Nitrogen Non-Cycling from Cover Crops Grown Before Corn and Spring Wheat- Unexpected Results

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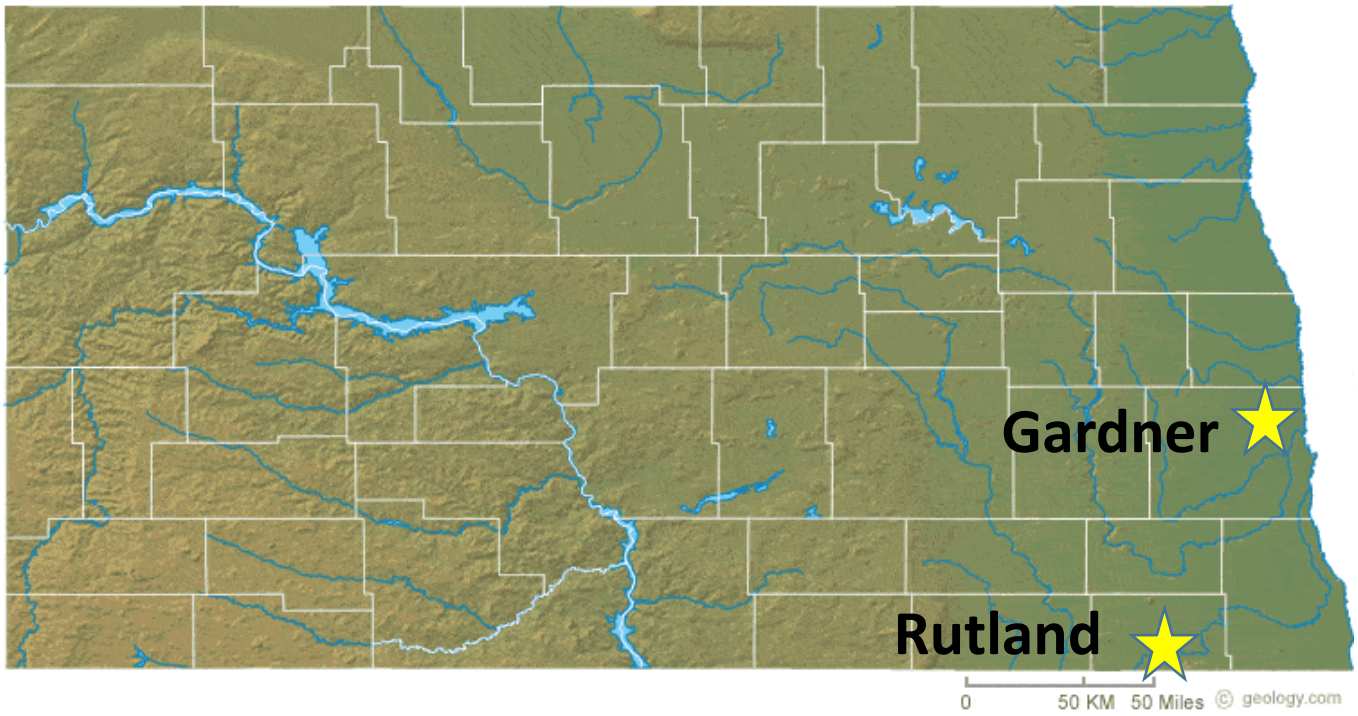
If you believe the books-

C/N ratio is all

If C/N ratio is > 40, N is tied up.

If C/N ratio is < 30, N is released. The lower the value, the quicker the release.

Two sites-



Rutland site- Early August 2016 seeding

After winter wheat- biostriptill

Field pea between future corn rows

Forage radish/turnip/flax in future corn rows (30” rows)

Volunteer winter wheat over all

Sprayed out ~8/15/2016

Experimental design

Split plot, each experimental site rotation is stand-alone

Main plots- cover crop, no cover crop
cover crop unique to experimental site

Subplots (to corn and to spring wheat only)-
N rates- 0, 40, 80, 120, 160, 200 lb N/acre

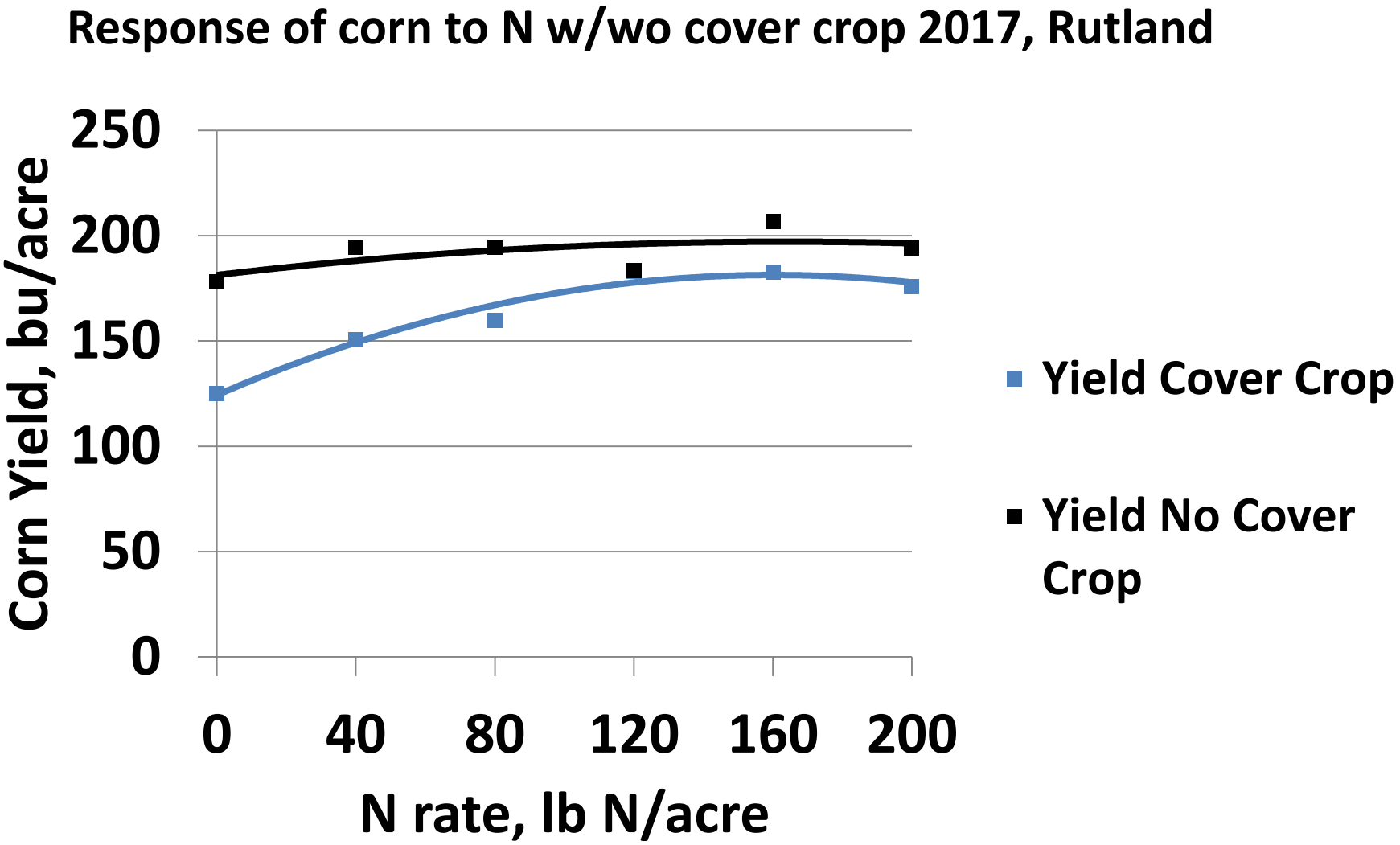
2016 Soil nitrate with time cover vs no cover crop

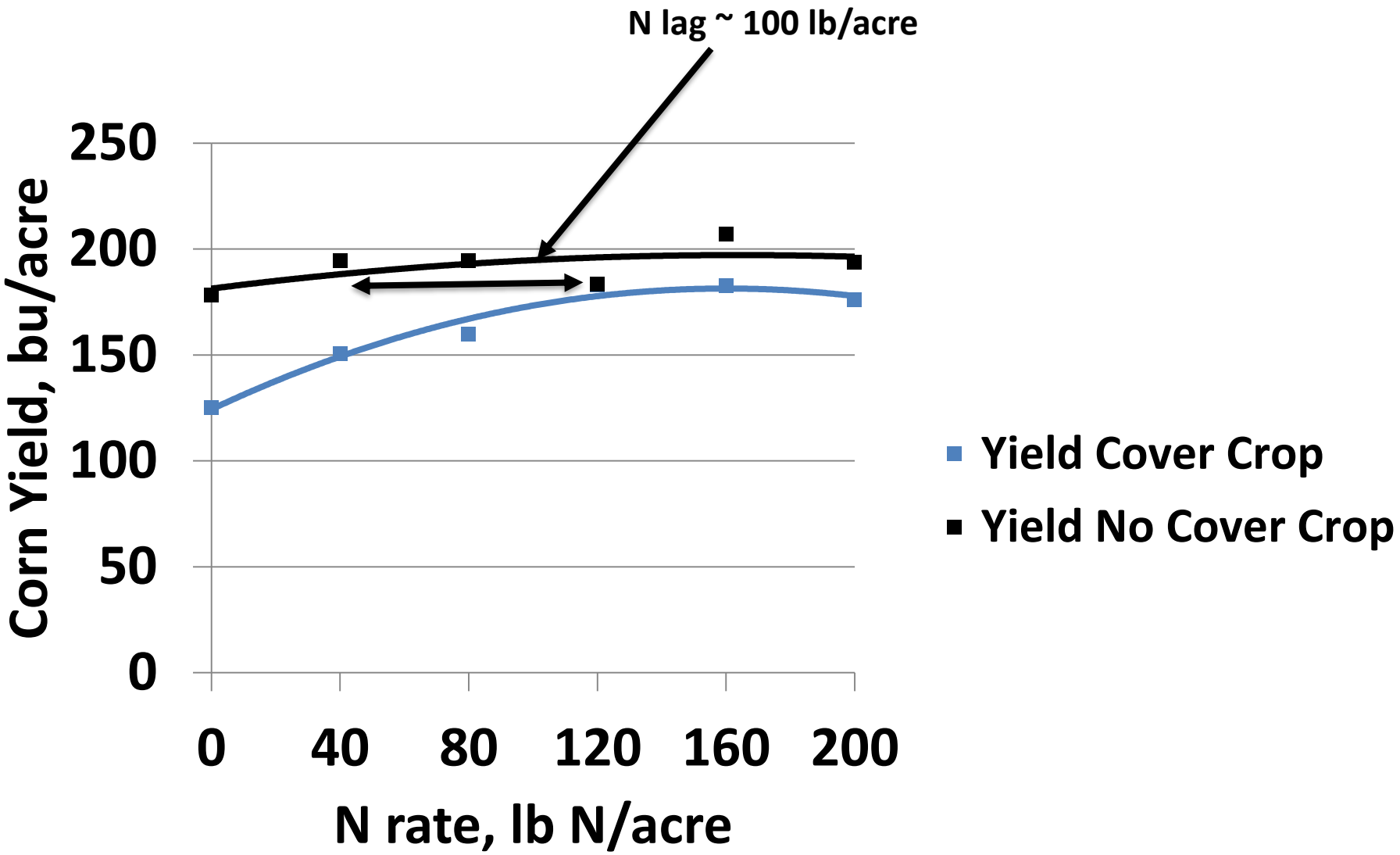
Treatment	8/12	9/28	10/24
Cover Crop	57	18	15
No Cover Crop	50	130	114

Cover crop N with time Rutland 2016

Measurement	9/28	10/24
	pounds per acre	
Dry matter	3340	5100
N	90	142
Inches water	5.05 vs 6.95	4.63 vs 6.98

Average C/N ratio was 18


Response of corn to N w/wo cover crop 2017, Rutland
Corn Yield, bu/acre
250
200
150
100
50
0
0
40
80
120
160
200
N rate, lb N/acre
Yield Cover Crop
Yield No Cover Crop


N lag ~ 100 lb/acre
Corn Yield, bu/acre
250
200
150
100
50
0
0
40
80
120
160
200
N rate, lb N/acre
Yield Cover Crop
Yield No Cover Crop

Economic drag from cover crop due to N deficit

(Assume $3.50/bu corn, 40 cent/lb N)

EONR for no-cover crop was 0 lb N/acre
EONR for cover crop was 136 lb N/acre

Economic loss was $57/acre due to lost yield at maximum and cost of additional N.

2017-

Gardner spring wheat (intended for 2018) after soybean (2017)

Oats, radish and camelina seeded R7, emerged September

In spring, camelina was common and

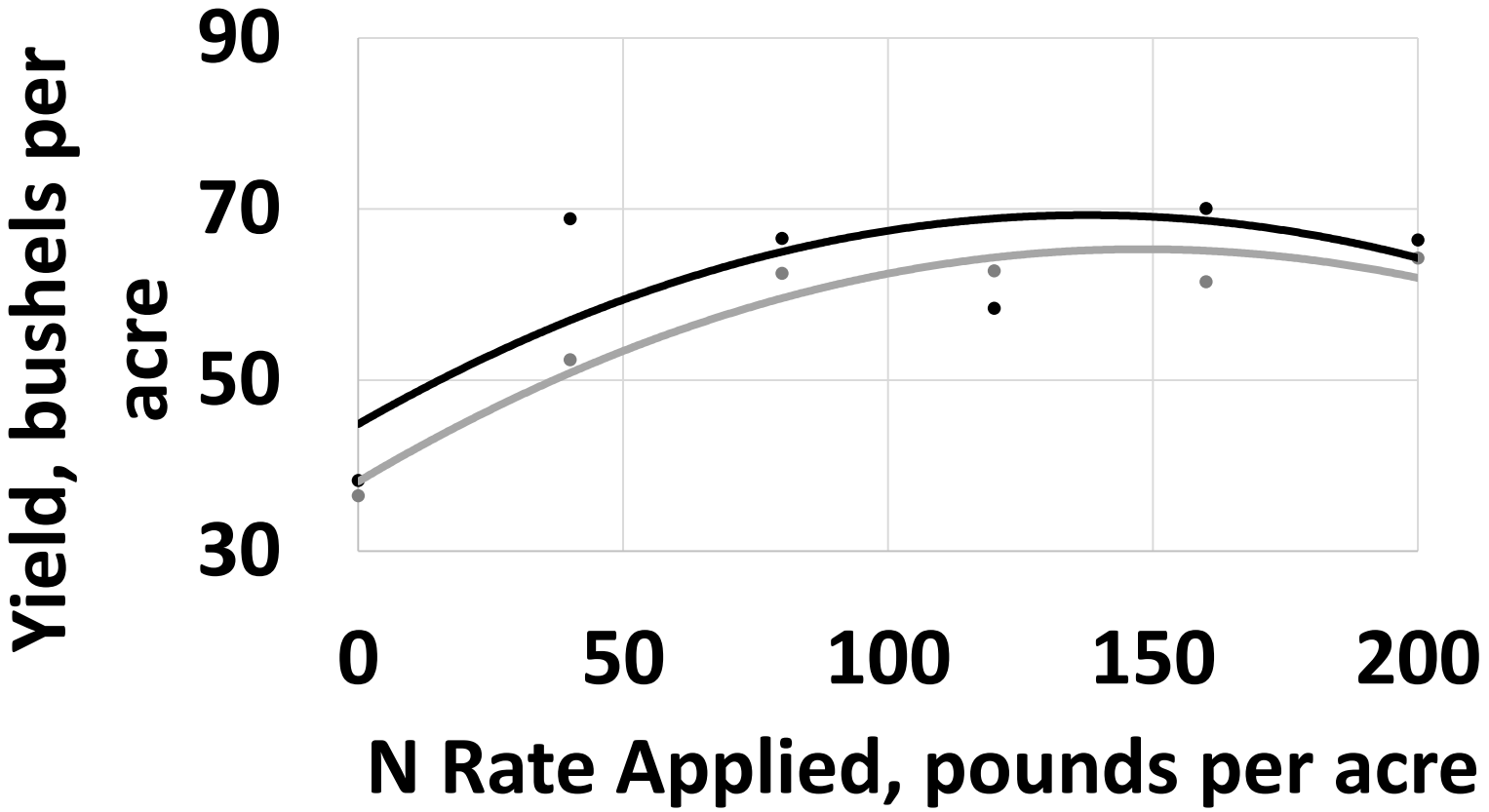
grew almost to maturity before termination

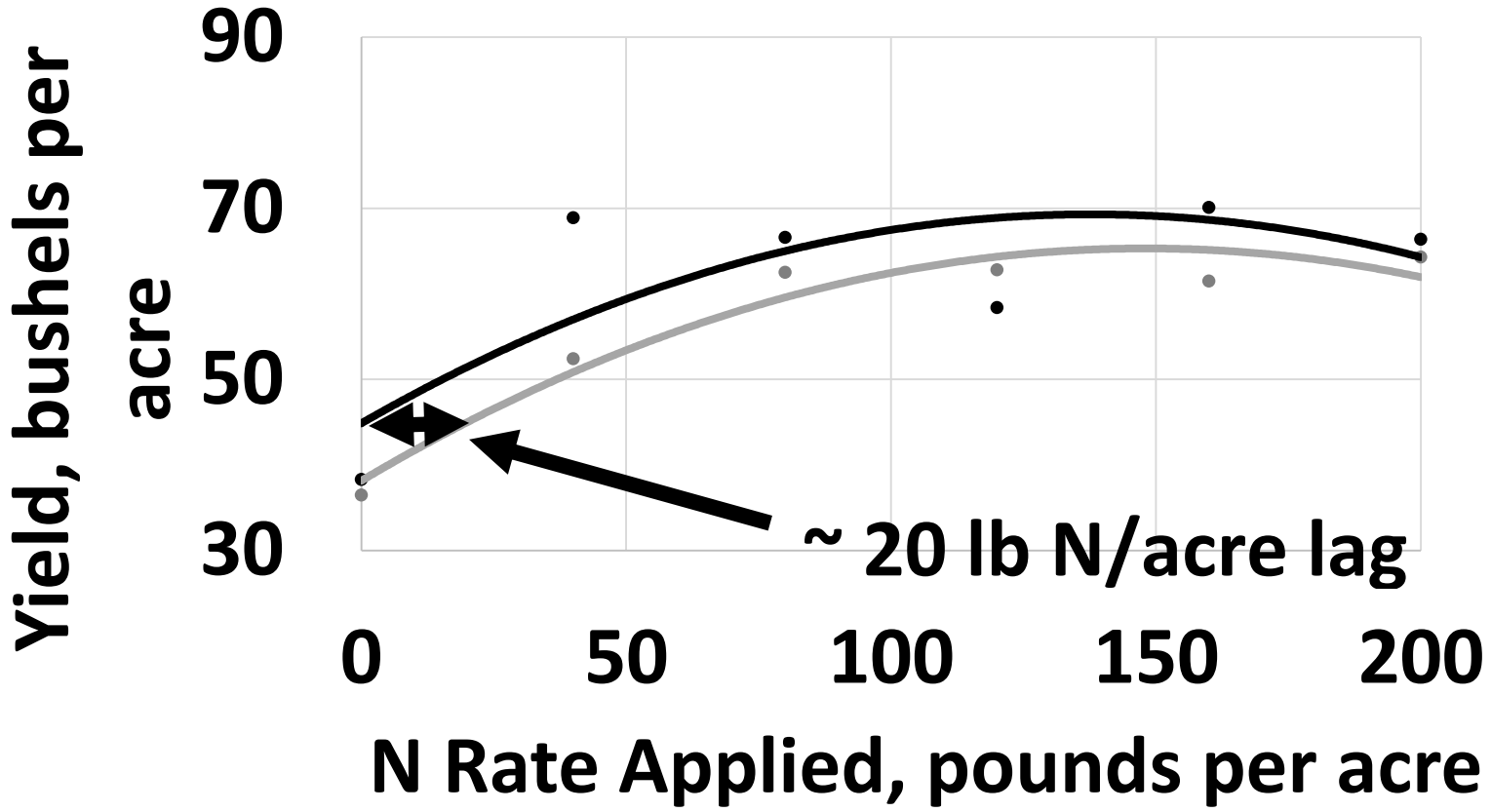
Residual nitrate-N and percent gravimetric water in cover crop and no-cover crop main plots, Gardner, 7 May 2017 prior to seeding spring wheat.

Treatment	Residual soil nitrate-N to 2-feet depth	Gravimetric water content, % by weight in 2-feet soil
Cover crop	73	34.8
No-cover crop	60 (NS)	33.7 (NS)

The spring wheat
was expertly harvested.

Spring wheat yield w/wo cover crop, Gardner, 2018




Yield, bushels per acre
90
70
50
30
~ 20 lb N/acre lag
0
50
100
150
200
N Rate Applied, pounds per acre

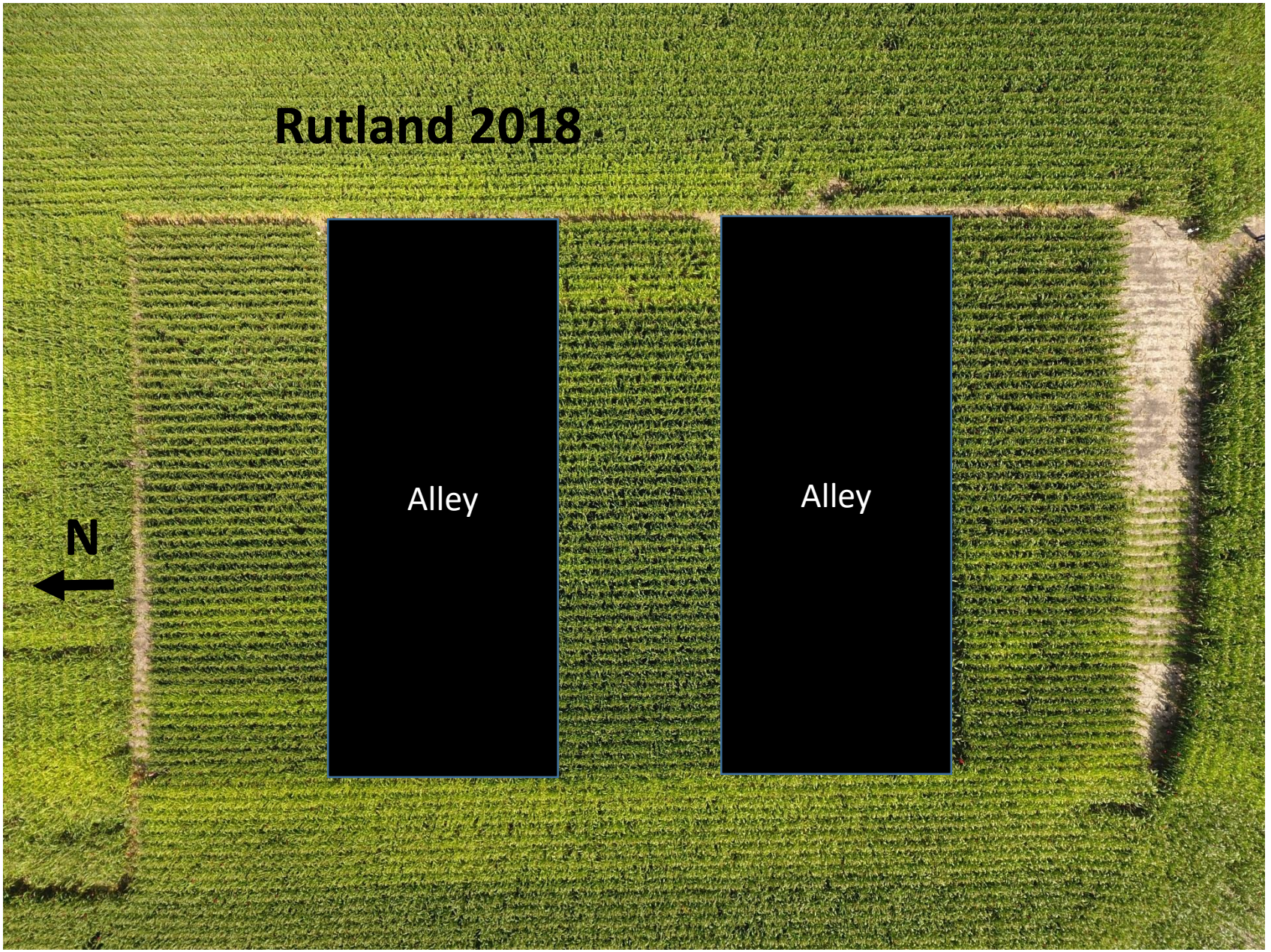
Economic drag from cover crop to spring wheat due to N deficit

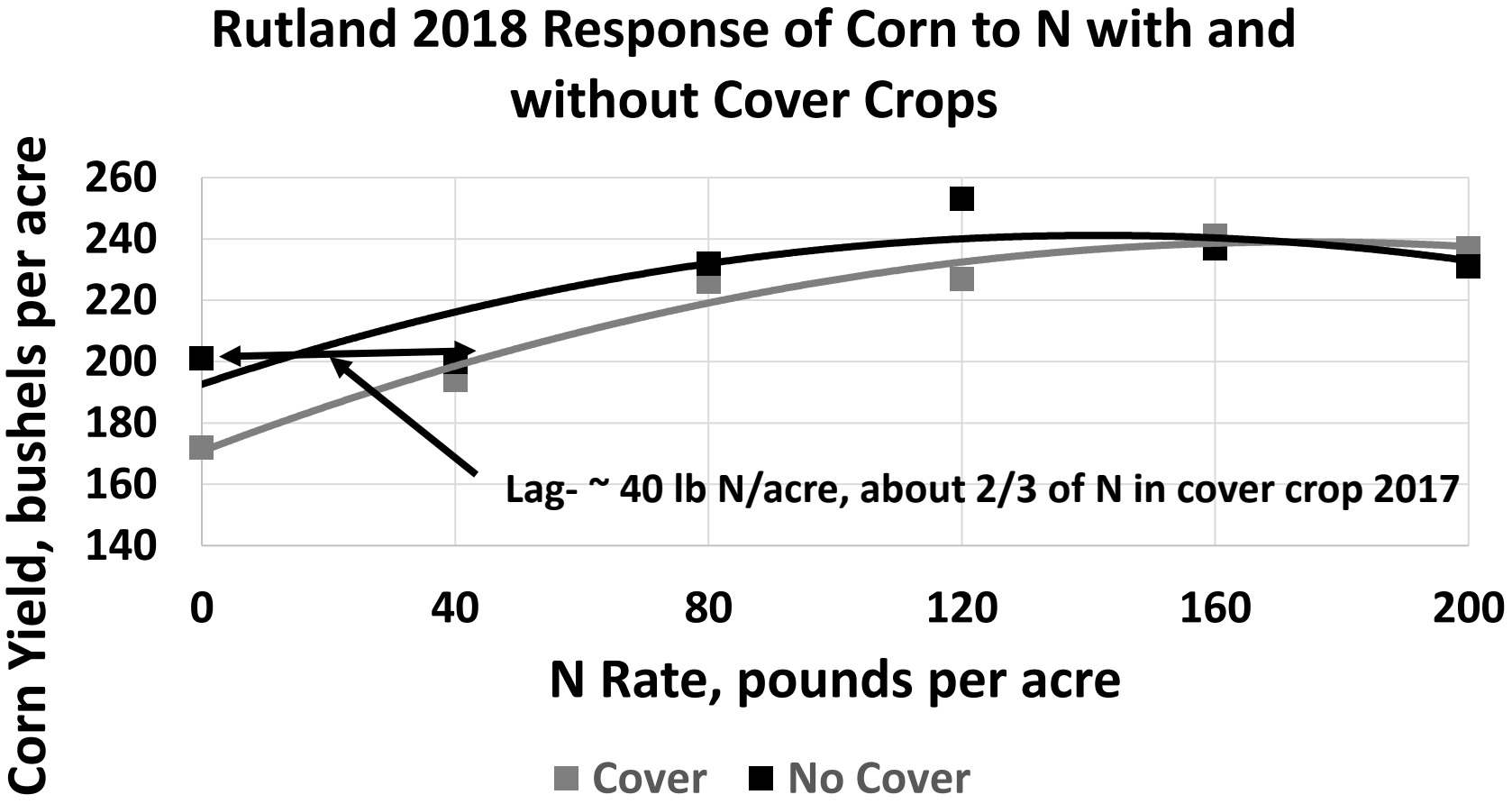
(Assume $6/bu spring wheat, 40 cent/lb N)

EONR for no-cover crop was 111 lb N/acre
EONR for cover crop was 125 lb N/acre
Yield drag was 7 bu/acre

Economic loss was ~$24/acre due to lost yield at maximum and cost of additional N.

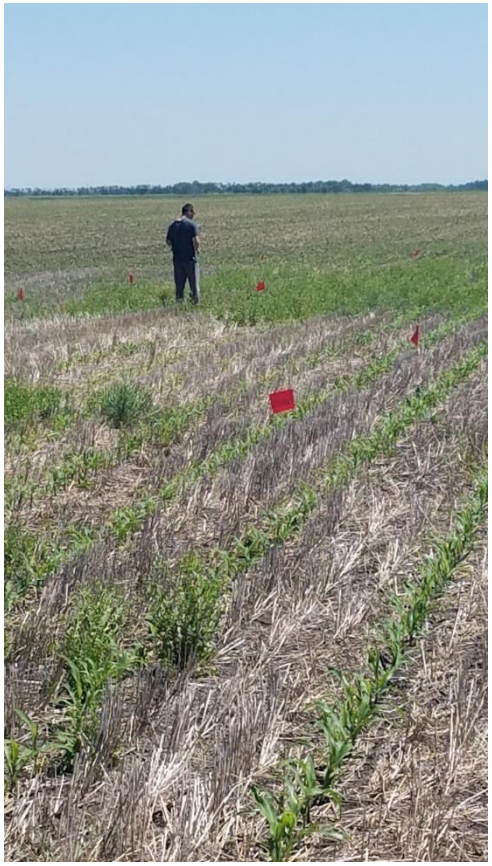
Corn in 2018-
Rutland after bio-striptill with radish/flax in future corn rows. Volunteer spring wheat throughout, fababean in row middles.


Rutland 2018
Alley
Alley
N

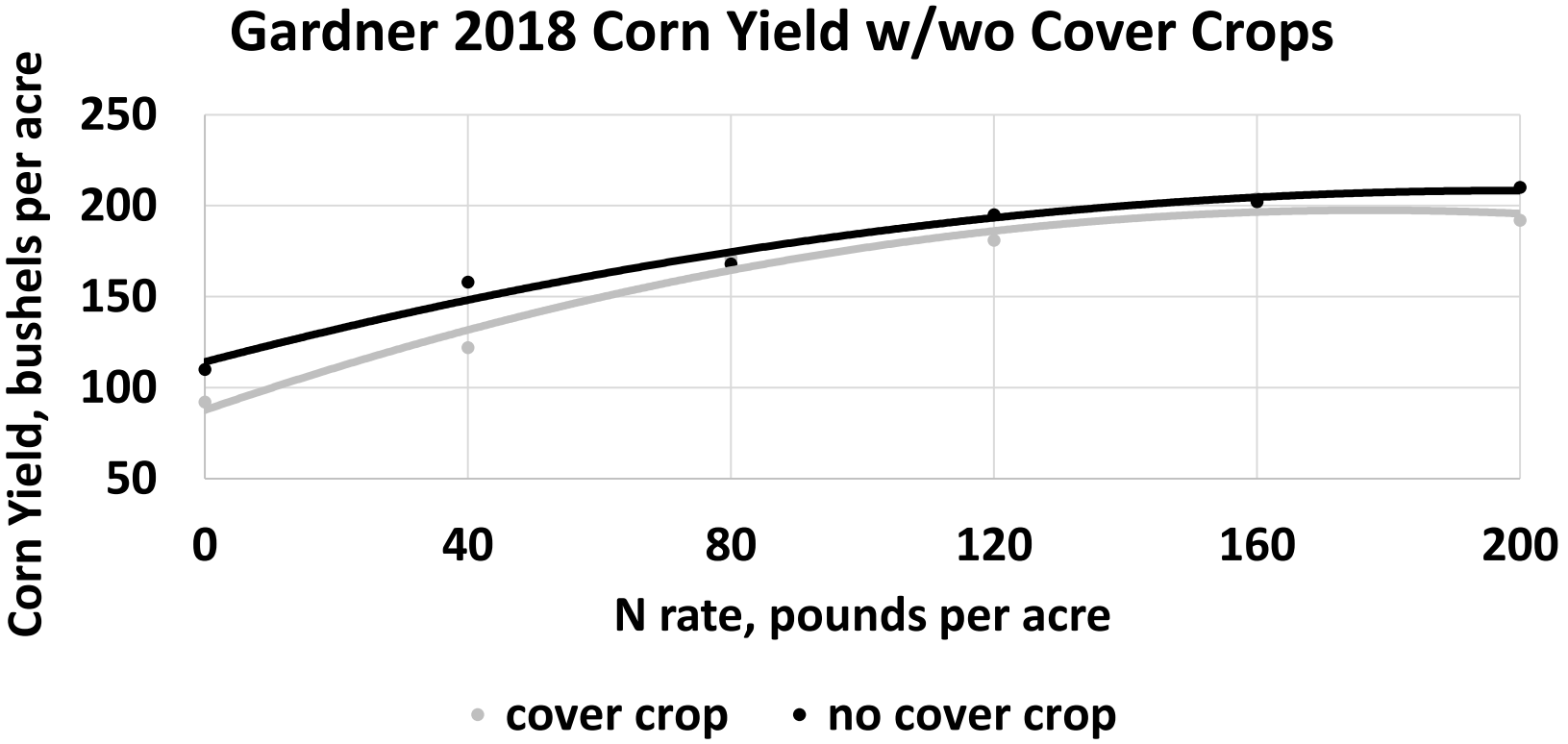

Rutland 2018 Response of Corn to N with and without Cover Crops
Corn Yield, bushels per acre
260
240
220
200
180
160
140
Lag- ~ 40 lb N/acre, about 2/3 of N in cover crop 2017
0
40
80
120
160
200
N Rate, pounds per acre
Cover
No Cover

Gardner 2018- Oats, radish, camelina after 2017 wheat harvest

Camelina survived .



Lag ~ 20 lb/acre, about the estimated N in camelina that overwintered.



Summary of 2 growing seasons-

-3 corn harvests following cover crops yielded less than those without. The 2018 Rutland cover crops appeared to release about 30 lb N/acre to the corn.

-1 of 1 spring wheat harvest yielded less with cover crops.

-Yield lag was roughly equal to the N lag from the N content of the cover crop N content that precedes the wheat or corn crop.

The lack of consistent N cycling is consistent with other mid-west research.

At conference in Des Moines last November, 5 studies looked at N cycling after rye, radish or both, and all found that N was not released.

We do not know where it goes.

I am investigating whether some of the N becomes fixed (like K) in the smectitic clays.

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