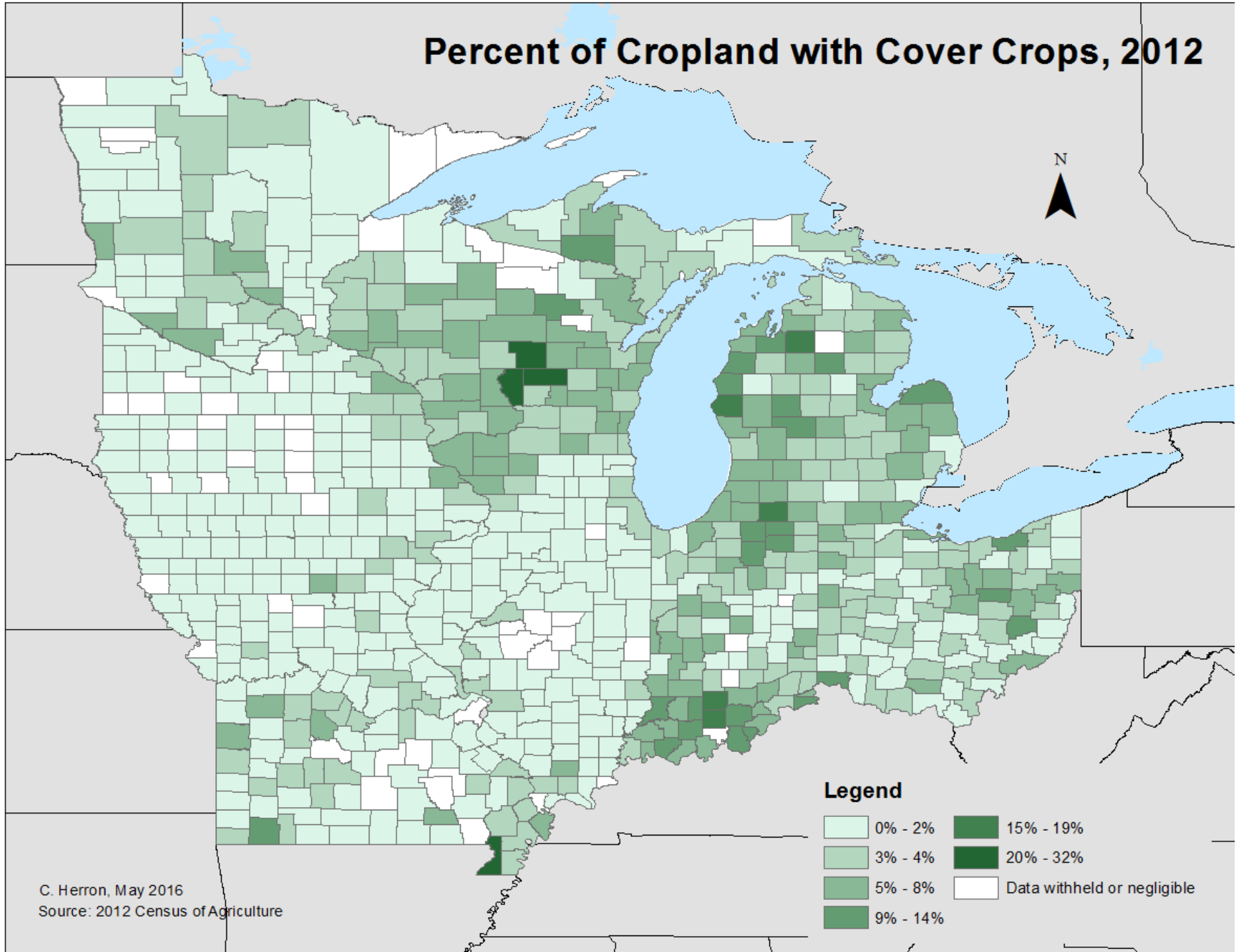
Adjusting nutrient management when using cover crops

Matt Ruark, UW-Madison & UW-Extension

Jaimie West, UW-Madison

DEPARTMENT OF SOIL SCIENCE
University of Wisconsin-Madison

UW Extension
University of Wisconsin-Extension


Percent of Cropland with Cover Crops, 2012
N
Legend
0% - 2%
3% - 4%
5% - 8%
9% - 14%
15% - 19%
20% - 32%
Data withheld or negligible
C. Herron, May 2016
Source: 2012 Census of Agriculture

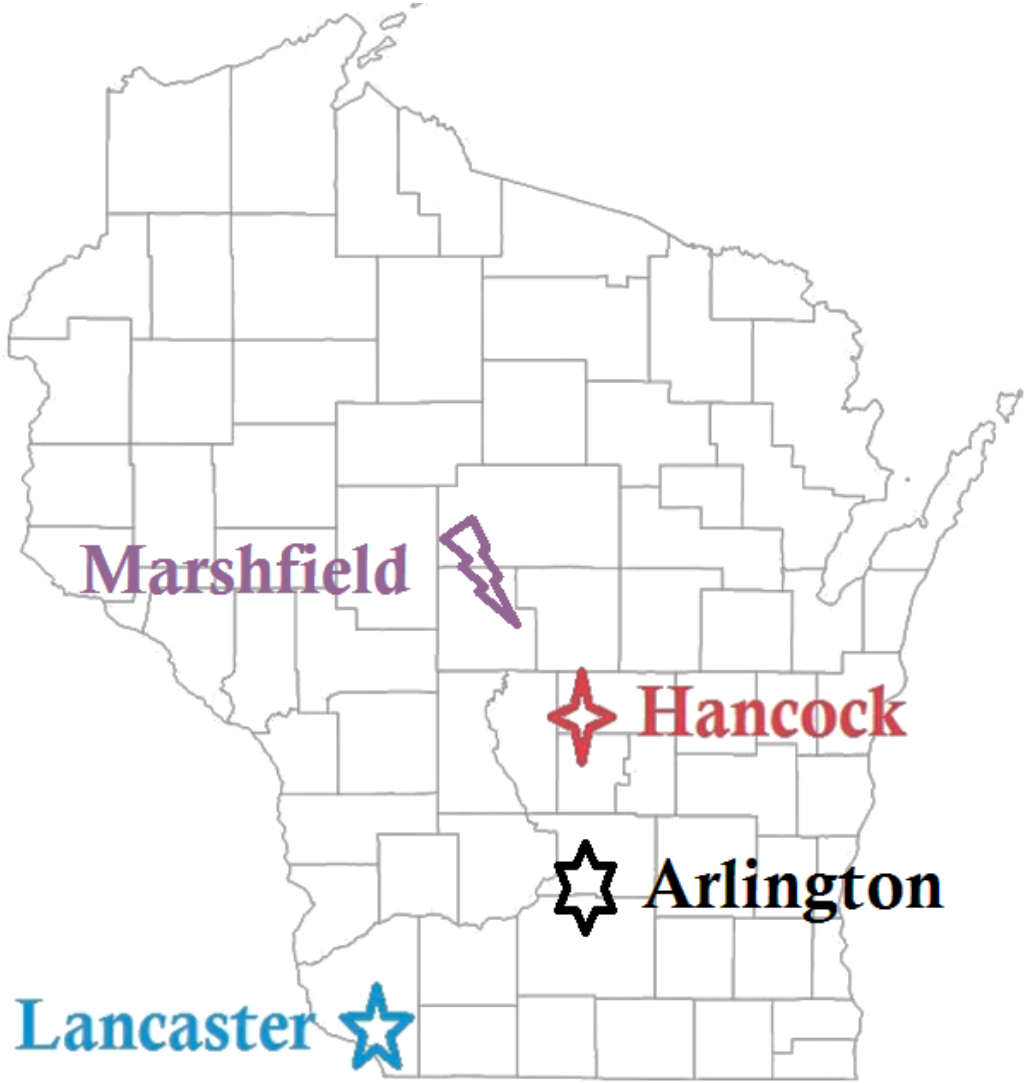
Multi-site and multi-year research is underway to evaluate cover crops as funded by the WI Fertilizer Research Council.

Objectives:

- Evaluate growth of fall seeded cover crops and their effect on soil nitrate
  - post corn silage harvest and manure application
  - no-till

- Determine yield and optimal N rate for corn following different cover crops

Research was conducted at UW Agricultural Research Stations



- **Arlington,**
  South Central WI
  - Plano silt loam
  - Very deep, well drained
- **Marshfield,**
  North-central WI
  - Withee silt loam
  - Somewhat poorly drained
- **Lancaster,**
  SW “Driftless” WI
  - Fayette silt loam
  - Well-drained
  - 2-6% slopes; moderately eroded

Evaluating cover crops following corn silage harvest and fall manure application

Four treatments:

- No cover crop
- Spring Barley (71-140 lb/ac)
- Winter rye (75-120 lb/ac) – terminated in spring
- Triticale (69-173 lb/ac)
    - Harvested as a forage crop

Evaluate the effects of cover crops on key parts of the production system

- Fall erosion control – how well does it grow and cover?
- Fall soil nitrate – how much less nitrate was potentially leached?
- Presidedress nitrate test – did the cover crop take away from this estimate of the manure N credit?
- Yield – were the covers a benefit or cause a drag?
- Response to N – is more or less N required to achieve optimal yields?

All fall manure is not alike.

Cover crop growth

Fall growth of cover crop ranges from minimal to excessive.

		Date	Fall'14	Date	Fall'15	Date	Fall'16
		2014	ton/ac	2015	ton/ac	2016	ton/ac
ARL	Rye	9/18	0.30	9/23	0.40	9/15	0.92
	Barley		0.39		0.37		1.06
	Triticale		0.44		0.36		1.00
LAN	Rye	9/29	0.15	9/23	0.62	9/27	0.44
	Barley		0.14		0.98		0.51
	Triticale		0.19		0.86		0.44
MAR	Rye			9/21	0.37	9/15	0.86
	Barley				0.25		1.16
	Triticale				0.25		0.78

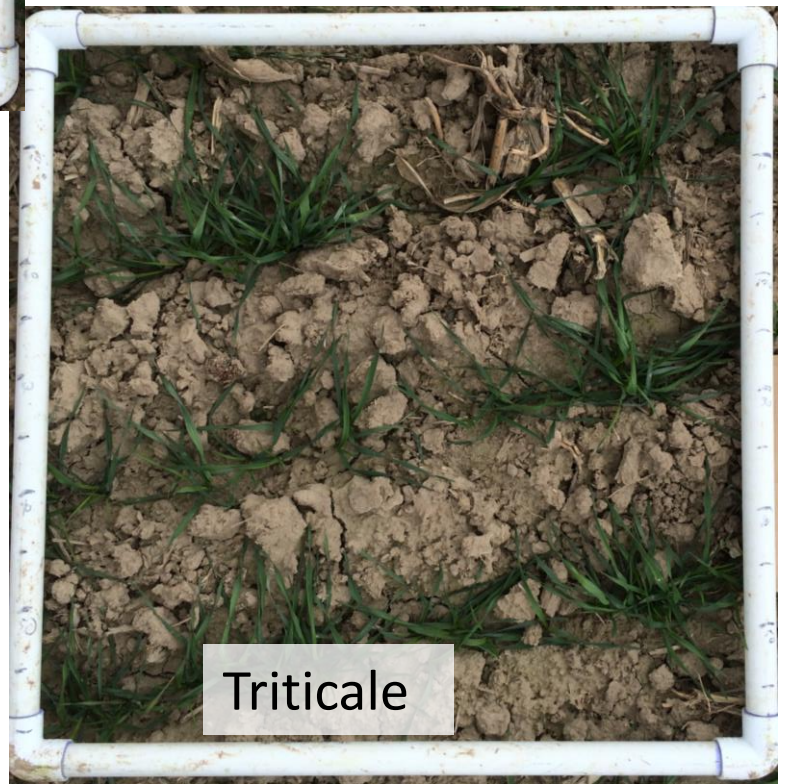
November 13, 2014

Lancaster ARS

1/8 ton DM biomass

Winter Rye

Barley



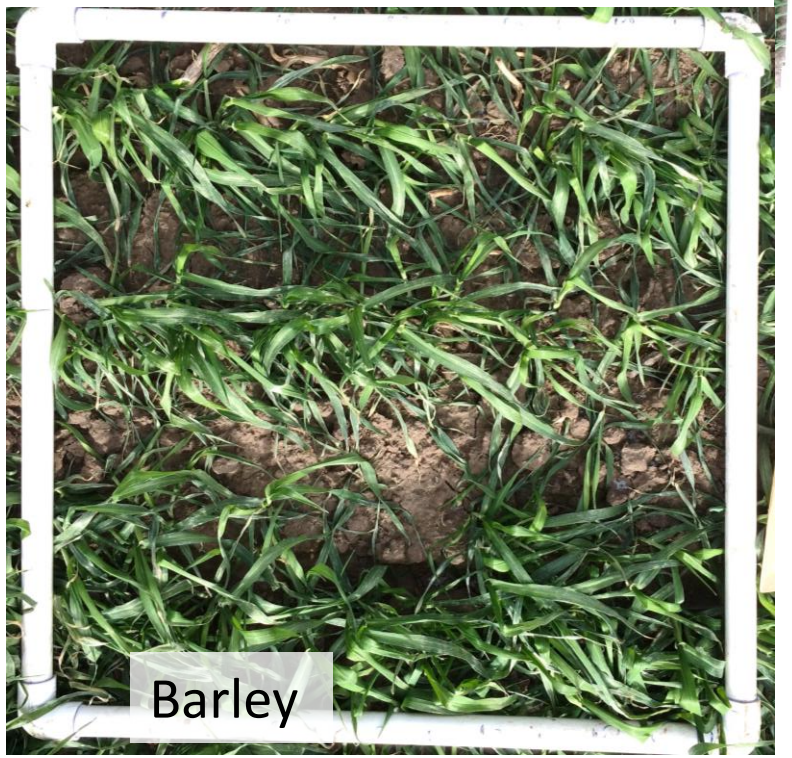
Triticale

November 14, 2014

Arlington ARS

1/3 ton DM biomass

Winter Rye



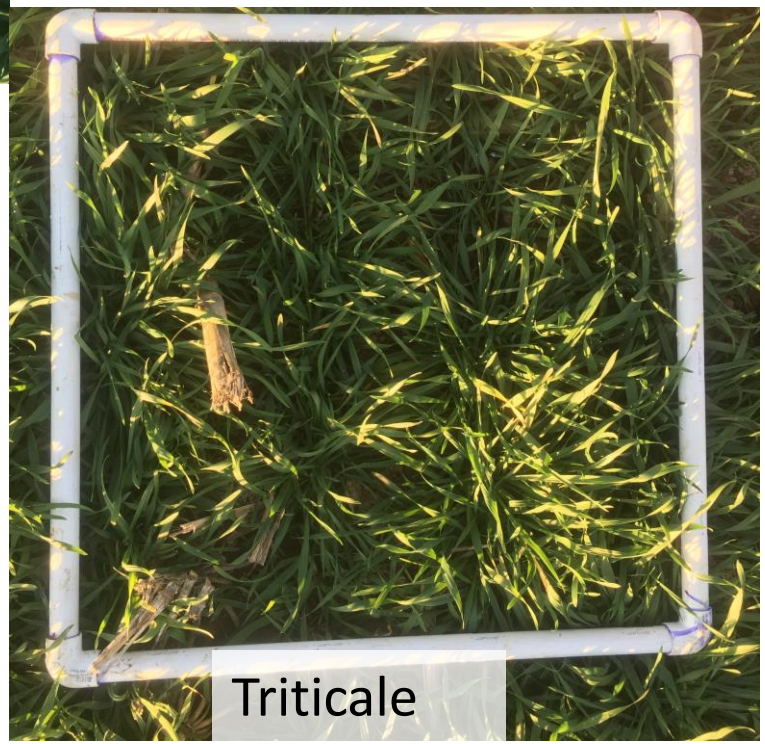
Barley

Triticale

November 16, 2016

Marshfield ARS

¾ to 1 ton DM biomass



Fall Soil nitrate

One-third of a ton of biomass can lead to a decrease of 25 lb-N/ac in the upper 2’ of soil

Site	Cover	DM	Fall 2014 nitrate-N reduction	DM	Fall 2015 nitrate-N reduction
		ton/ac	lb-N/ac	ton/ac	lb-N/ac
ARL	Rye	1/3	19	1/3	24
	Barley		23		18
	Triticale		25		19
LAN	Rye	1/8	6	3/4	25
	Barley		8		13
	Triticale		5		21
MAR	Rye			1/4	1
	Barley				2
	Triticale				5

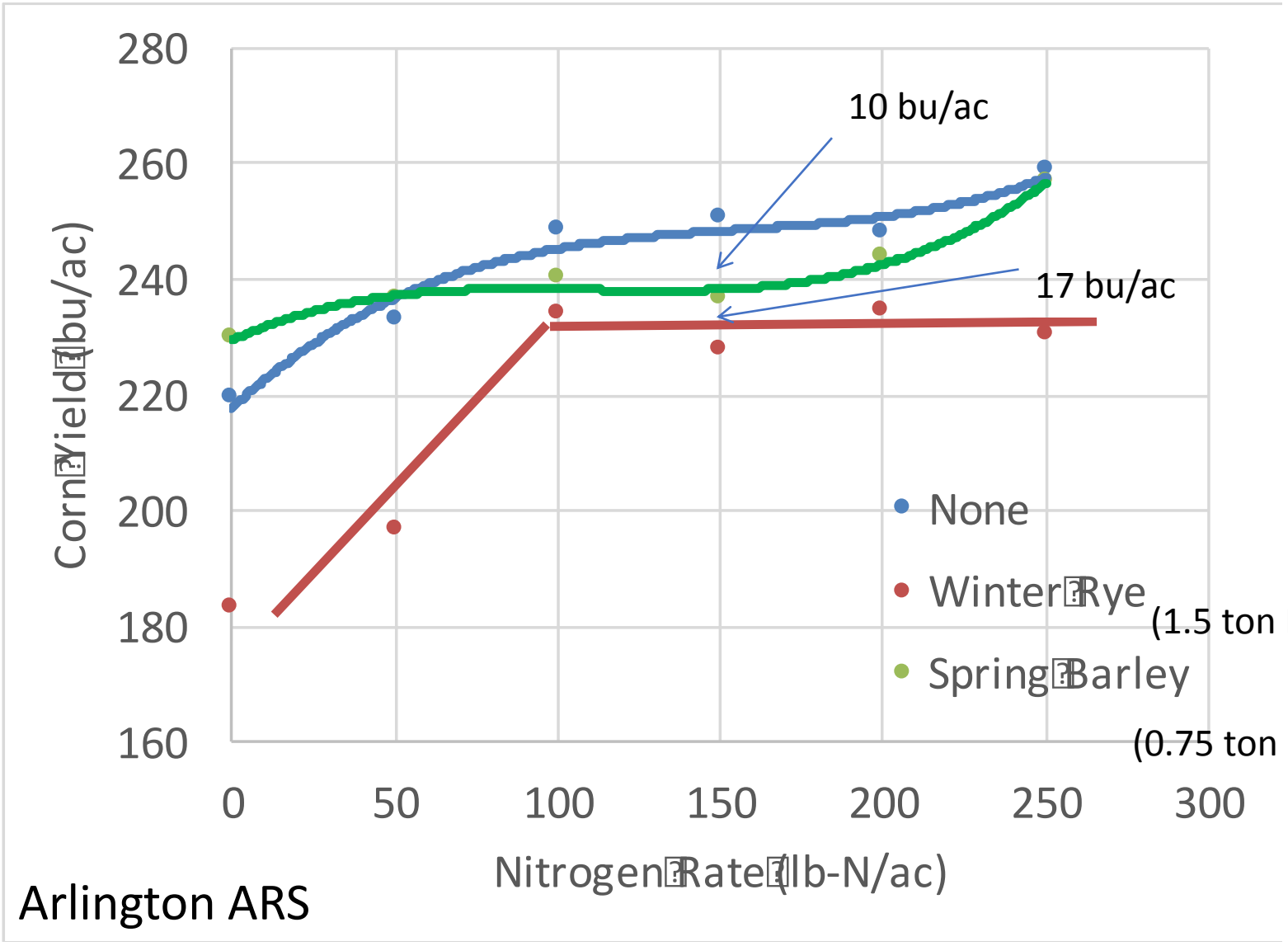
Manure nitrogen credits

Cover crops wipe out some of the manure N credit based on PSNT

	ARL		LAN		MAR	
	ppm	N credit	ppm	N credit	ppm	N credit
None	14	35	13	35	16	60
Barley	18	100	16	60	8	0
Rye	11	10	5	0	5	0
Triticale	5	0	6	0	5	0

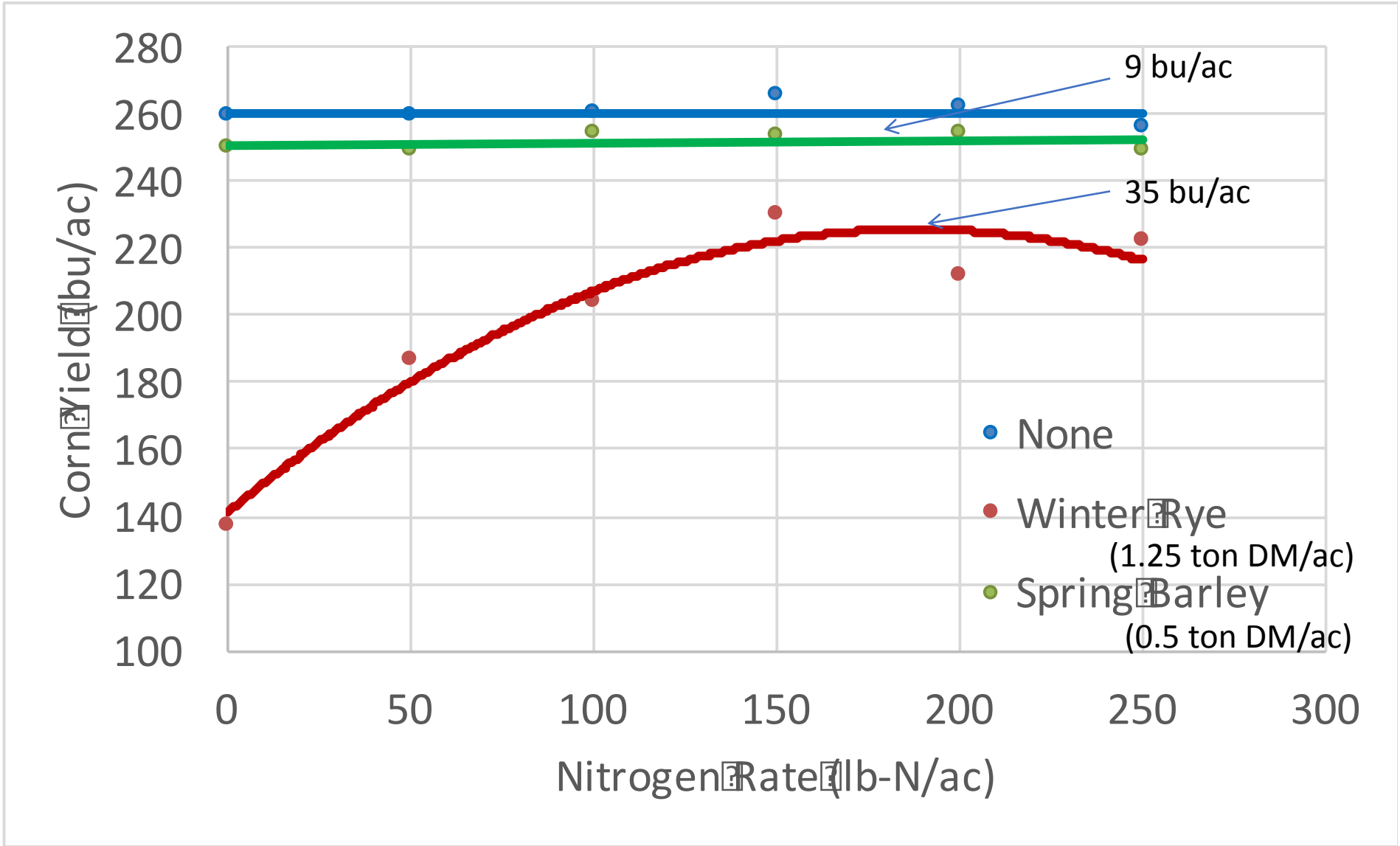
Yields

Yield drag flowing covers, although with spring barley can be reduced with more N

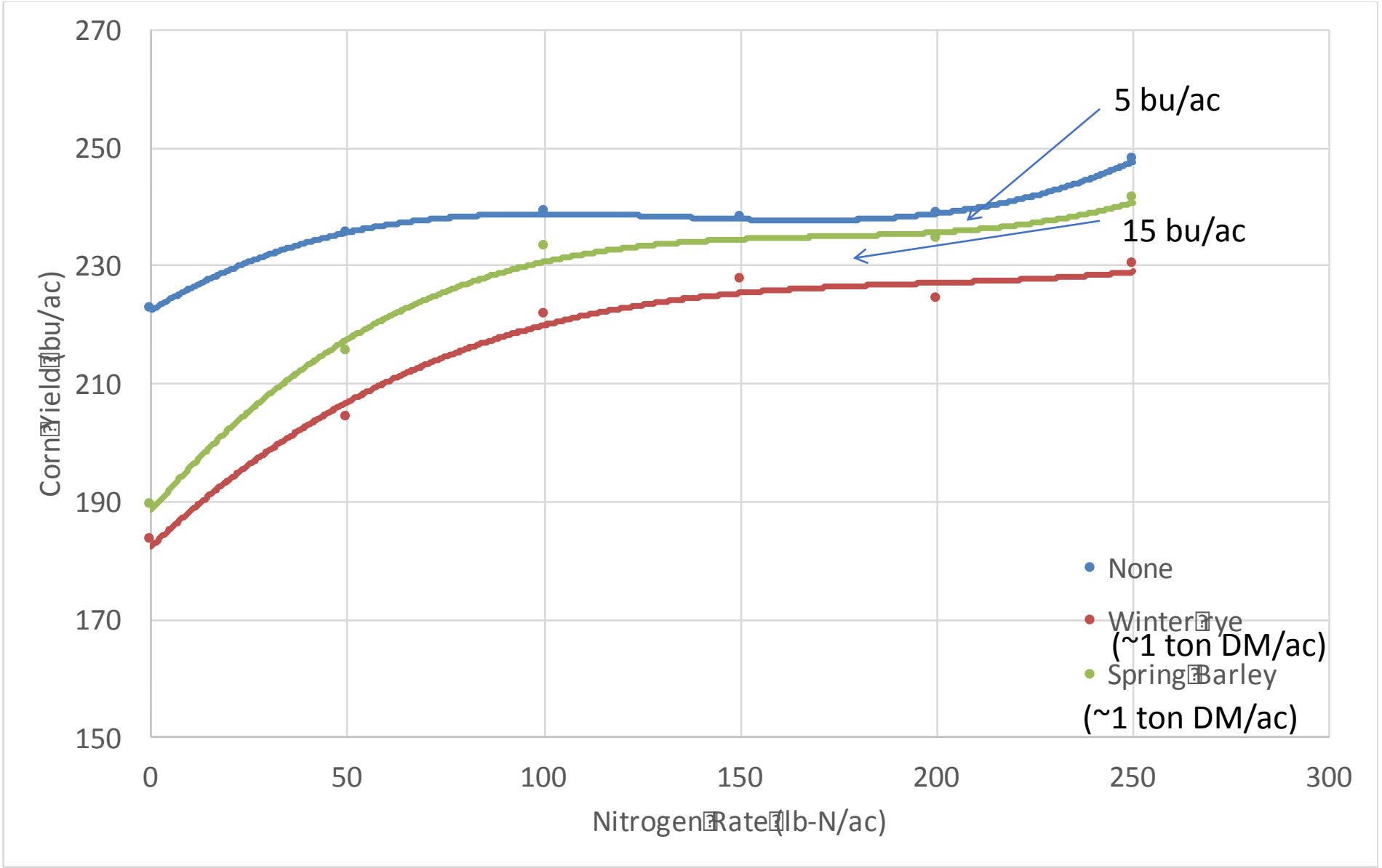


Arlington ARS

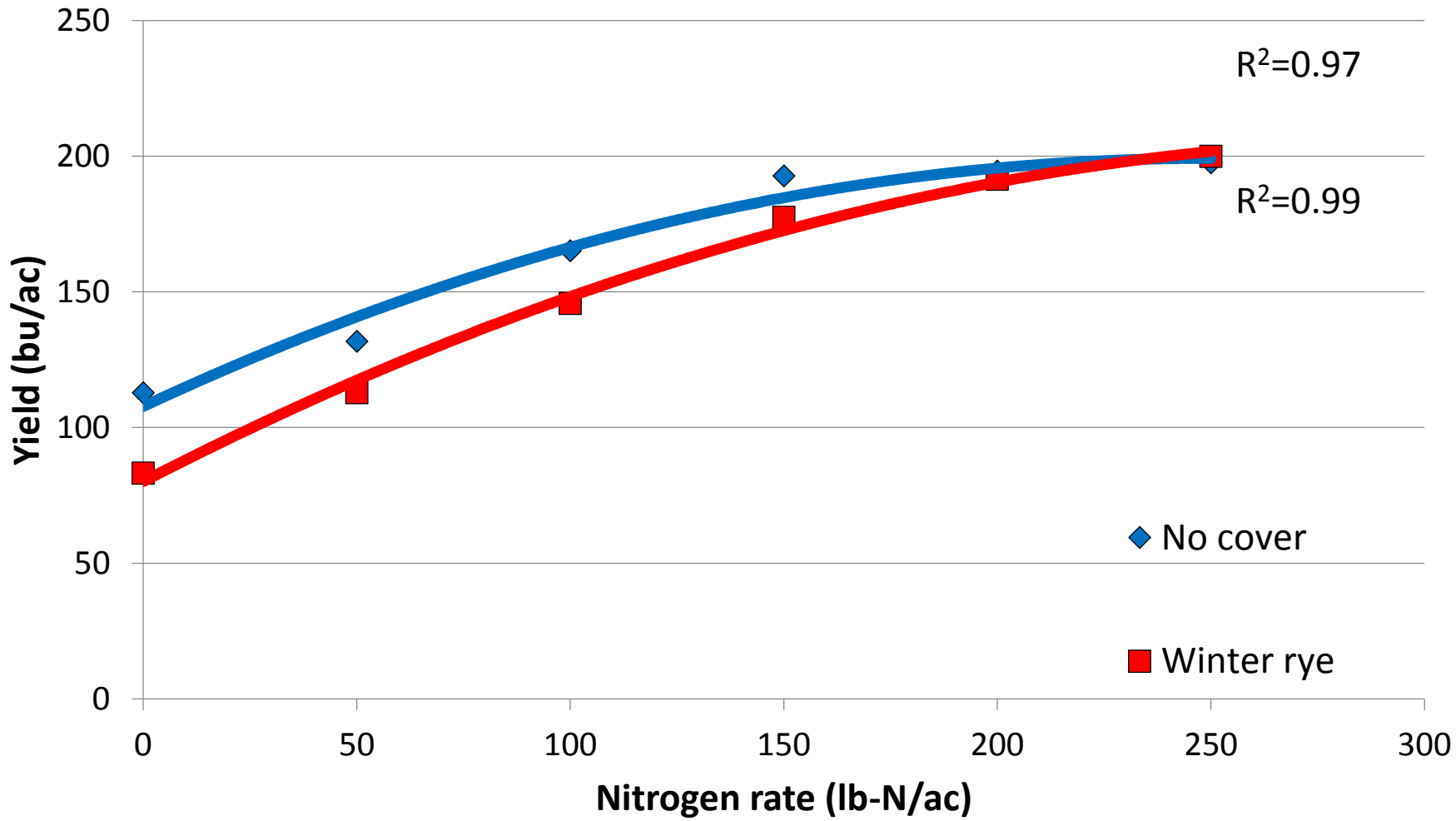
Flat responses at LAN, but still yield drag with spring barley. Larger yield drag (+30 bu/ac) with winter rye.



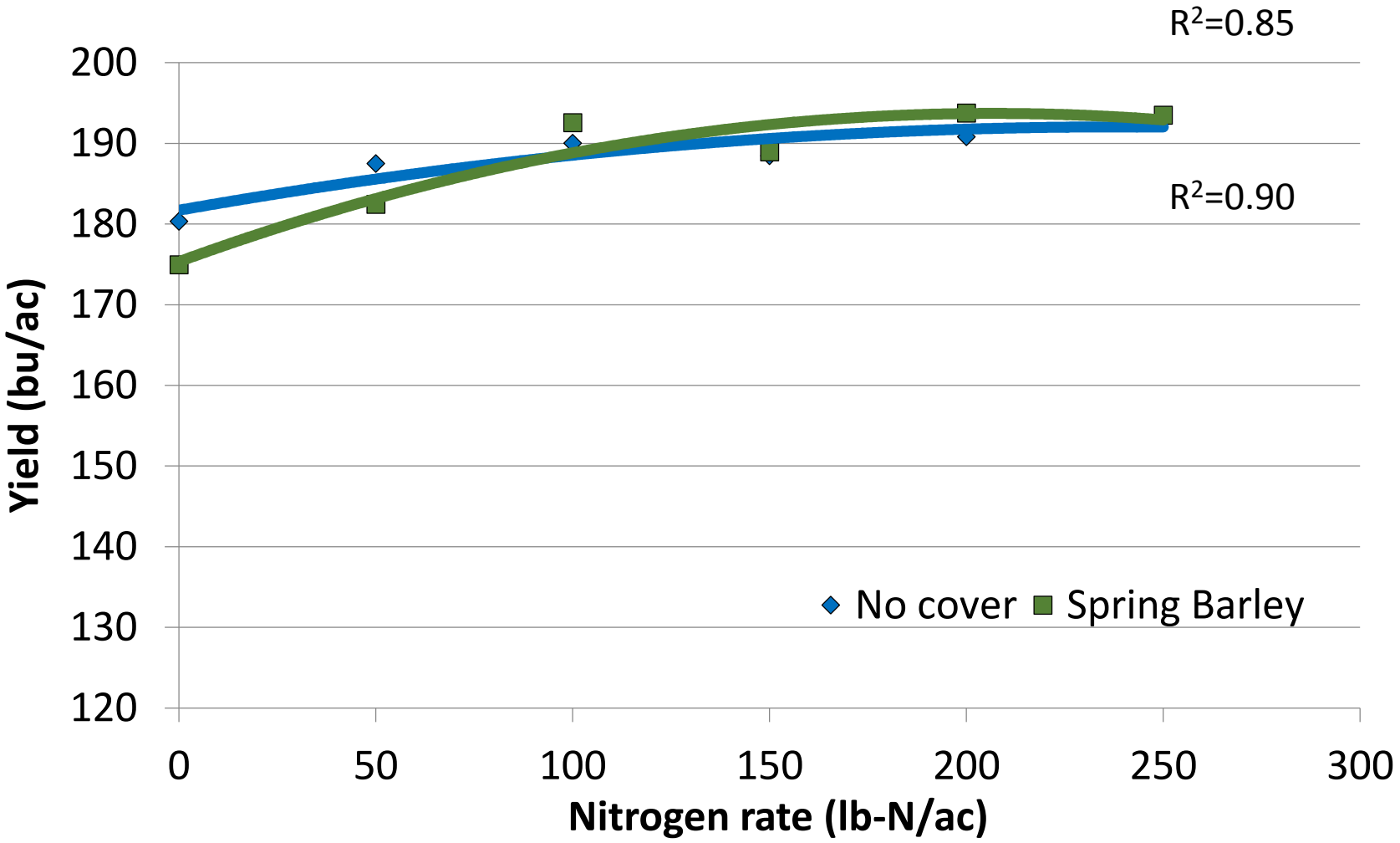
Same trend at MAR with small yield drag with barley, larger drag with rye.



No yield drag, but different optimum N rate for winter rye (Lancaster 2015)



No statistical difference in yields among no cover and winter-killed covers (Arlington 2015)



Corn

Average Yield Difference of the 50 trials displayed: **0.0** bu/acre.

90% Confidence Interval for the Average Yield Difference: from **-1.0** to **1.0** bu/acre.

Soybean

Average Yield Difference of the 12 trials displayed: **0.2** bu/acre.

90% Confidence Interval for the Average Yield Difference: from **-0.6** to **1.0** bu/acre.

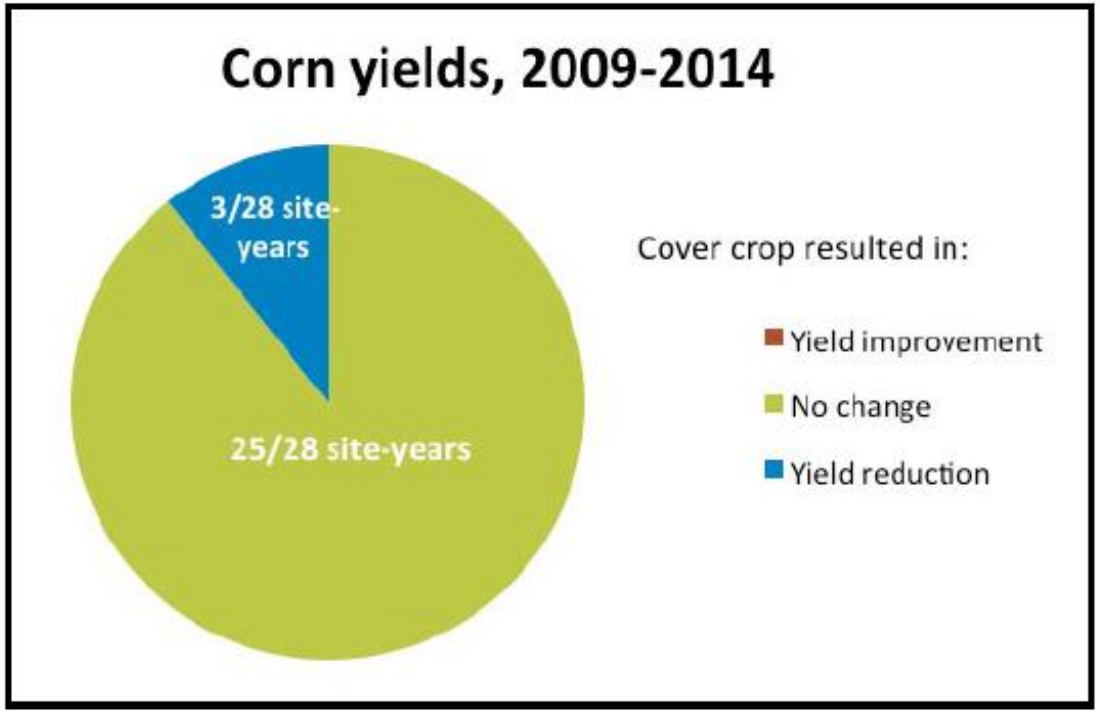


Figure 2. Trends with respect to cover crop effect on corn yields at 28 site-years from 2009 to 2014.

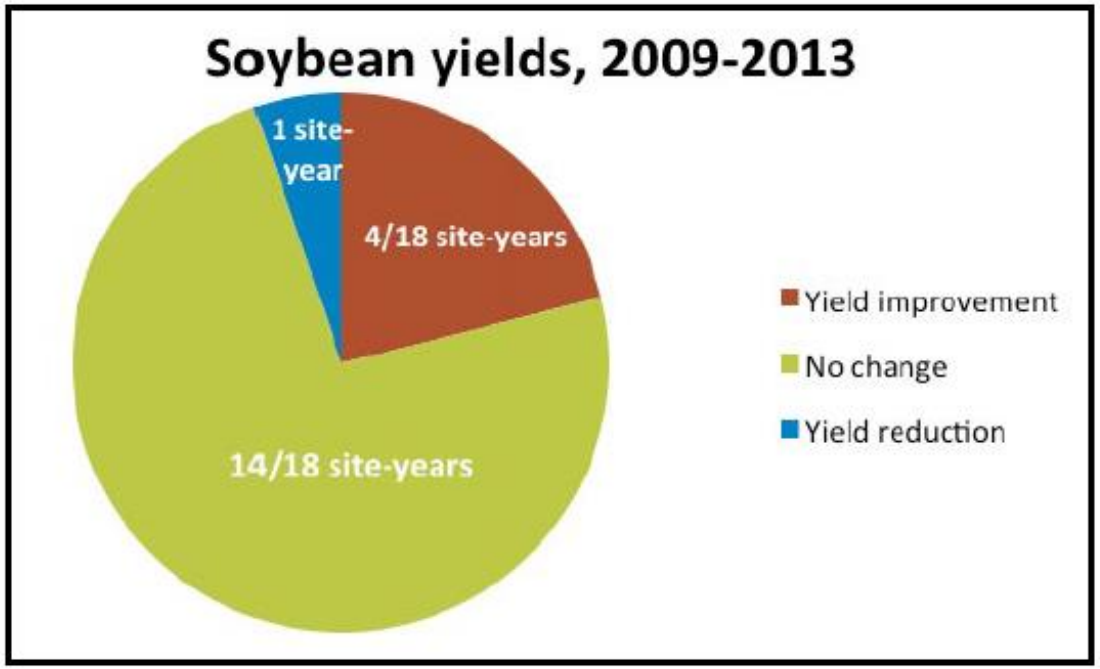
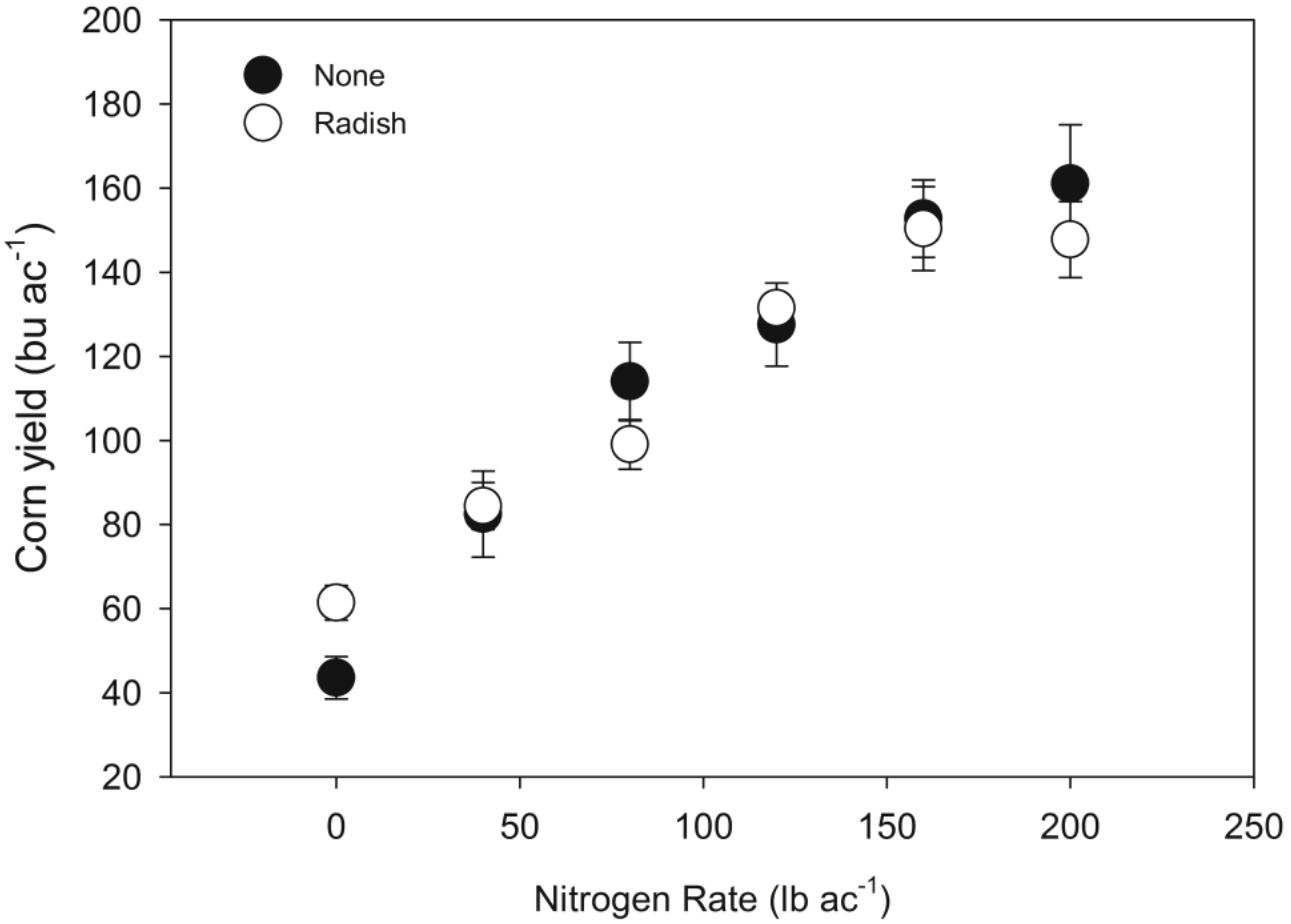
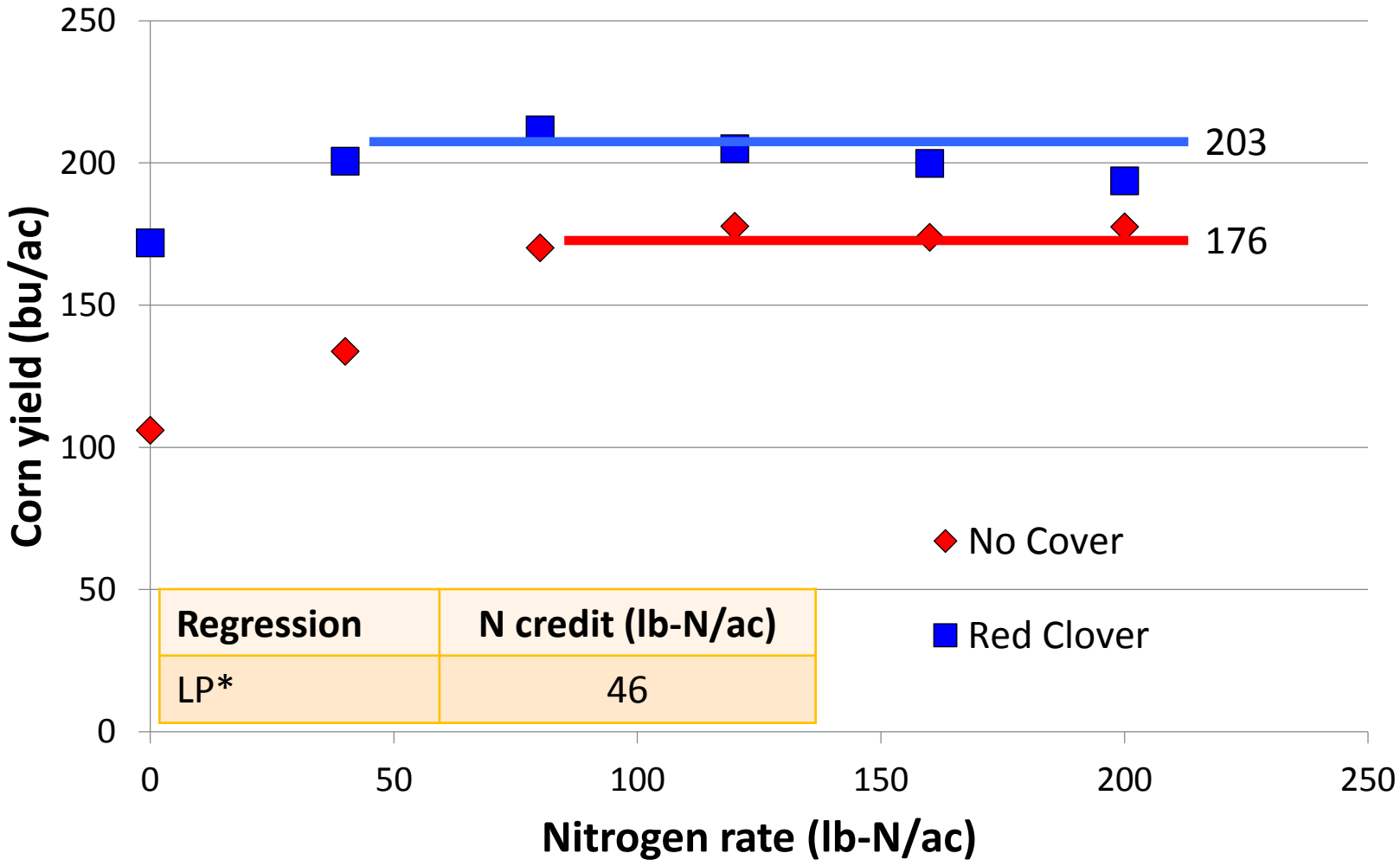


Figure 3. Trends with respect to cover crop effect on soybean yields at 18 site-years from 2009 to 2013.

2013 Corn Yields
Washington County, WI
No-till corn following winter wheat



Yield response from Janesville in 2010 shows a 46 lb-N/ac N credit from red clover (plus yield gains)



What nutrient management adjustments should I make when using cover crops

- With grass cover crops –
  - Use nitrogen in starter fertilizer
  - Don’t expect residual soil nitrate (i.e. no PPNT credit)
  - If excessive growth, reduce the N credit you are taking with fall applied manure (how much – I don’t know yet)
- With radish –
  - No change
- With legumes –
  - Can take a 40 to 60 pound N credit with good growth

DEPARTMENT OF SOIL SCIENCE
University of Wisconsin-Madison

UW Extension
University of Wisconsin-Extension

Questions?
Comments?
Concerns?

Grasses

Winter rye (or cereal rye)
Annual ryegrass
Oat
Barley
Triticale

- Establish and grow quickly
- Scavenge soil nitrogen
- High C:N ratio

Brassicas

Radish
Mustard
Turnip

- Slower to establish
- Scavenge soil nitrogen (even more than the grasses if given enough time)
- Medium C:N ratio

Legumes

Red Clover
Berseem Clover
Crimson Clover
Hairy Vetch

- Slower to establish
- Fix N from atmosphere
- Low C:N ratio