Nitrogen cycling in cover crops

2020 Advanced Crop Advisors Workshop

Fargo, ND

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Nutrient Cycling-

What is cycling?

-Nutrients are taken up by cover crop,
-cover crop dies or is terminated,
-Nutrients in cover crop are released through rainfall (K) or as inorganic end-products of microbial decomposition.

Carbon/Nitrogen ration

All plants and parts of plants have a characteristic range of carbon (C) to nitrogen (N)

this C/N ration is important in predicting whether N will be trapped, released or neither after a crop is harvested, or when a cover crop or any organic-based nutrient amendment is applied to a soil.

Generally, residues with a C/N ratio of over 30 will tie-up N and not release it.

Residues with a C/N ratio from 20-30 will not affect the N status for crops short-term.

Residues with C/N ratio under 20 tend to release N. Those residues with really low C/N ratios (Very green residues) will release the most the quickest.

North Dakota experience-

Most cover crops are currently seeded after a short-season crop such as barley, canola, or spring wheat.

Photo courtesy
of Ron Wiederholt

2008 Field Pea Relay cover crop biomass Carrington, ND (Lawley- now in Canada)

2008 Field	CoverCrop Biomass	Percent N (%)	Total N
	lb/acre	%	lb/acre
1	3026	4.3	130
2	1582	4.0	63
3	1877	3.7	69

Nutrient cycling in cover crops??

Rutland 2016-17 story-

Fall 2016- cover crop
5,097 lb/acre dry matter- 142 lb N/acre

Residual nitrate in cover crop following winter wheat.

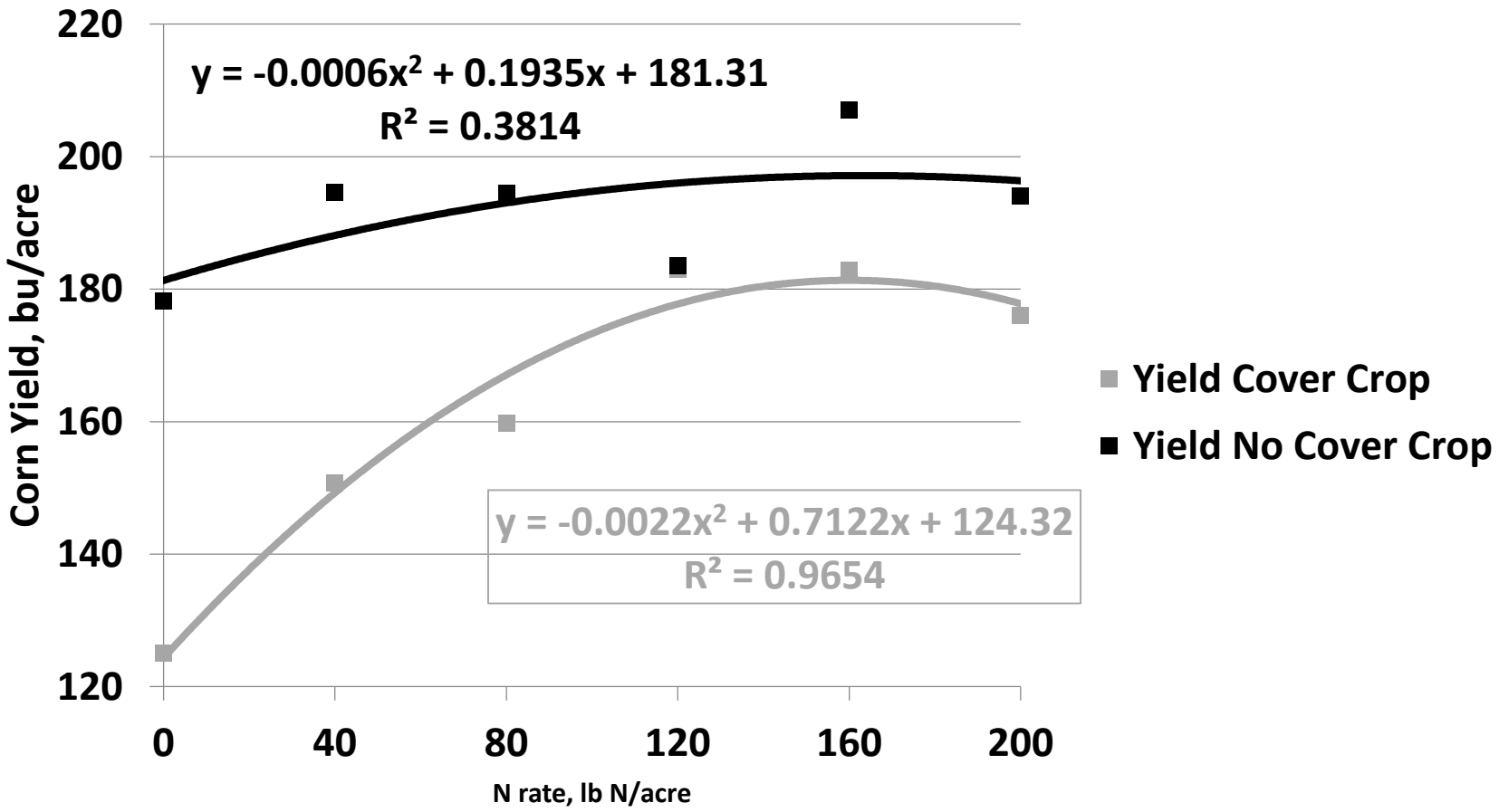
Treatment	8/12	9/28	10/24
	Nitrate-N, lb/acre		
Cover crop	57	18	15
No Cover Crop	50	130	114

Residual nitrate in cover crop following winter wheat.

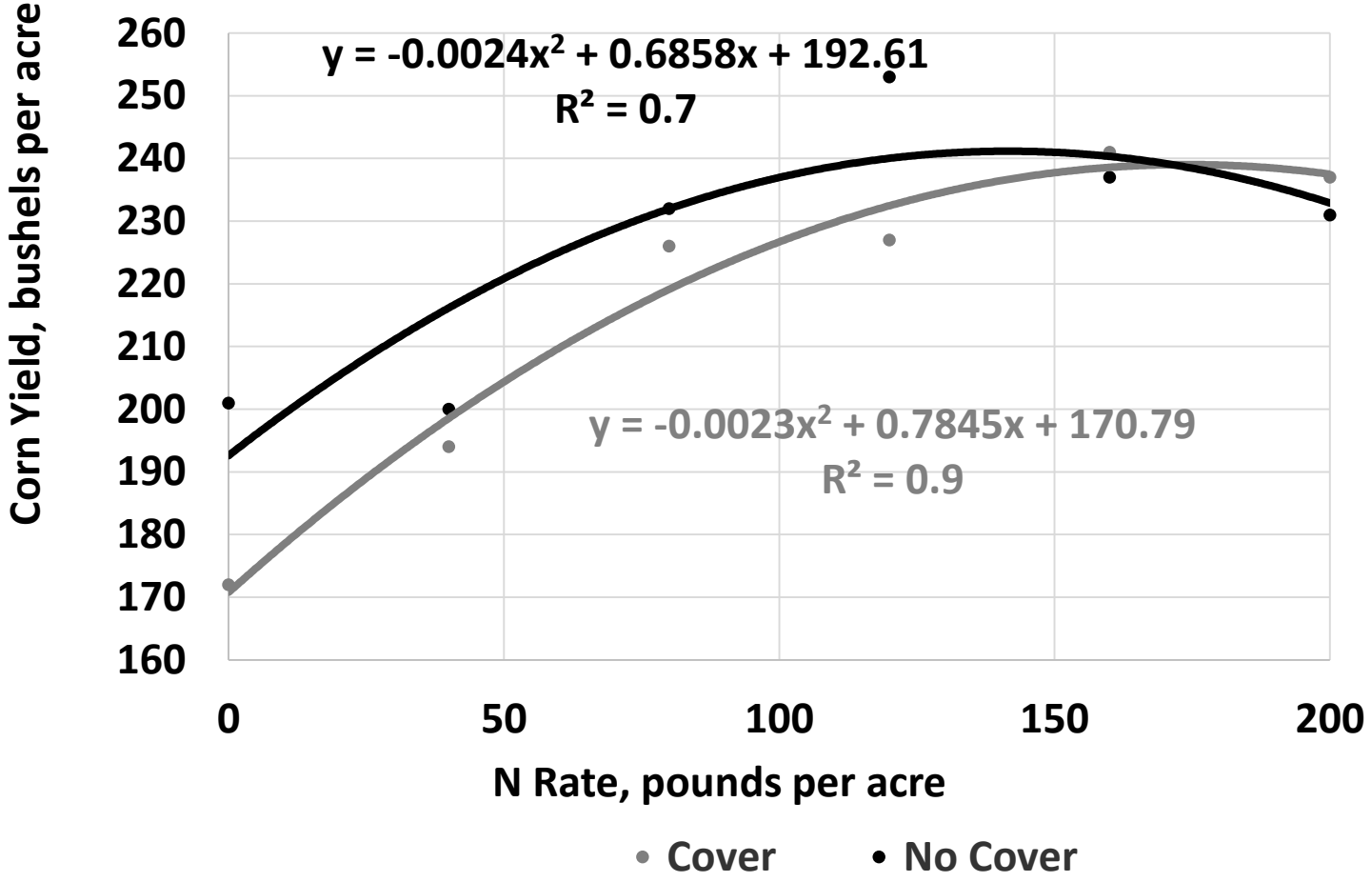
Treatment	5/11
	Nitrate-N, lb/acre
Cover crop	41
No cover crop	77

Soil moisture similar between treatments, May, 2017.
About 29% by weight to 2 foot depth.

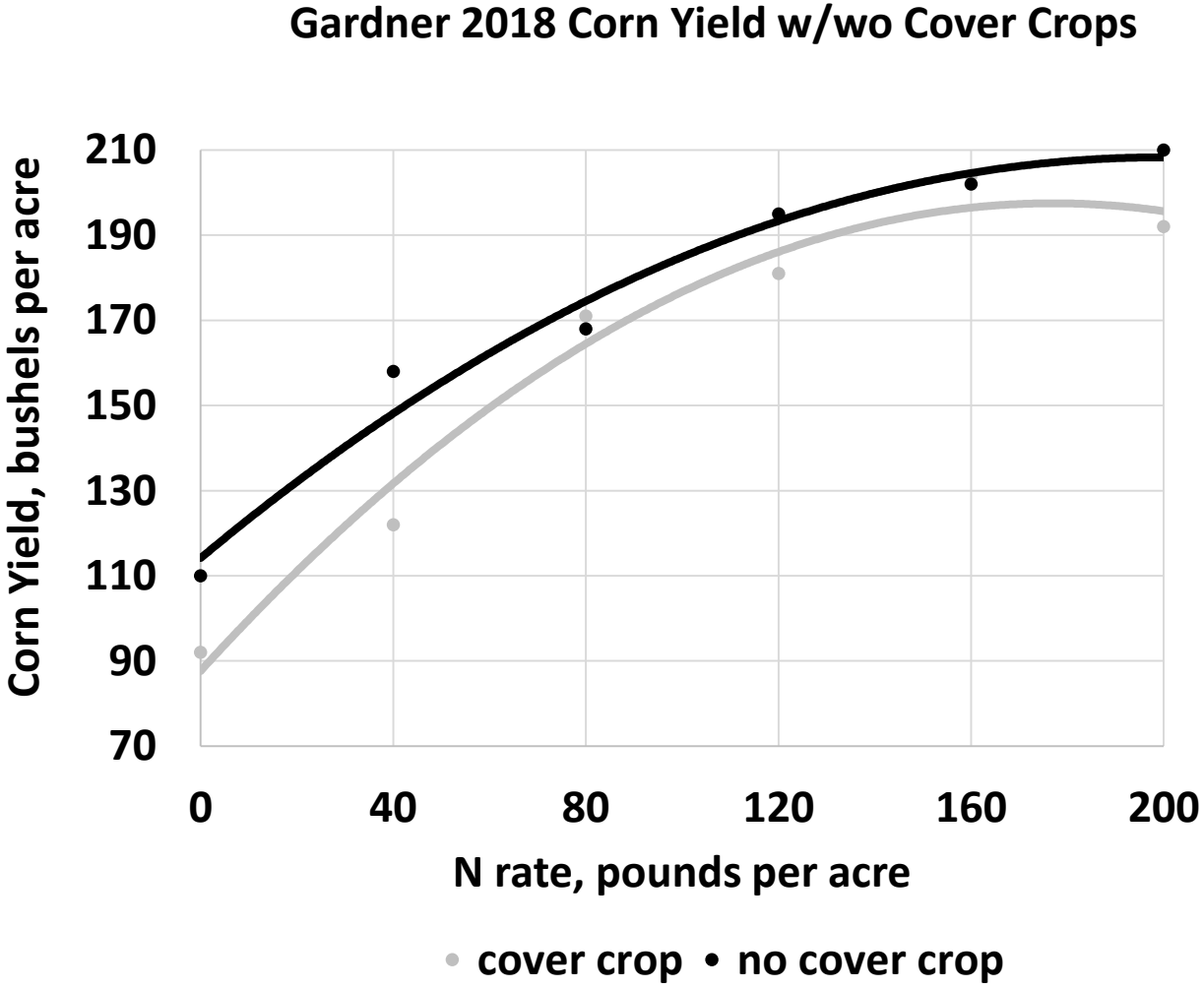
Rutland 2017 Corn Yield w/wo Cover Crops



Response of Corn 2018 to N with and without Cover Crops

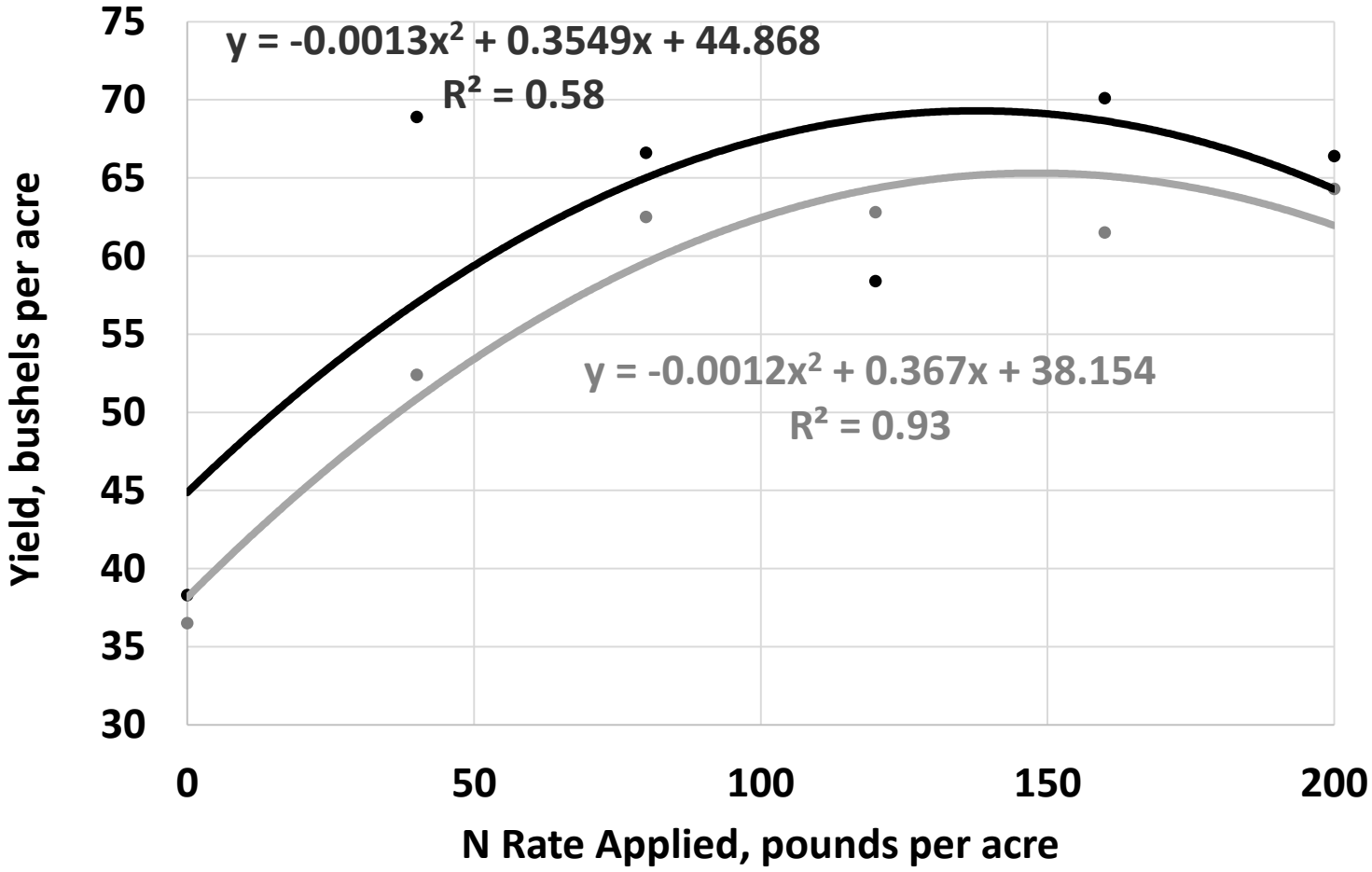


Fall 2017 cover crop N- 69 pounds per acre.
Spring 2018 nitrate after cover crop 55 lb/a, no cover crop 85 lb/a

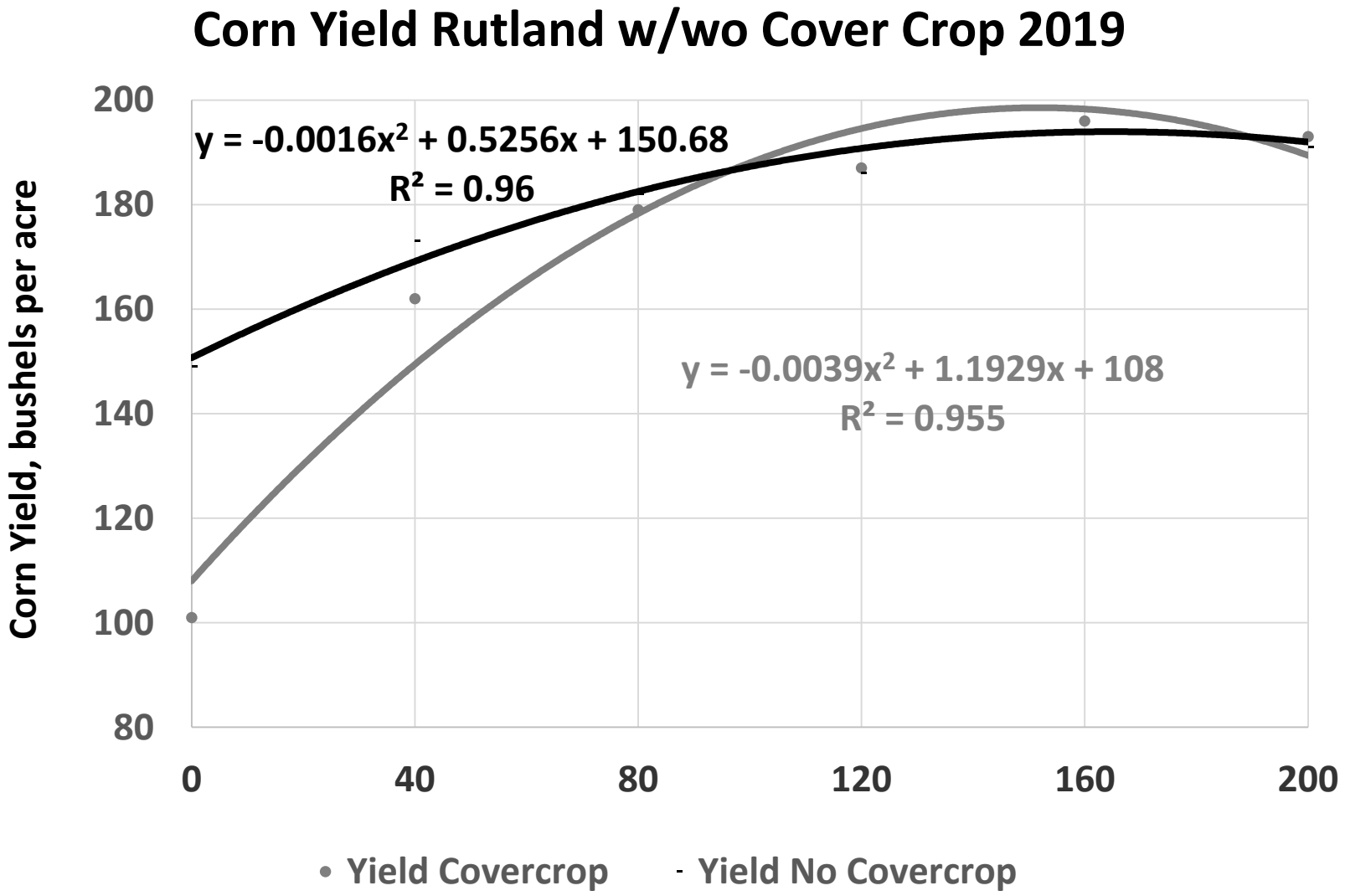


N content of cover crop rye May, 2018 10 lb N/acre
Spring nitrate-N cover crop 55, no cover crop 85

Gardner spring wheat yields w/wo cover crops 2018

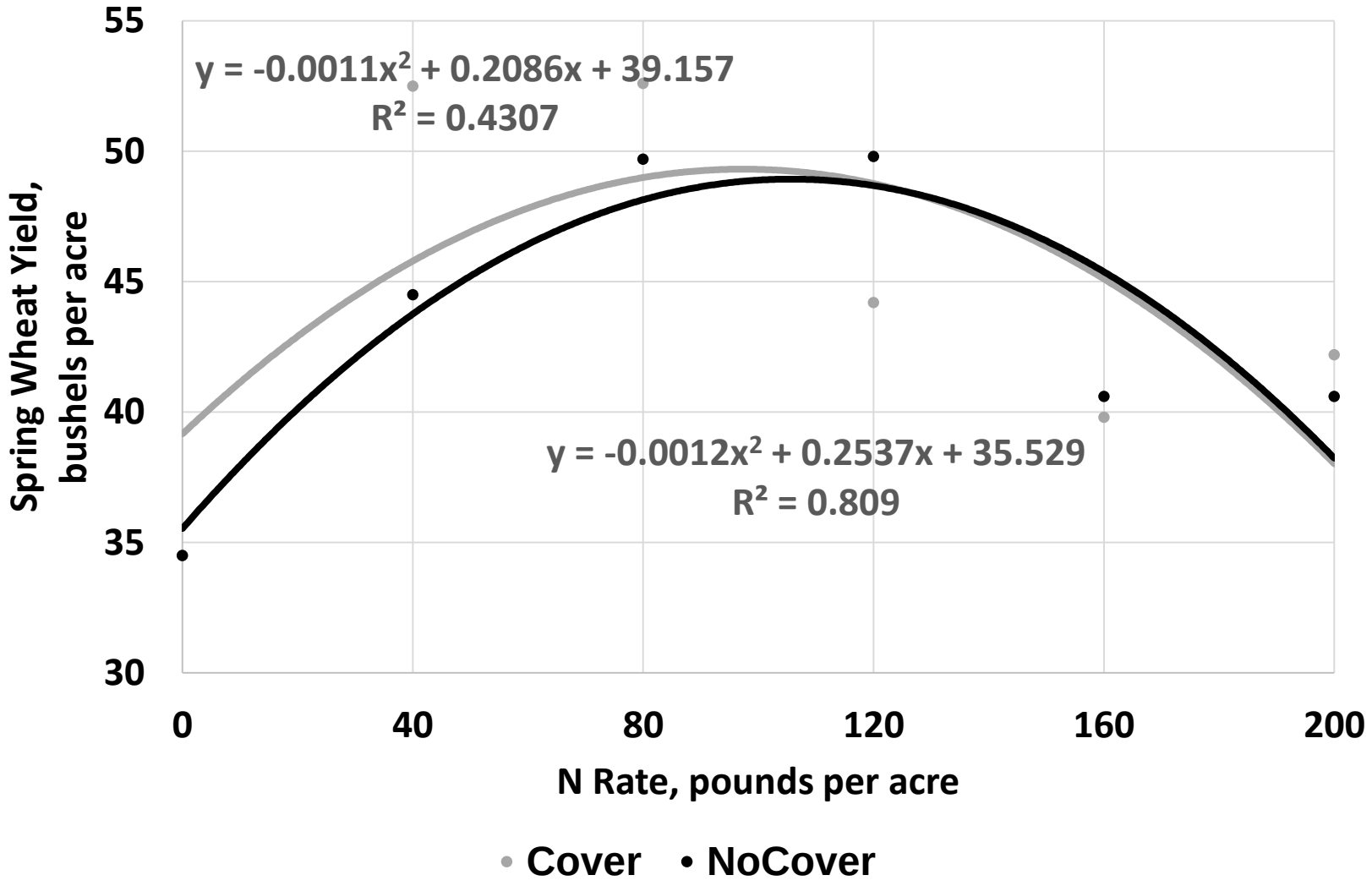


Cover crop N content was about 20 lb/acre



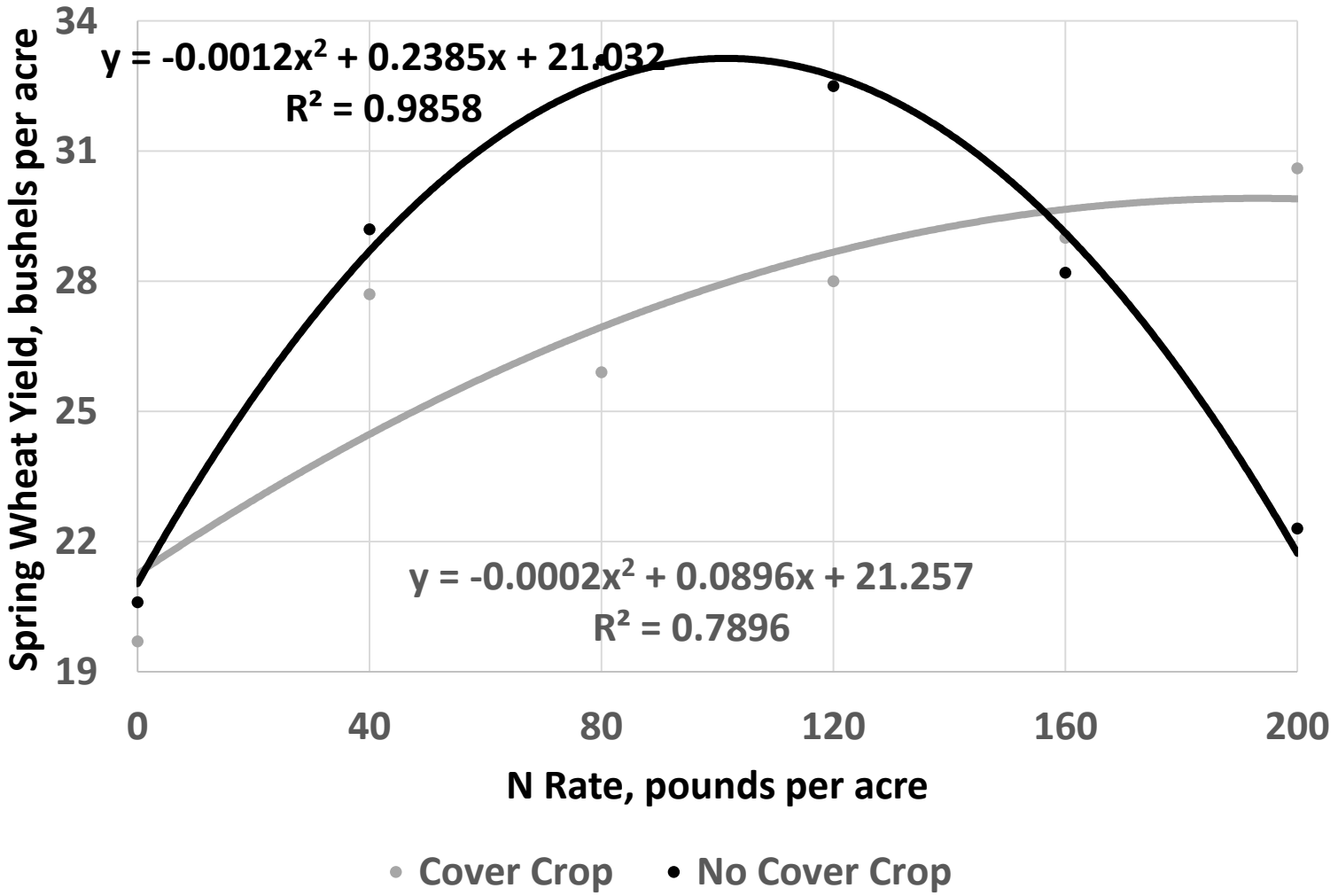
N content cover crops fall 2018 117 lb N/acre

Rutland Spring Wheat Yield w/wo Cover Crop 2019



Only 2 lb N/acre in oats fall 2018. Cover crop improved- Is N coming out from previous years??

Gardner 2019 Spring Wheat Yield w/wo Cover Crops



Only 2 lb/a N in cover crop oats fall 2018. Soil nitrate similar in spring

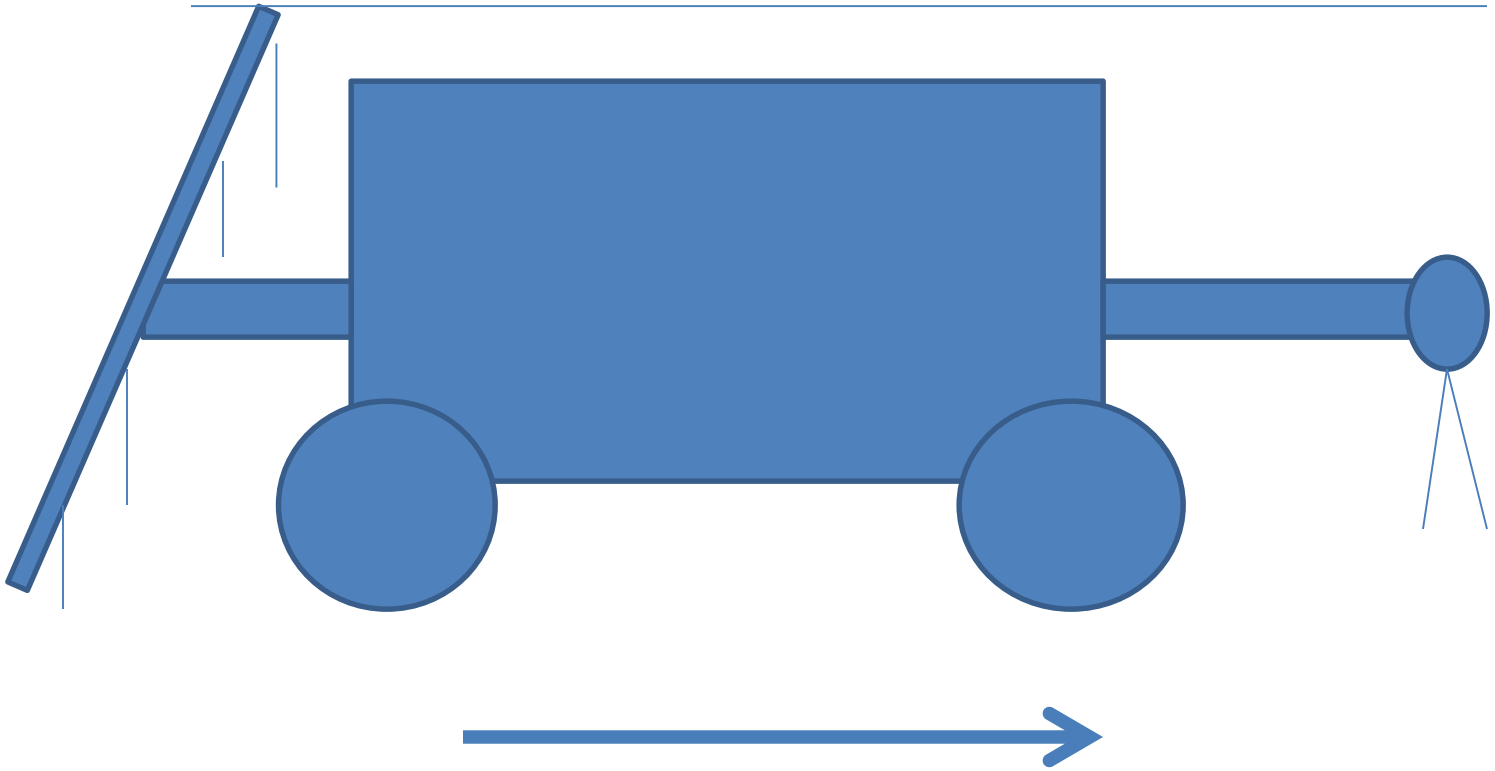
Knowing that cover crops contain N means <u>nothing</u> to the next crop without a <u>standard</u>

Active optical sensor algorithms are been published

Greenseeker (Trimble)

Holland Crop Circle Sensor (Holland Scientific)

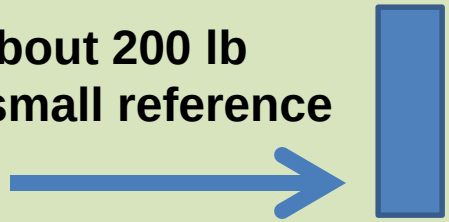
Distance sensor to application point =
block of variable rate fertilizer applied



Example field- 160 acres

Use zone sampling to direct the initial N-rate to field

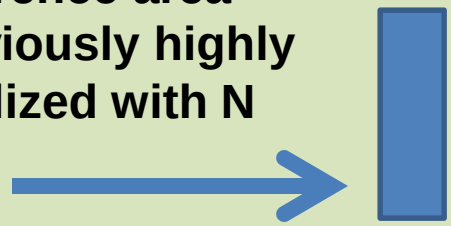
Apply about 200 lb N to a small reference area

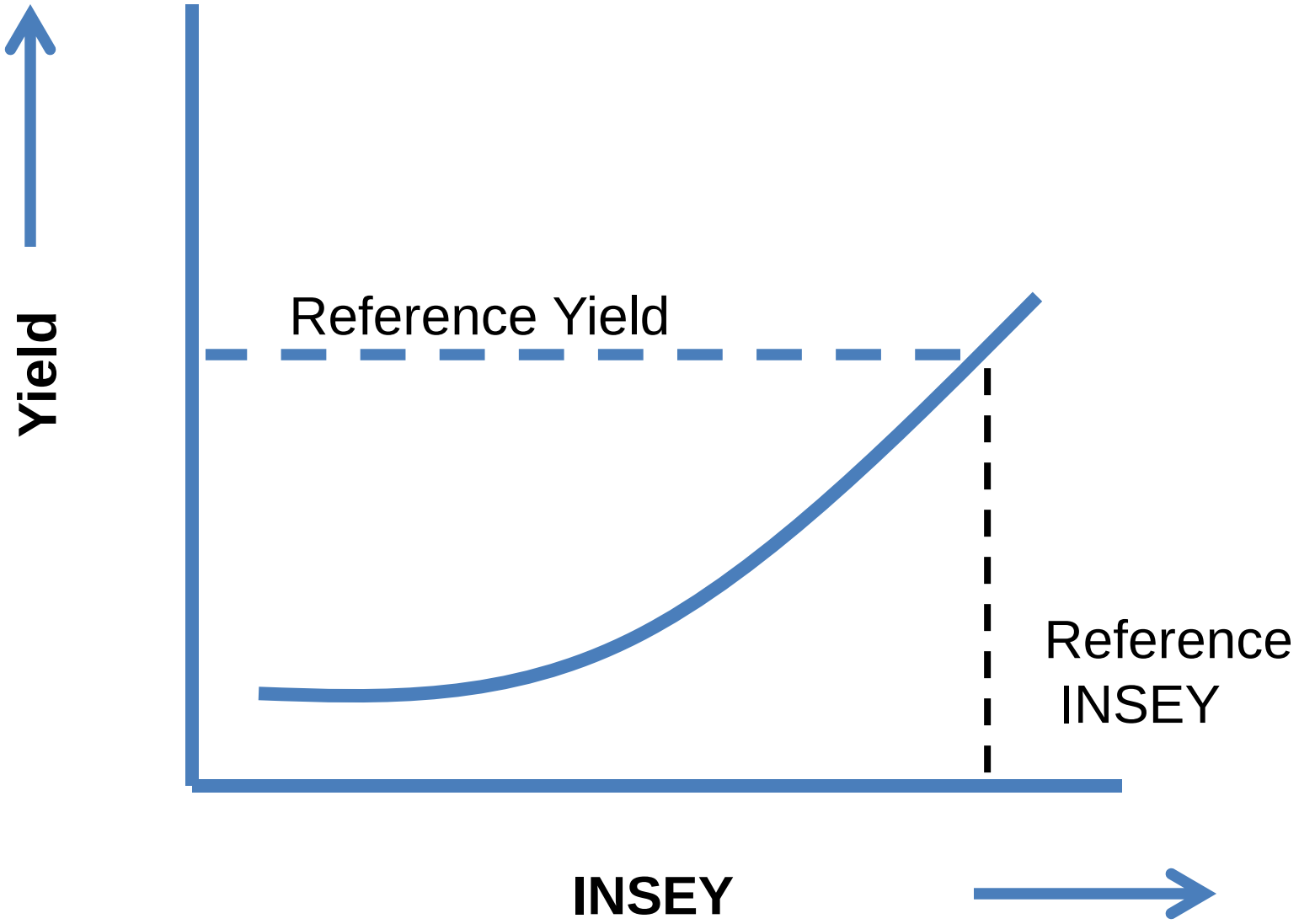


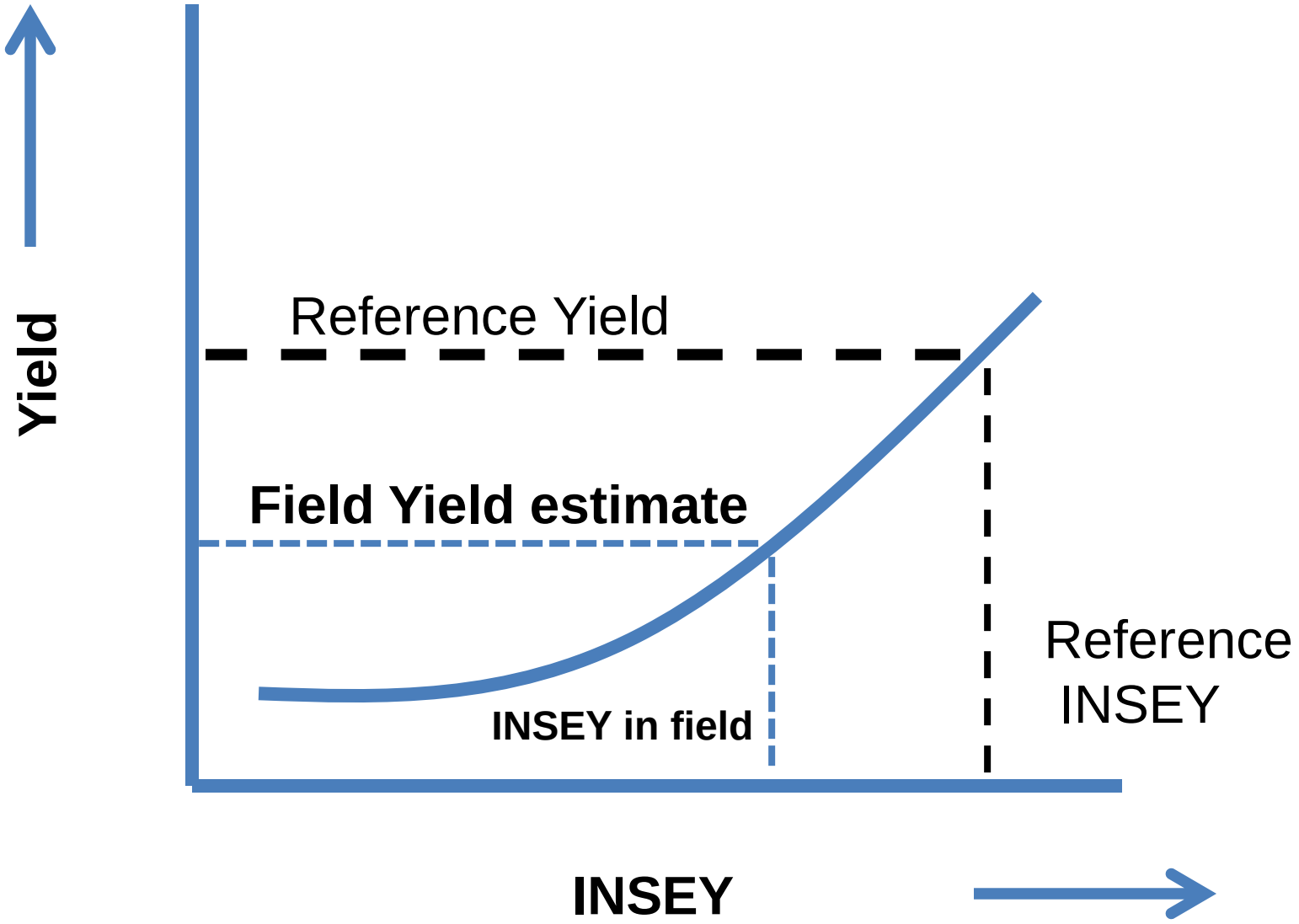
Example field- 160 acres

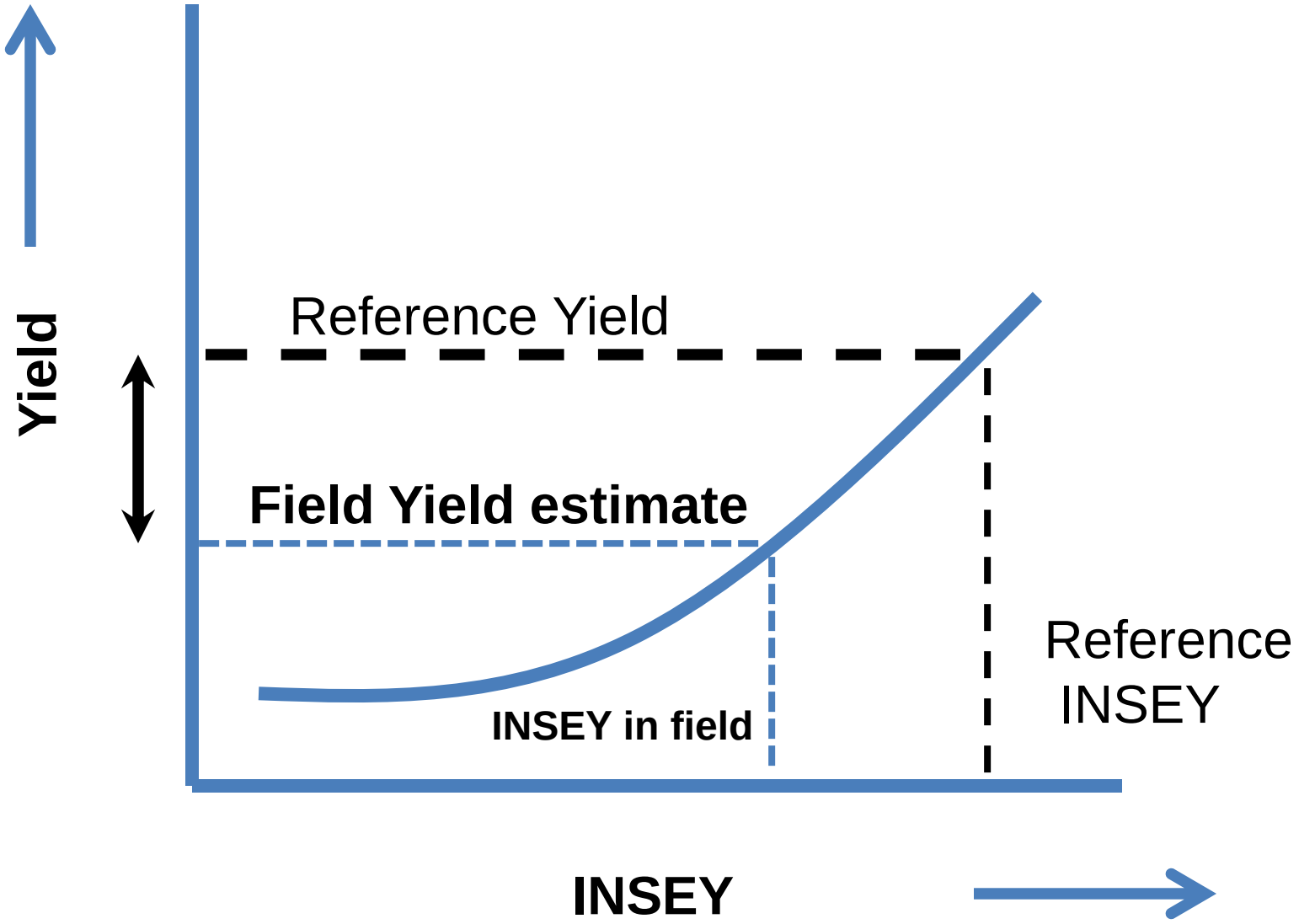
When applicator enters the field to apply side-dress application, the reference area serves as the INSEY that is the maximum supported by an application, less an INSEY of 5%.

Reference area previously highly fertilized with N

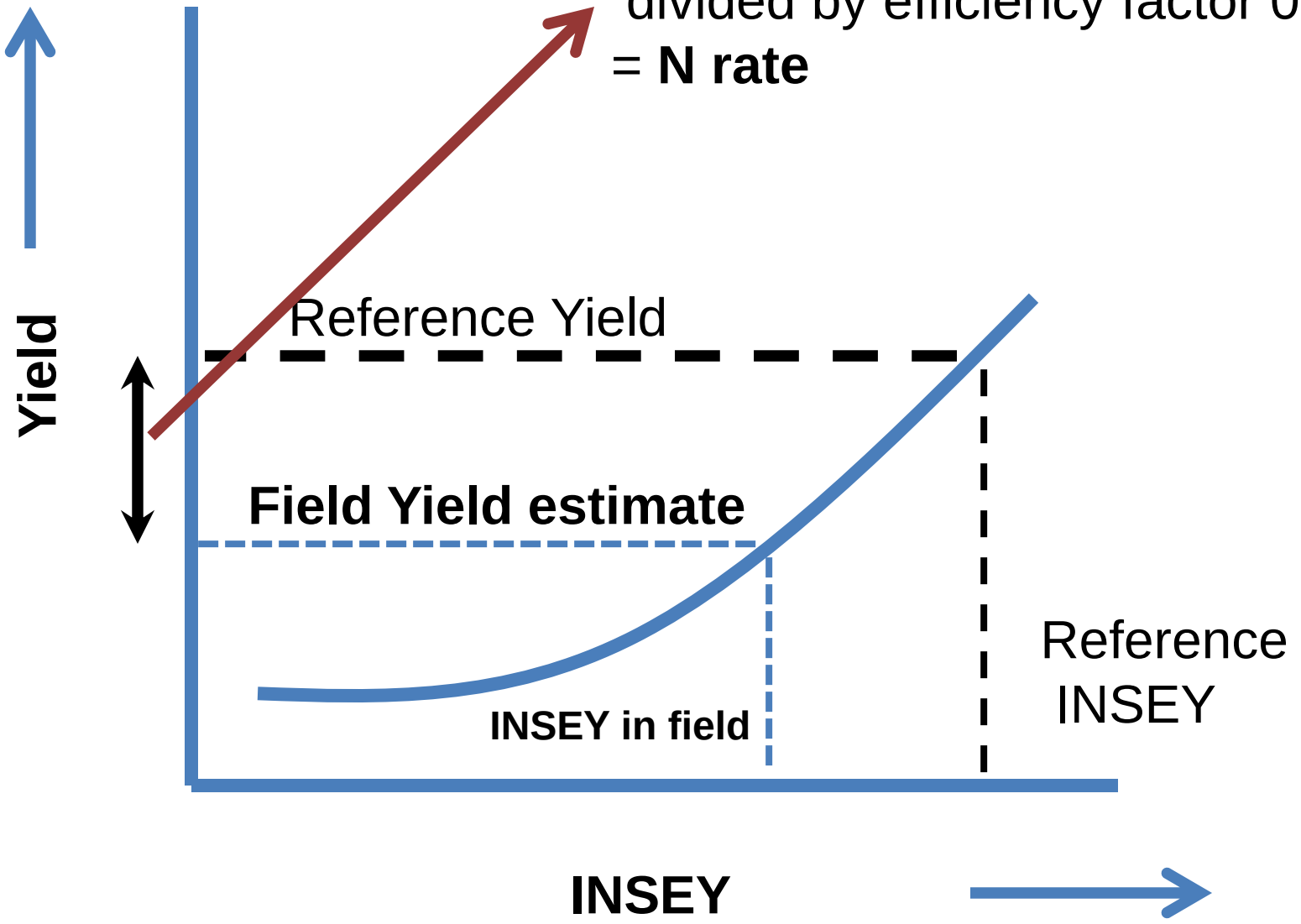



Yield
Reference Yield
Reference
INSEY
INSEY


Yield
Reference Yield
Field Yield estimate
INSEY in field
Reference
INSEY
INSEY


Yield
Reference Yield
Field Yield estimate
INSEY in field
Reference
INSEY
INSEY

Corn yield difference in pounds per acre.
X 1.25 % N in corn grain
divided by efficiency factor 0.6
= **N rate**



Example-

Reference yield predicted- 220 bushels

In-field yield estimated- 160 bushels

difference = 60 bushels X 56 lb grain/bushel = 3360 pounds
X 0.0125 = 42 lb N
42 /0.6 efficiency factor = 70 lb N
at that location.

Summary-

The C/N ratio of the cover crop at death/termination is important. BUT

Nitrogen that can be credited to the next crop is iffy.

If decomposition does not go to completion within the period of crop uptake, full equation-value of benefit will not be realized.

An N-rich standard, consisting of the N credit rate, will help the grower have confidence that the N credit is deserved, or will direct them to provide supplemental N to make up deficit.

Acknowledgement

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www.cropsyscap.org**