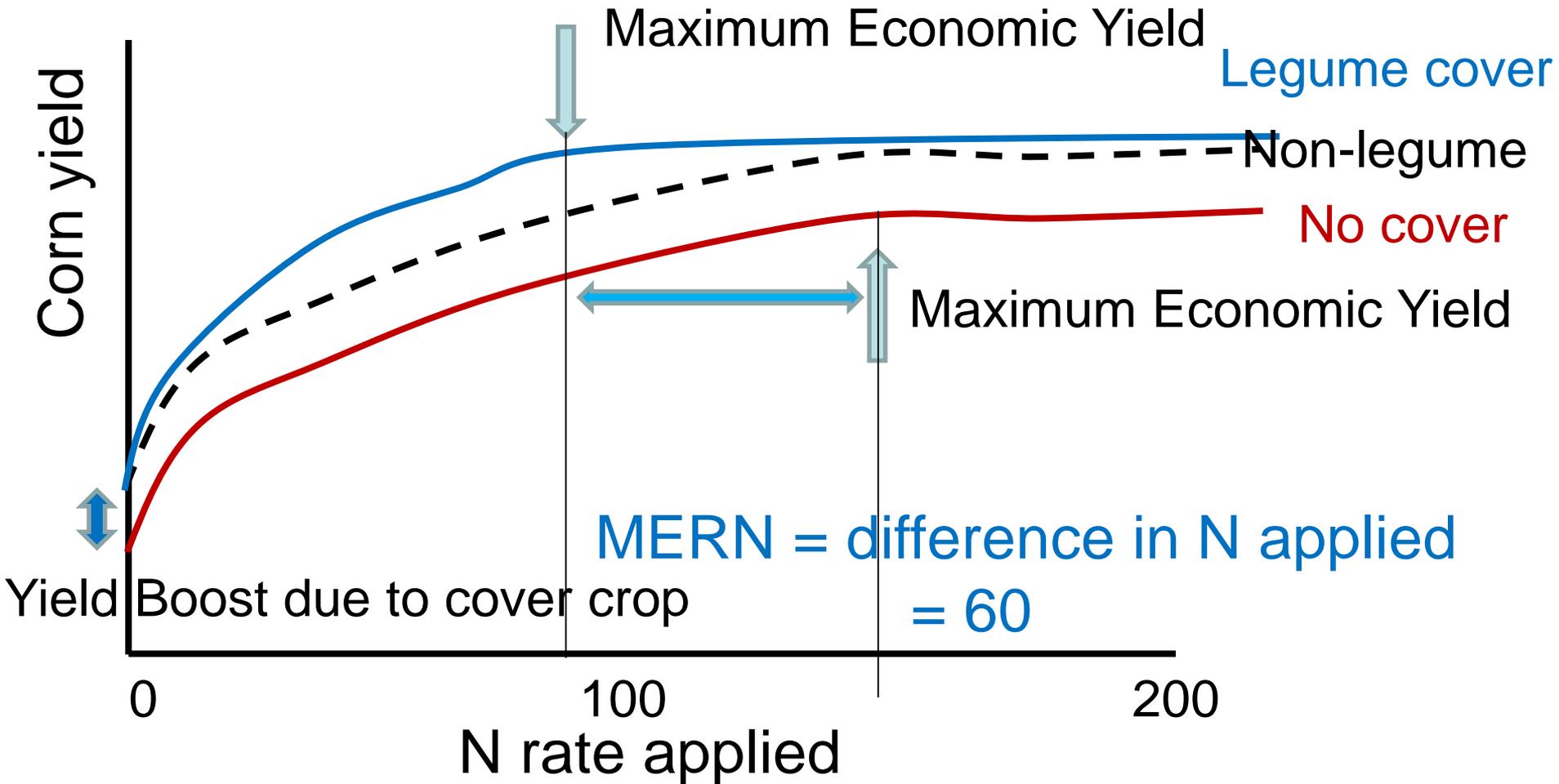


N Credit vs. Most Economic Rate of N



Depends on price of corn and fertilizer

Most Economical Rate of N (MERN) of Legume Cover Crop



Red clover effects on N credit, yield and profit of conventional-till corn

Tillage system	Corn Price \$ bu ⁻¹	N Cost \$/ ac	Cover crop	MERN ² Kg N ha ⁻¹	MEY ³ Mg ha ⁻¹	Gross return ⁴ \$ ha ⁻¹	Profit
	3.81	0.45	No red clover	143			
			Red clover	79			
			Difference,	**			
			Rotational effect (%)				
Conventional tillage	2.54	0.45	No red clover	129			
			Red clover	74			
			Difference	**			
			Rotational effect (%)				
Conventional tillage	3.81	0.68	No red clover	129			
			Red clover	74			
			Difference	**			
			Rotational effect (%)				
No-till corn	2.54	0.68	No red clover	107			
			Red clover	63			
			Difference	**			
			Rotational effect (%)				

N credit
73 lb N/ac

4.5 -7%
increase
in yield

Increase
profit of
\$28 to
\$48/ ac

N credit for No-till corn

60 lb N/ac

Published July 2, 2015

Review & Interpretation

Integrating Cover Crops for Nitrogen Management in Corn

Hairy Vetch
40 to 133
lb N/ac

Systems on Northeastern U.S. Dairy

Red clover
69 to 138
lb N/ac

letterings,* Sheryl N. Swink, Sjoerd W. Duiker, Ka
Douglas B. Beegle, and William J. Cox

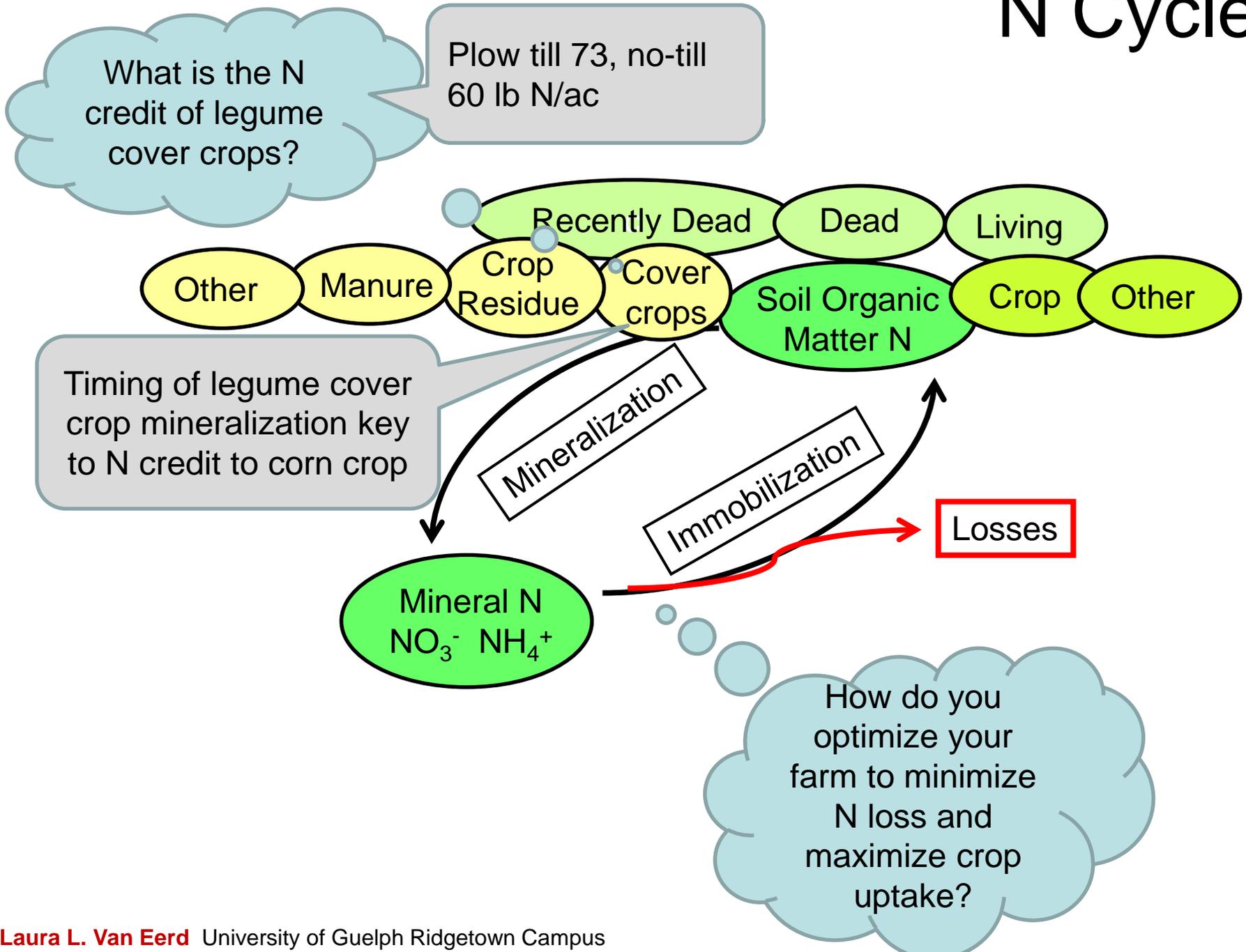
ement values (NFRVs) of legume winter cover crops for corn in

ing

the traditional method.

Ontario	Crimson clove		CT	Spring, into winter wheat	~78	Samson et al. (1991)‡
Ontario	Red clover		CT	Spring, into winter wheat	~78	Samson et al. (1991)‡
PA	Red clover spring seeded into winter wheat	yr1	CT	Mid-Apr., broadcast into winter wheat	155	Dou and Fox (1994)§
PA	Red clover spring seeded into winter wheat	yr2	CT	Mid-Apr., broadcast into winter wheat	27	Dou and Fox (1994)§
PA	Red clover spring seeded into winter wheat	yr1	NT	Mid-Apr., broadcast into winter wheat	144	Dou and Fox (1994)§
PA	Red clover spring seeded into winter wheat	yr2	NT	Mid-Apr., broadcast into winter wheat	42	Dou and Fox (1994)§
WI	Red clover		CT	Mid-late Apr. with oat	95–115	Stute and Posner (1995b)

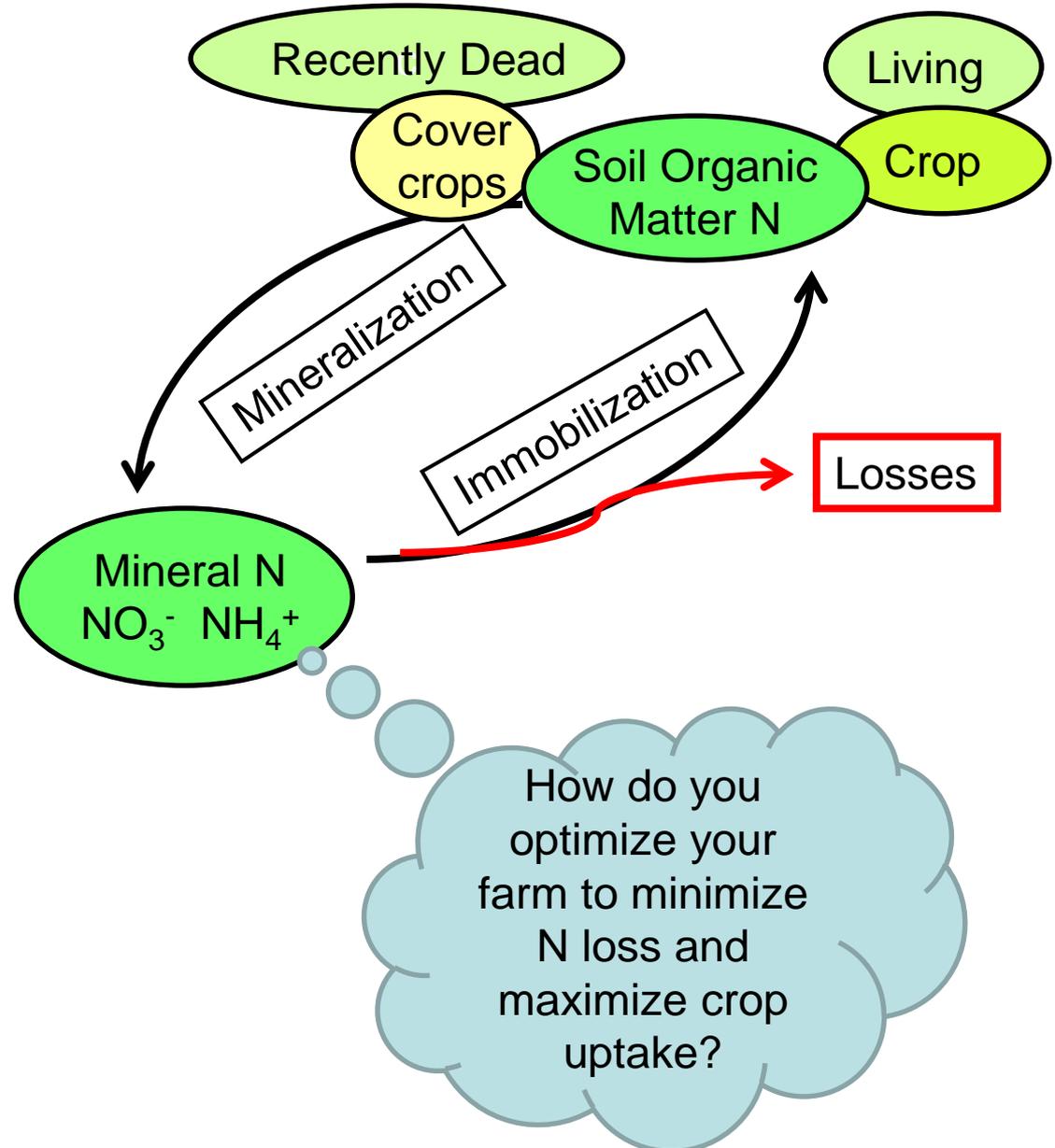
N Cycle



N Cycle

Cycle depends on:

- Soil
 - Health
 - %OM
 - Texture
 - Temperature
 - Moisture
 - pH
 - Compaction
- Production Practices
 - Crop rotation
 - Tillage system
 - Cover crop
 - Manure
 - Fertilizer
- Weather
 - Temperature
 - Precipitation



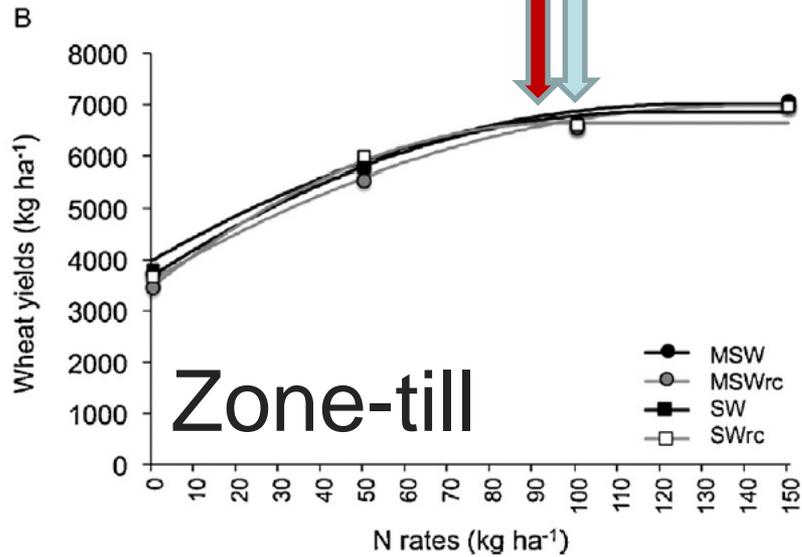
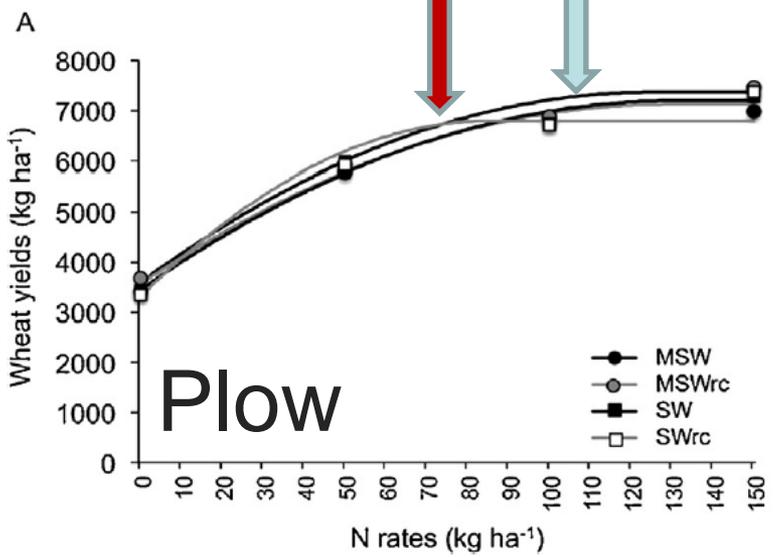
Long-term Tillage + Crop Rotation



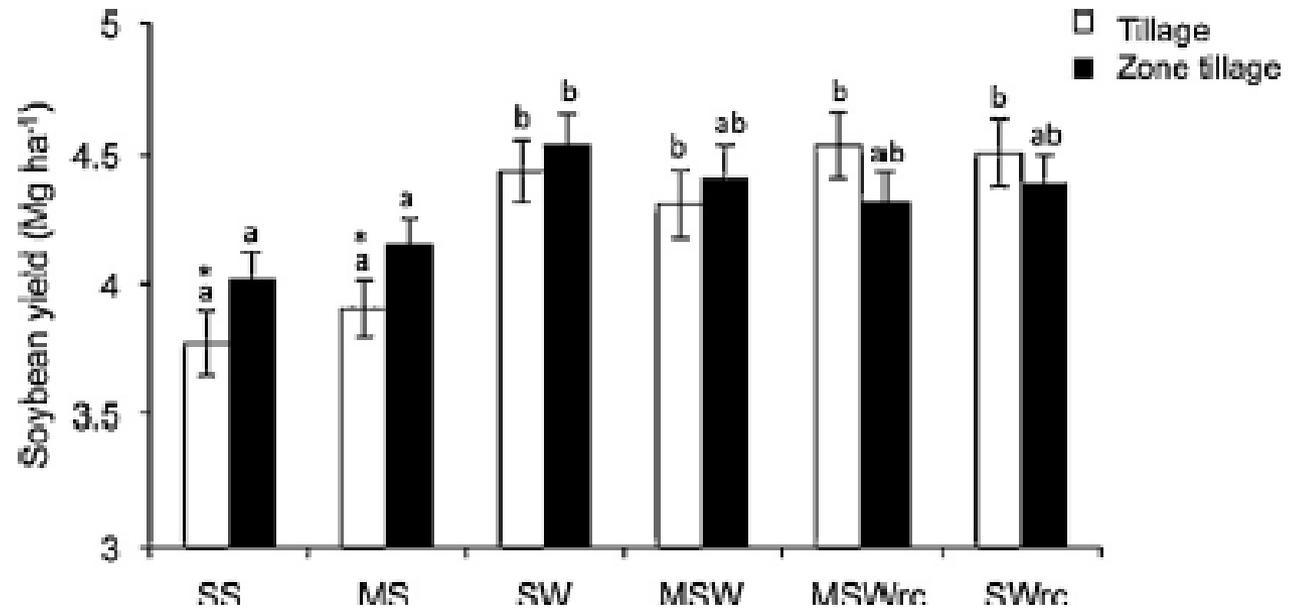
Ridgetown Est. 1995

- clay loam, Orthic Humic Gleysol
- No till (NT) vs. CT (fall plow+ spring cultiv.)
- Rotation: continuous corn (C-C), contin. soybean (S-S), S-C, S-winter wheat (S-W), and C-S-W
- 4 N fertilizer rates to corn and wheat
- 2008 increased N rates, sowed red clover into W, + changed to zone-till
- **Van Eerd et al. 2014 . Can. J. Soil Sci.**

Wheat: Don't need more Fert N w red clover



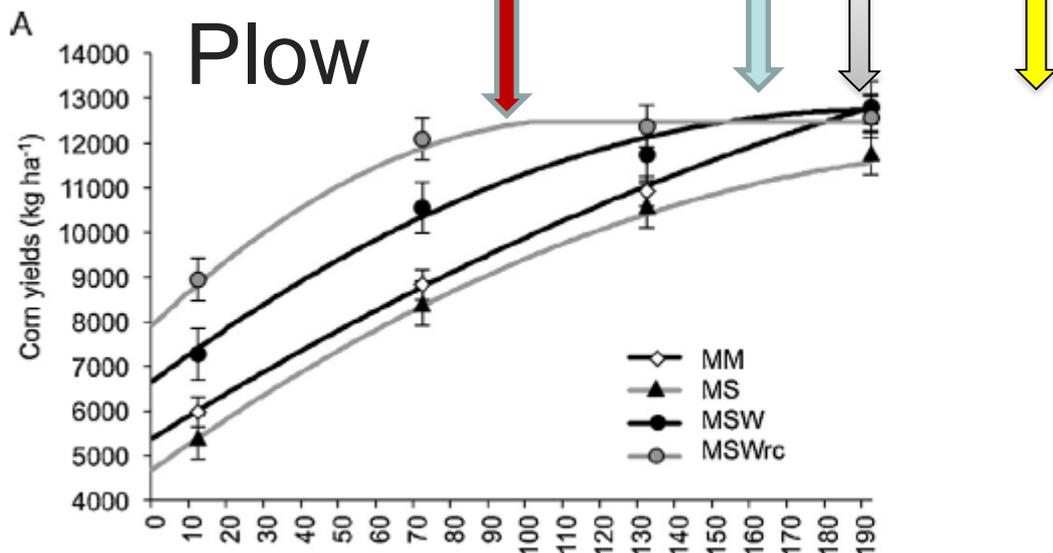
Higher soybean yield with wheat



Gaudin et al. 2015

Fig. 4. Soybean yields response to rotation and tillage. LS means (2010–2013)

Corn Yields at Ridgetown



17% (till) to 21% (zone-till) increase in MERN with wheat ALONE and more with red clover



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Culture
Systems &
Environment



Wheat improves nitrogen use efficiency of maize and soybean-based cropping systems

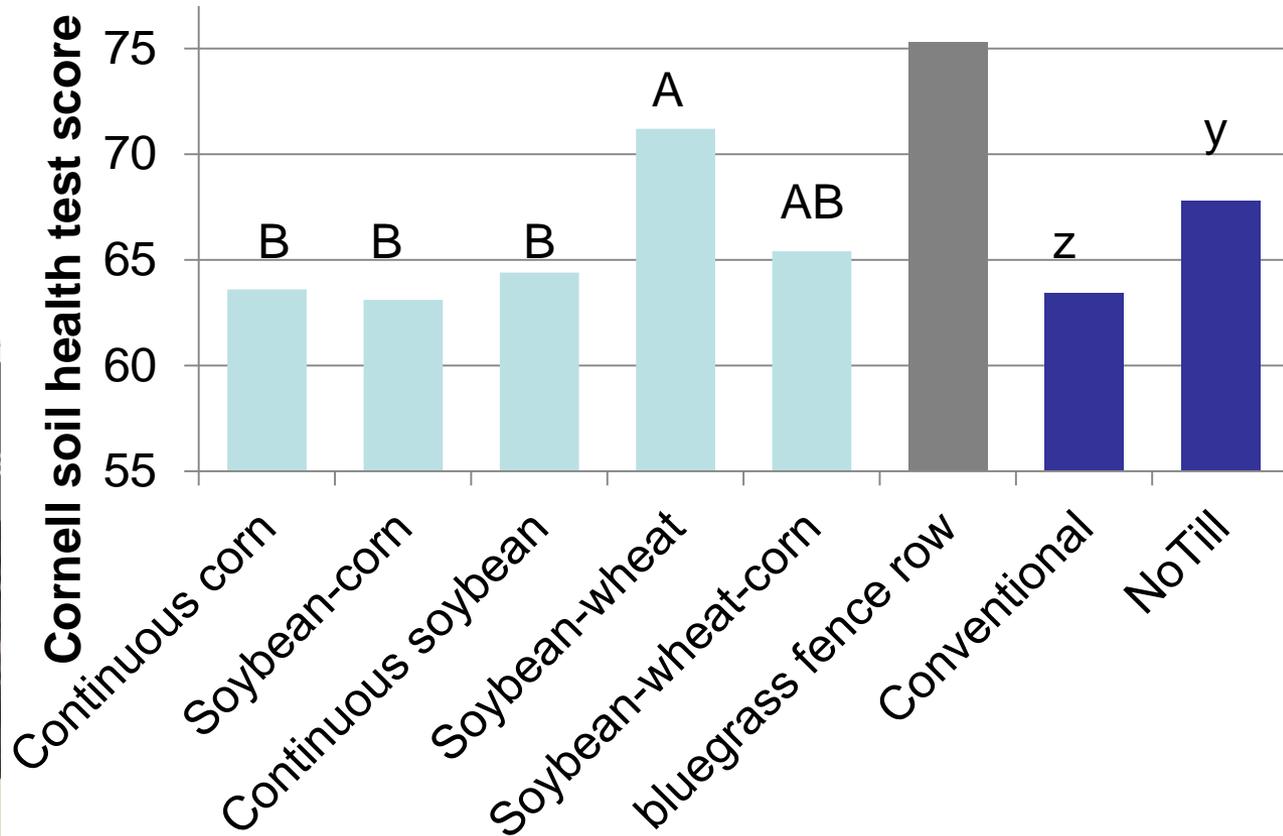


2015- August



from Dr. D.C. Hooker

Long-term trial -Ridgetown

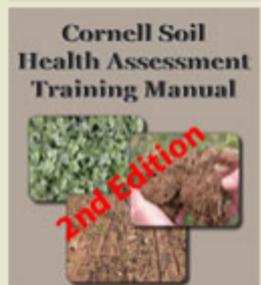


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Cornell Soil Health

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Online resource:

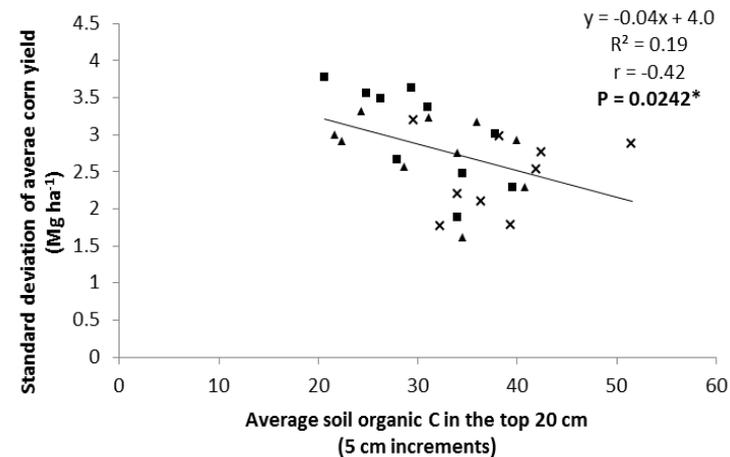
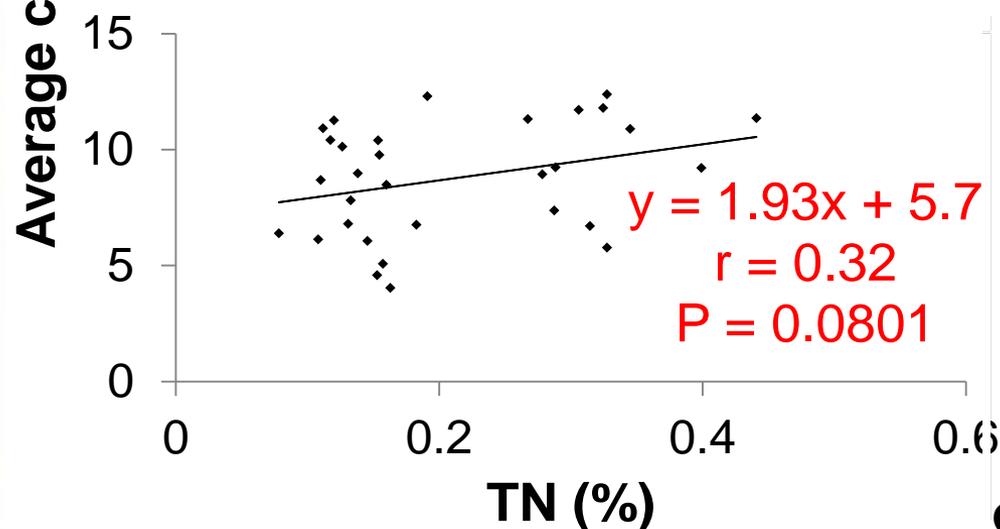
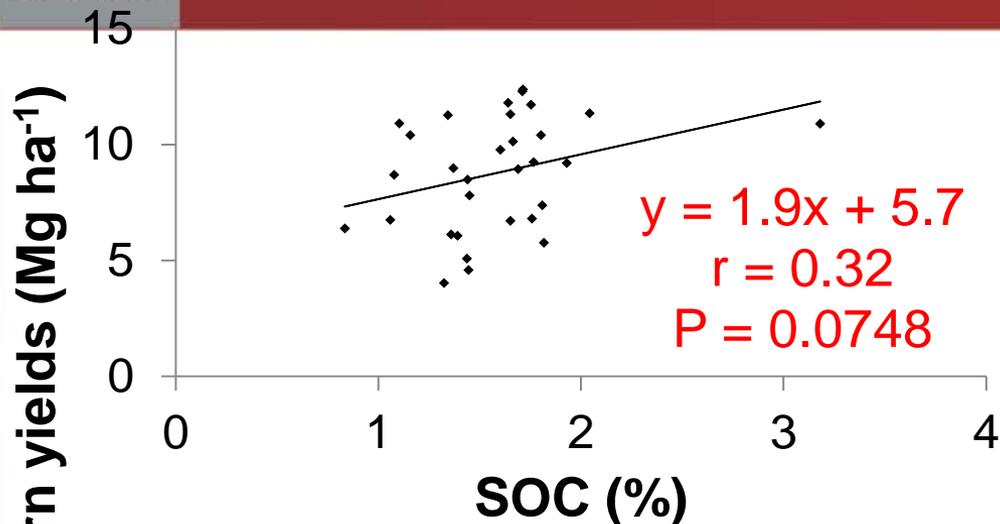


Cornell Soil Health Testing for 2016

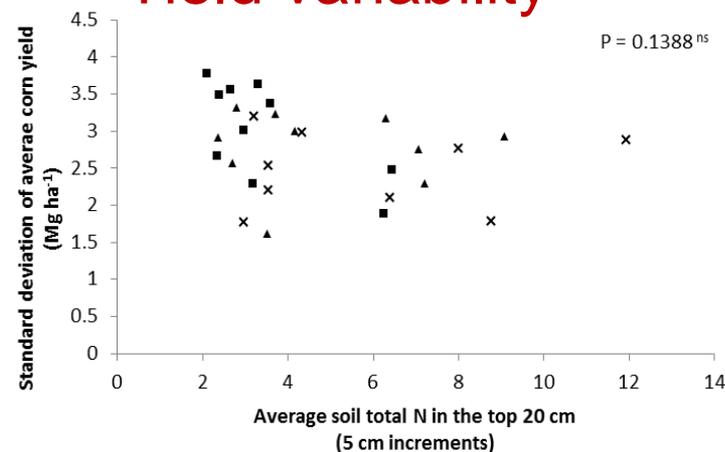


Ridgetown
Van Eerd et al. 2014. Can J Soil Sci 94

How do average crop yields relate to soil organic C & total N?



Yield variability



Congreves et al. 2015. unpublished

Red Clover, Wheat Protects against extreme weather years

Winter wheat alone

- Better corn and soybeans yields in extreme years (cool-wet, hot-dry)

Red clover undersown into wheat

- Increased corn yield resilience by 7% and soybean 22%



At Elora

RESEARCH ARTICLE

Increasing Crop Diversity Mitigates Weather Variations and Improves Yield Stability

Amélie C. M. Gaudin^{1*}, Tor N. Tolhurst², Alan P. Ker², Ken Janovicek¹, Cristina Tortora³, Ralph C. Martin¹, William Deen¹

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N Cycle

