Use of Nitrification Inhibitor with Manure

Carrie Laboski & Todd Andraski

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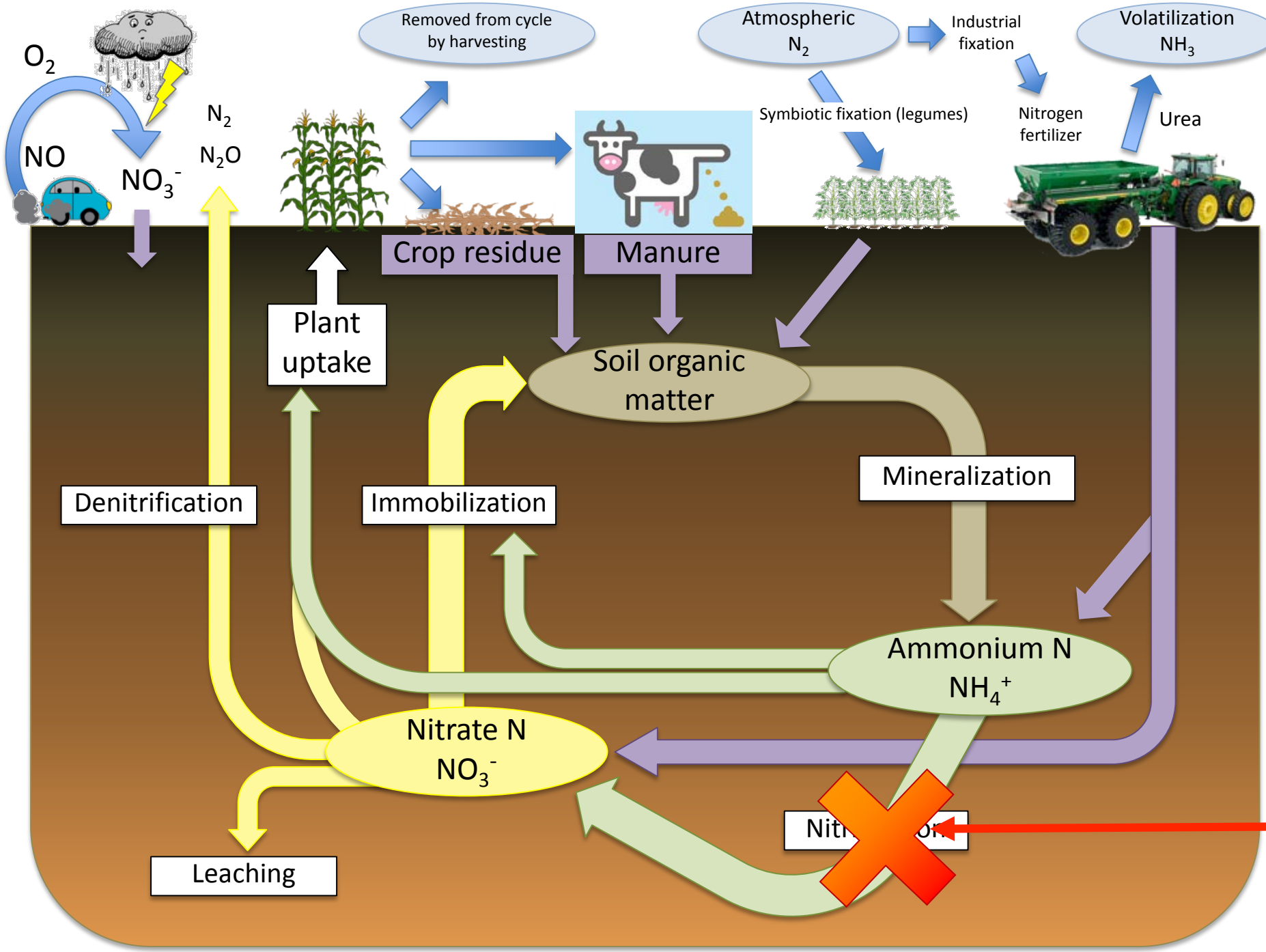
DEPARTMENT OF SOIL SCIENCE
University of Wisconsin-Madison

UW Extension
University of Wisconsin-Extension



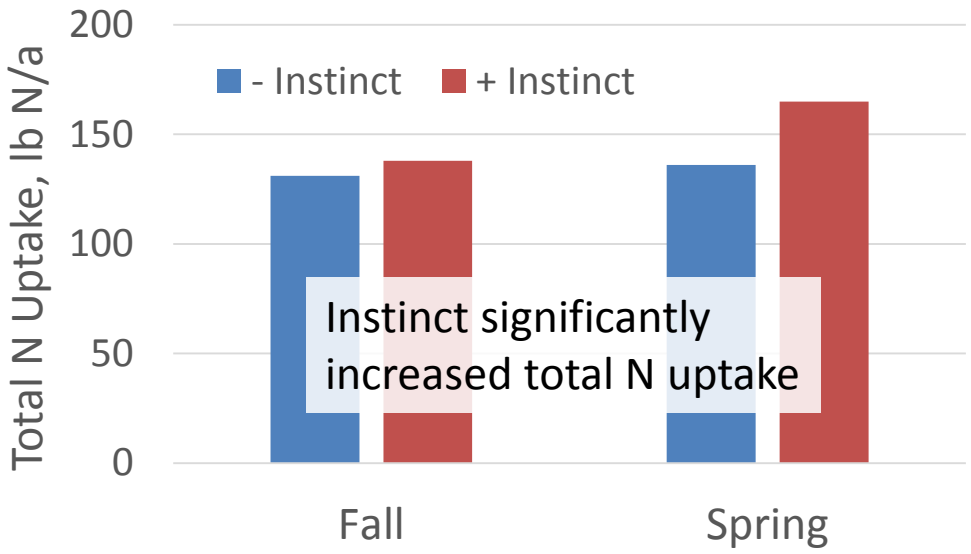
- $NH_4^+ \rightarrow NO_2^- \rightarrow NO_3^-$
- Controlled by:
  - Supply of NH_4
  - Temp. & moisture
  - Population of nitrifying organisms
  - Soil pH
  - Oxygen is required

Inhibitors temporarily block

Effect of Instinct and time of broadcast/incorporated dairy slurry application on corn yield and total N uptake at Arlington, WI, 2011

Timing	Instinct		Mean Timing	Instinct		Mean Timing
	No	Yes		No	Yes	
	Grain Yield, bu/a			Silage Yield, T DM/a		
Fall 10/21; 52 lb avail. N/a	135	141	138	7.25	7.54	7.40
Spring 5/3; 67 lb avail. N/a	135	156	146	7.15	8.40	7.78
Mean Instinct	135	149		7.20 b	7.97 a	

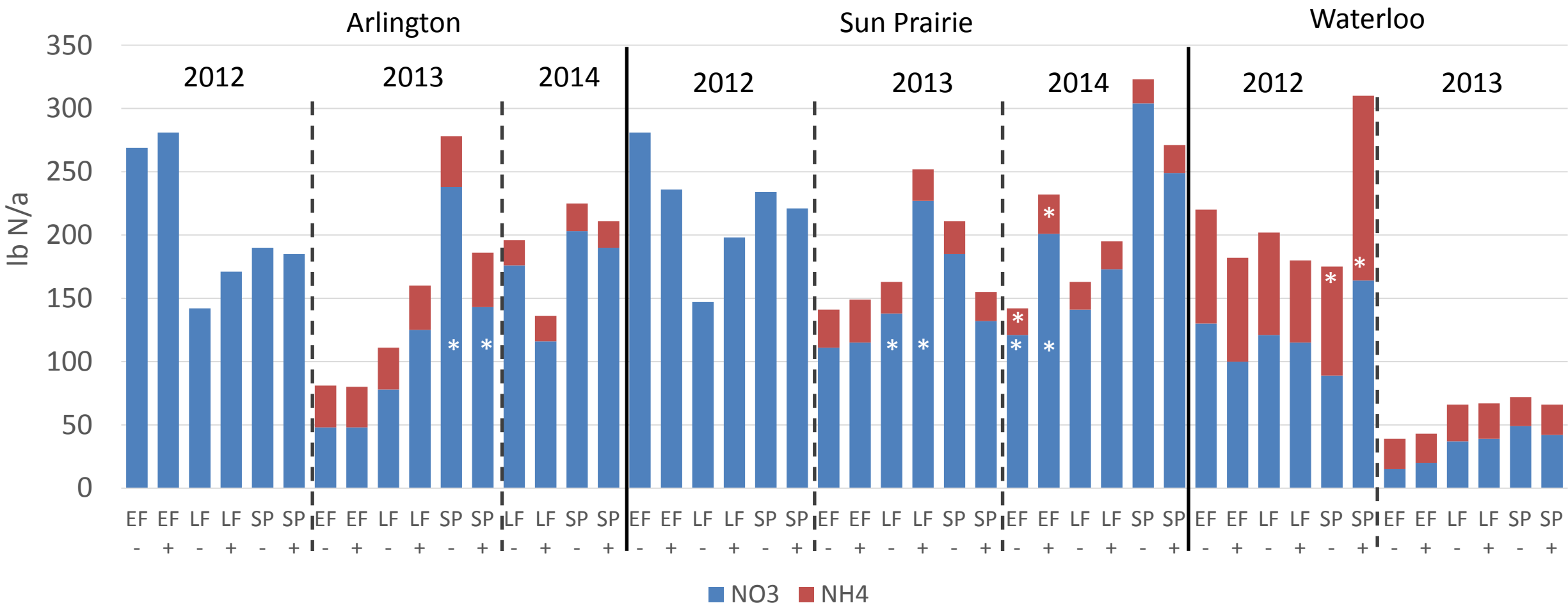
Instinct
- Did not effect soil NO_3 or NH_4 concentrations in late fall, spring (0-2'), or PSNT.
- Significantly increased V8 & VT SPAD meter readings for both application timings



N availability from digested, separated dairy liquid manure as affected by application timing and use of Instinct

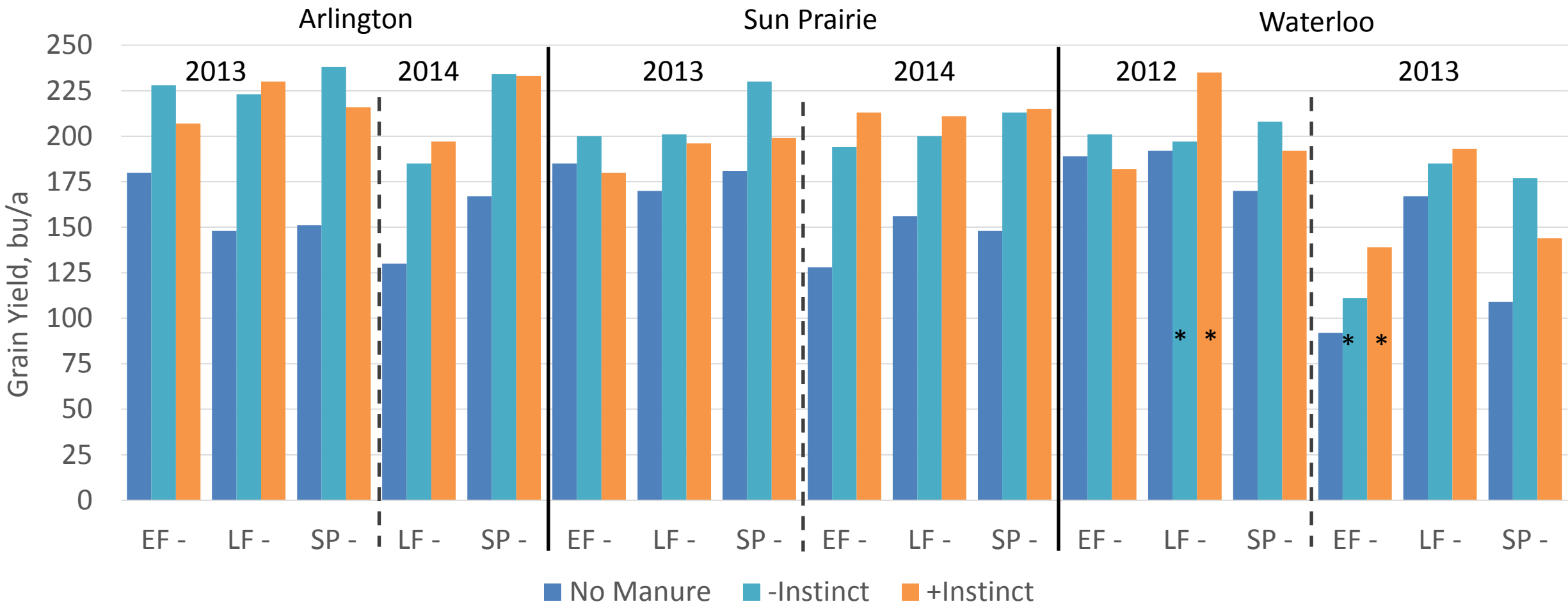
- 8 site-years
  - All sites well drained, except Waterloo 2012 (poorly drained)
- Timing
  - Early fall – early/mid-Oct.
  - Late fall – early/mid- Nov.
  - Spring
- 8,700 gal/a; ~55-60% NH_4-N
- With and without Instinct
  - Label rates (37 vs 70 oz/a)
  - Added to tanker & agitated
- Injected application

Effect of Instinct & manure timing on 0-2’ soil N at ~V6



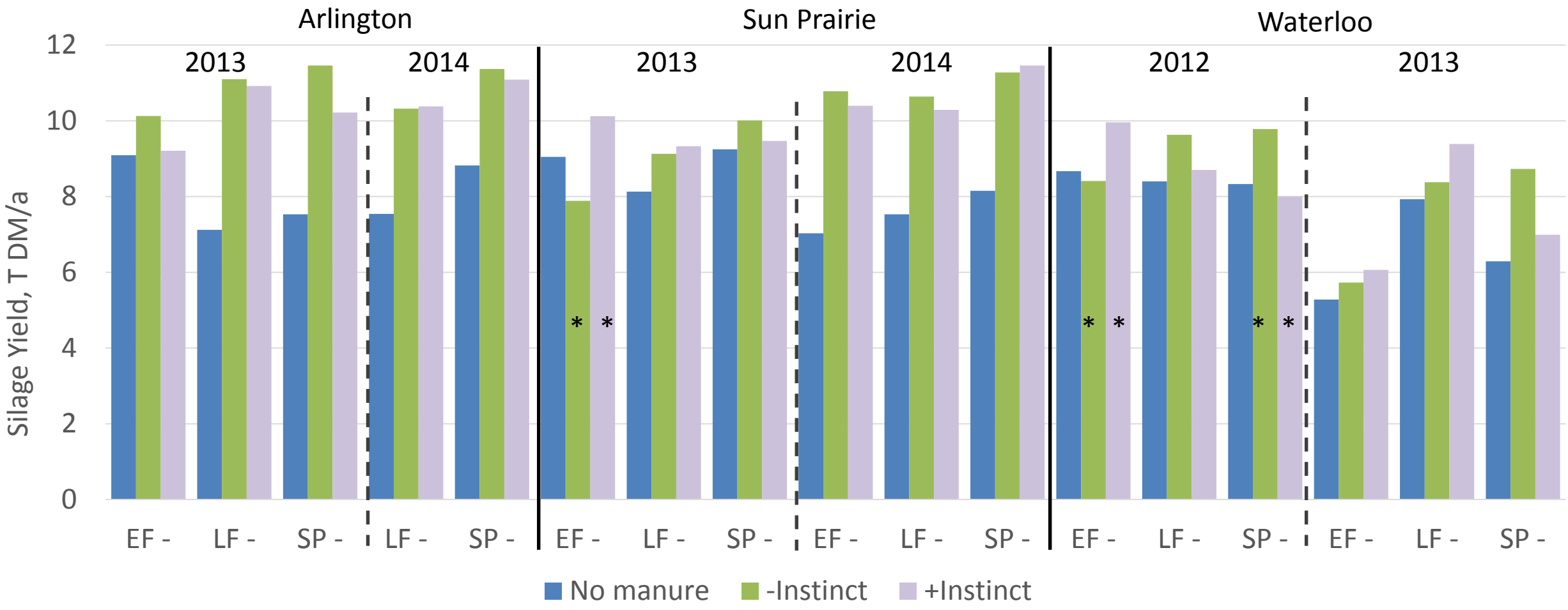
* Indicate significant differences with Instinct application for a given location/year/timing

Effect of Instinct & manure timing on grain yield



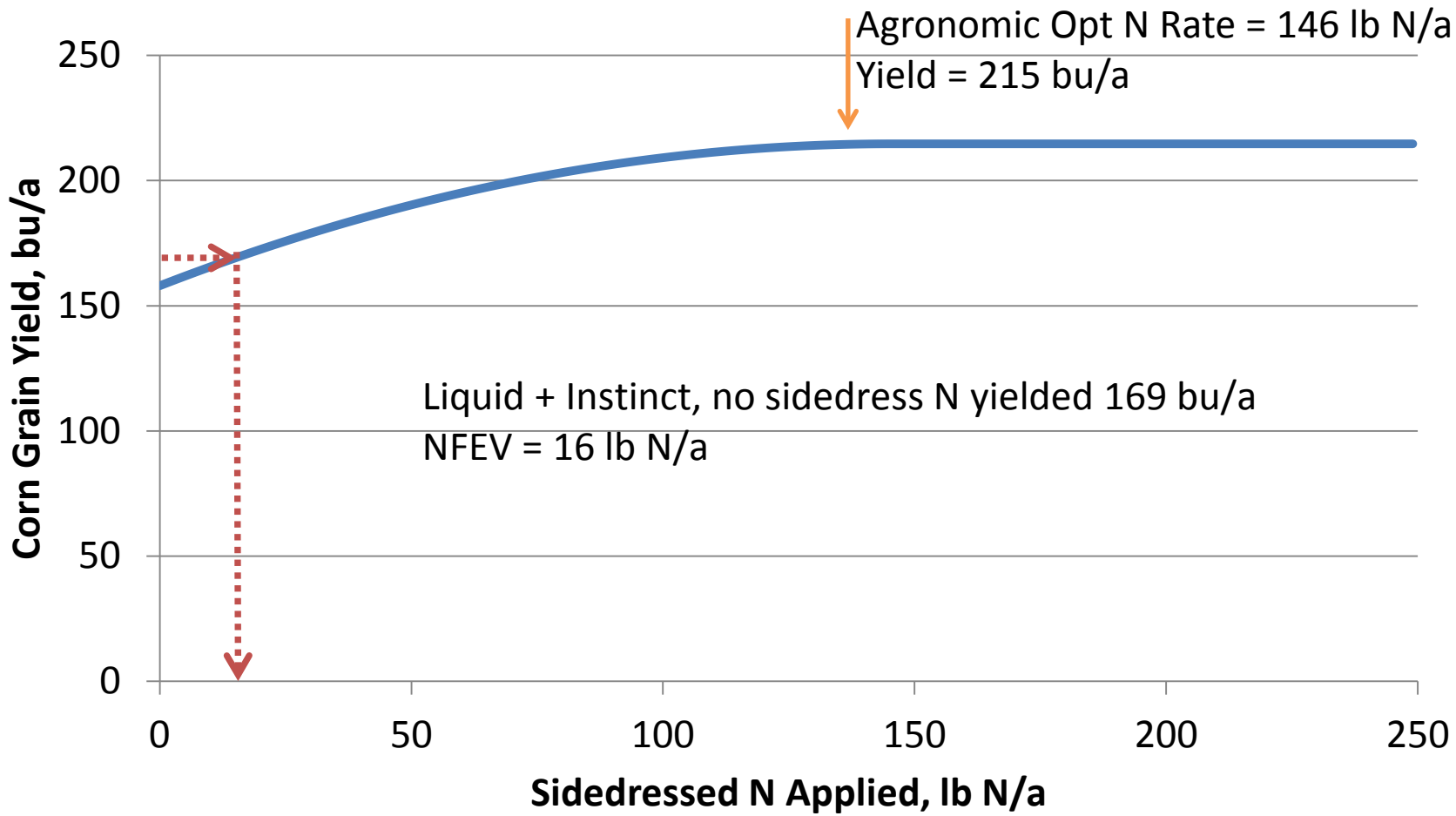
* Indicate significant differences with & without Instinct application for a given location/year/timing

Effect of Instinct & manure timing on silage yield



* Indicate significant differences with & without Instinct application for a given location/year/timing

Fertilizer N equivalence value of manure



Manure N availability as influenced by timing of application and use of Instinct

		Arlington		Sun Prairie		Waterloo	
Year	Timing	- Instinct	+ Instinct	- Instinct	+ Instinct	- Instinct	+ Instinct
		---------- % of total N available ----------					
2013	Early Fall	39	20	*	*	23	78 ↑
	Late Fall	45	55 ↑	*	*	40	55 ↑
	Spring	70	63	*	*	*	61
2014	Early Fall	-	-	*	*		
	Late Fall	44	63 ↑	*	*		
	Spring	*	*	*	*		

Availability calculated using N fertilizer equivalence value method

* Availability could not be calculated with this method.
- Indicates treatment did not exist.

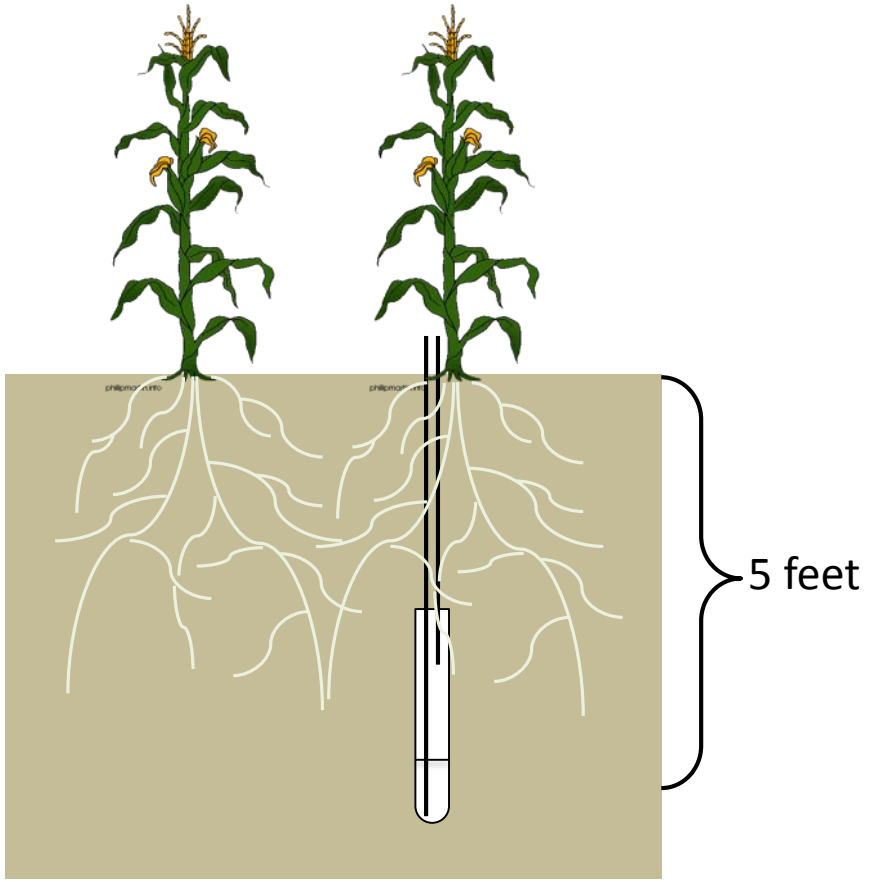
Summary

- Lost sites because of drought: A12, SP12
- In general, regardless of time of manure application, use of Instinct with liquid dairy manure on well drained soils did not have much an effect on:
  - Late fall soil NO_3 & NH_4 concentrations in the 0-4' profile
  - Soil NO_3 & NH_4 concentrations in the 0-2' profile at V6
  - Grain & silage yield
- Calculated manure N availability suggests Instinct may have been effective at improving N availability for some sites/timings

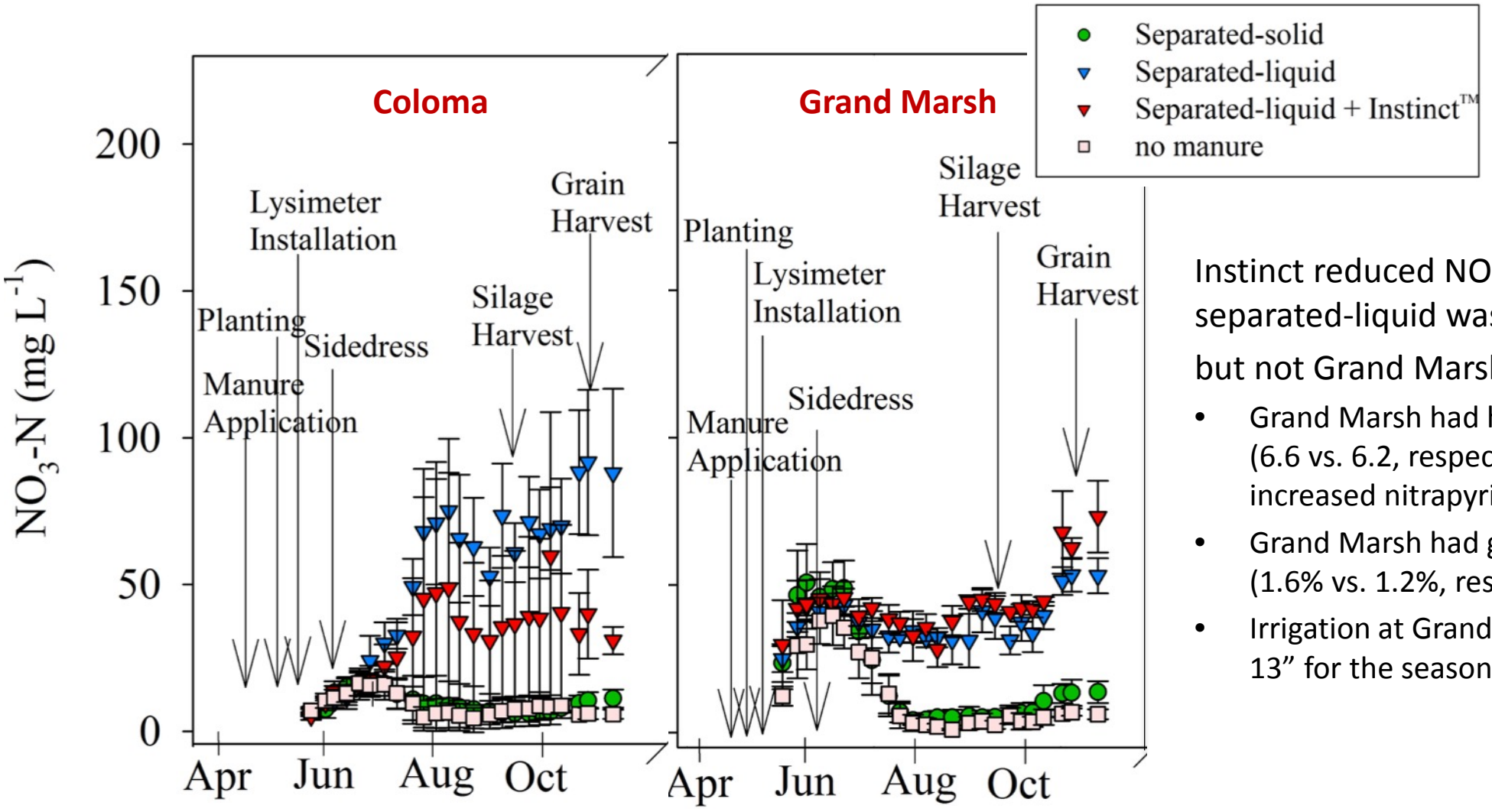
Evaluation of the use of Instinct with spring manure application in sandy soils

- Locations
  - Coloma (Billet sandy loam)
  - Grand Marsh (Billet sandy loam & Richford loamy sand)
- Main plot treatments
  - No manure
  - Separated-liquid, injected
    - 413 & 429 lb total N/a
  - Separated-liquid + 34 oz Instinct, injected
    - 427 & 443 total lb N/a
  - Separated solid (131 & 138 lb N/a)

58% NH_4



Lysimeter NO_3^- concentration, 0 lb N/a sidedressed



Instinct reduced NO_3-N leaching where separated-liquid was applied at Coloma, but not Grand Marsh

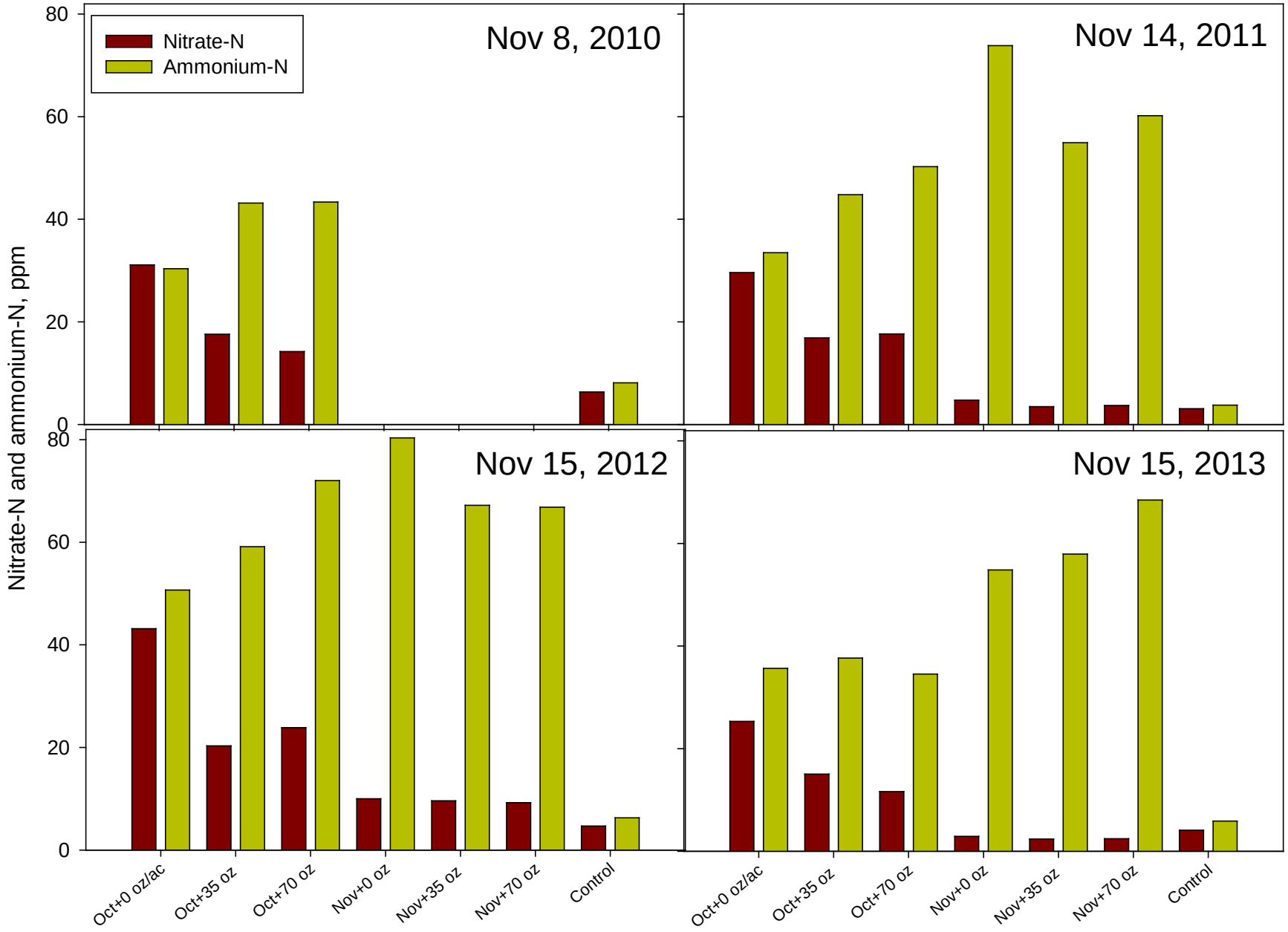
- Grand Marsh had higher pH than Coloma (6.6 vs. 6.2, respectively), which may have increased nitrapyrin degradation
- Grand Marsh had greater OM than Coloma (1.6% vs. 1.2%, respectively)
- Irrigation at Grand Marsh started earlier and was 13” for the season compared to 12” for Coloma

Effect of fall swine manure application timing and use of Instinct on corn grain yield in Minnesota

- Treatments
  - Two manure application timings: Early October (immediately after soybean harvest and early November (soil temps < 50° F).
    - Manure rate based on manure nutrient analysis from each application timing to give 120 lb of available N/ac based on 80% availability if sweep injected.
  - Three rates of Instinct (0, 35, and 70 oz./ac)
- Experimental sites: at SROC in Waseca, MN
  - Nicollet-Webster clay loam soils:
    - SOM=4.5-5-5%
    - Somewhat poorly & poorly drained soil
- Previous crop: soybean

Vetsch, 2015

Soil NO_3-N and NH_4-N (0-1 ft) as affected by swine manure application timing and Instinct™ rate



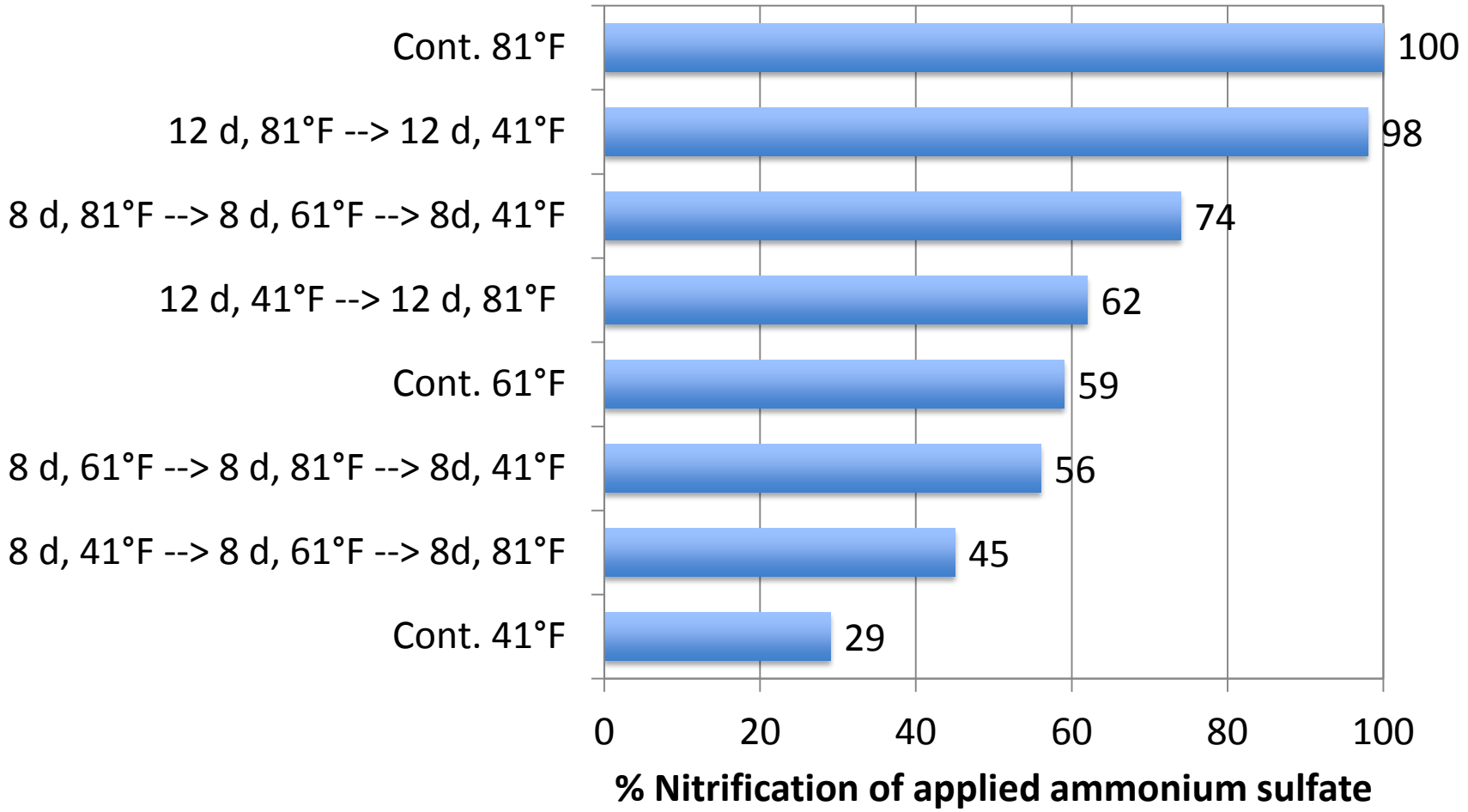
Vetsch, 2015. unpublished

Corn grain yield as affected by swine manure application timing and Instinct™ rate.

Application Timing	Instinct Rate	Years / Environments				
		2011	2012	2013	2014	4-Yr Avg.
	oz./acre	----------corn grain yields, bu/acre ----------				
October	0	171	175	165b	138	162b
October	35	180	170	185a	161	174a
October	70	185	179	190a	161	179a
November	0	182	188	192a	145	177a
November	35	194	181	186a	158	180a
November	70	194	184	193a	153	181a
Effect of Application Timing						
October		179b	175a	180b	153a	172b
November		190a	184a	190a	152a	179a
Effect of Instinct Rate						
0 oz/ac		177b	182a	178b	142b	170b
35 oz/ac		187a	176a	185ab	159a	177a
70 oz/ac		189a	182a	191a	157a	180a
Interaction Effects						
Timing×Rate		NS	NS	**	NS	*

Vetsch, 2015. unpublished

Effect of soil temperature on nitrification of $(NH_4)_2SO_4$ applied to a Canadian soil with ~3.4% organic matter



Redrawn from Chandra, 1962.

Relative probability of increasing corn yield using a nitrification inhibitor

Soil type	Time of nitrogen application		
	Fall	Spring preplant	Spring sidedress
Sands & loamy sands	Not recommended	Good	Poor
Sandy loams & loams	Fair	Good	Poor
Silt loams & clay loams			
Well drained	Fair	Poor	Poor
Somewhat poorly drained	Good	Fair	Poor
Poorly drained	Good	Good	Poor

Note: Table was developed based on data collected in Wisconsin and the upper Midwest.

Thank you!

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Carrie Laboski

Soil Fertility/Nutrient Management Specialist

laboski@wisc.edu

608-263-2795

www.NPKetc.soils.wisc.edu

http://ipcm.wisc.edu/

https://youtube.com/user/uwipm

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