Nitrogen and Phosphorus Recalibration for Sunflower – New Recommendations

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New Fertilizer Recommendations

- NDSU Ext. Circular available by March 1st
- Interactive online N calculator in the works

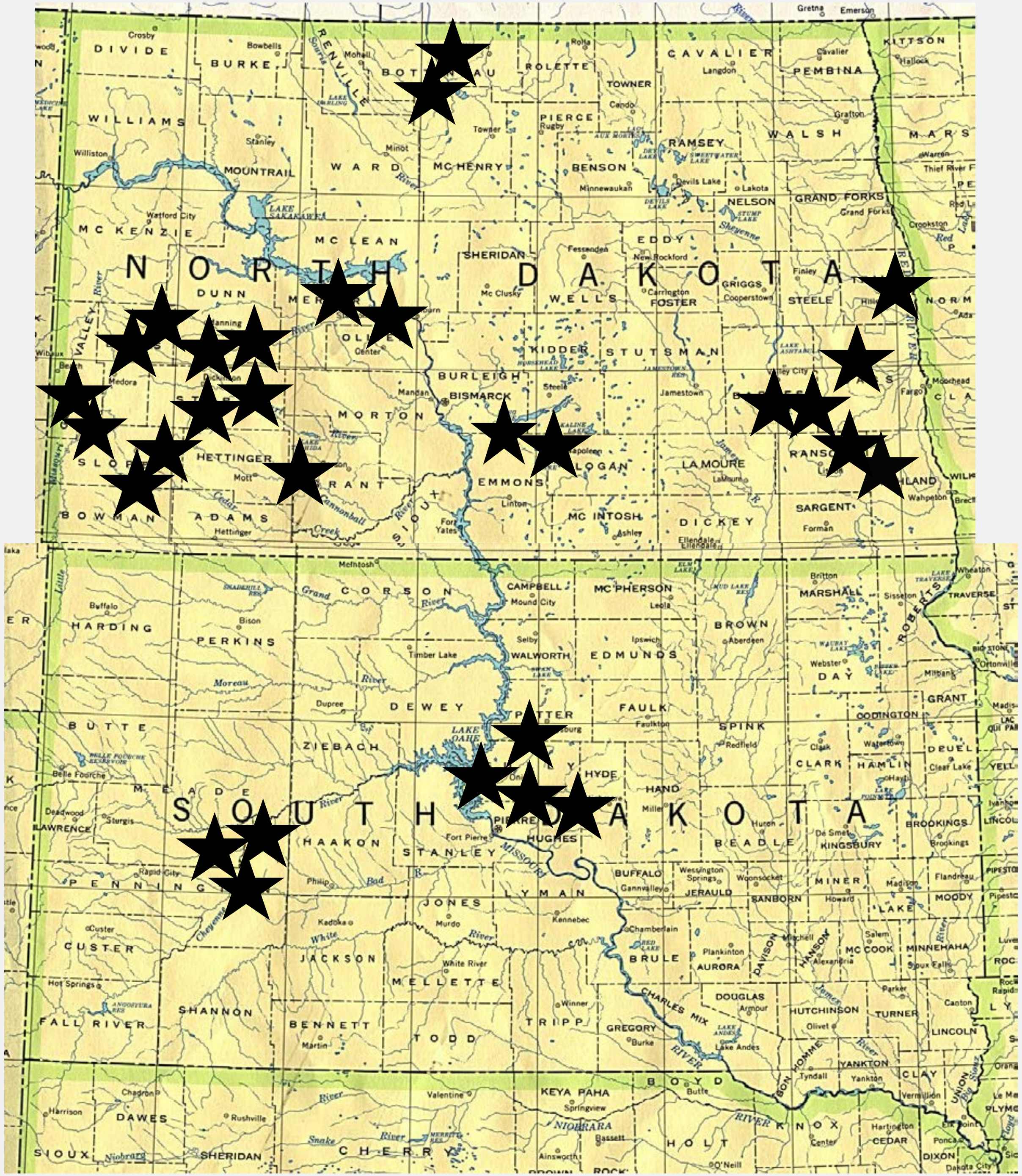
Using:

- General productivity history
- Economic analysis
- Documented responses – yield, oil

First update since original research in 1970s

Old- Linear response
New- Curvilinear, diminishing returns for N

- **30 experiments in 2014-2015**


NORTH DAKOTA
SOUTH DAKOTA
DIVIDE
BURKE
RENVILLE
ROLETTE
CAVALIER
PEMBINA
KITTSON
TOWNER
WILLIAMS
PIERCE
RAMSEY
WALSH
MOUNTRAIL
WARD
MC HENRY
BENSON
NELSON
GRAND FORKS
MC KENZIE
MC LEAN
SHERIDAN
EDDY
DUNN
WELLS
FOSTER
GRIGGS
STEELE
KIDDER
STUTSMAN
BURLEIGH
BISMARCK
MORTON
EMMONS
LOGAN
LA MOURE
HETTINGER
GRANT
BOWMAN
ADAMS
MC INTOSH
DICKEY
SARGENT
Crosby
Bowbells
Mohall
Rolla
Langdon
Cavalier
Cando
Rugby
Towner
Minot
Stanley
Williston
Watford City
Minnewaukan
Devils Lake
Lakota
Grand Forks
Grafton
Fessenden
New Rockford
Mc Clusky
Carrington
Cooperstown
Finley
Center
Mandan
Steele
Jamestown
Napoleon
Linton
Fort Yates
Ashley
Ellendale
Forman
Wahpeton
Fargo
Moorhead
Mott
Hettinger
Medora
LAKE SAKAKAWEA
Gretna
Emerson
CAMPBELL
MC PHERSON
MARSHALL
ROBERTS
CORSON
HARDING
PERKINS
WALWORTH
EDMUNDS
BROWN
DAY
GRANT
DEWEY
POTTER
FAULK
SPINK
CODINGTON
DEUEL
BUTTE
ZIEBACH
HYDE
HAND
CLARK
HAMLIN
MEADE
LAWRENCE
HAAKON
STANLEY
HUGHES
PIERRE
BEADLE
KINGSBURY
BROOKINGS
PENNINGTON
JONES
LYMAN
BUFFALO
JERAULD
SANBORN
MINER
LAKE
MOODY
CUSTER
JACKSON
MELLETTE
BRULE
AURORA
DAVISON
HANSON
MC COOK
MINNEHAHA
SHANNON
BENNETT
TODD
TRIPP
GREGORY
CHARLES MIX
DOUGLAS
HUTCHINSON
TURNER
LINCOLN
FALL RIVER
BON HOMME
YANKTON
CLAY
UNION
DAWES
SIOUX
SHERIDAN
CHERRY
KEYA PAHA
BOYD
HOLT
KNOX
CEDAR
DIXON
Buffalo
Bison
Mound City
Leola
Britton
Sisseton
Selby
Ipswich
Aberdeen
Timber Lake
Webster
Milbank
Dupree
Gettysburg
Faulkton
Redfield
Clark
Watertown
Clear Lake
Belle Fourche
Sturgis
Deadwood
Rapid City
Philip
Fort Pierre
Miller
Huron
De Smet
Brookings
Flandreau
Madison
Howard
Woonsocket
Wessington Springs
Gannvalley
Kadoka
Murdo
Kennebec
Chamberlain
Plankinton
Mitchell
Salem
Alexandria
Sioux Falls
Custer
Hot Springs
White River
Winner
Burke
Armour
Parker
Canton
Olivet
Tyndall
Yankton
Vermillion
Elk Point
Martin
Lake Andes
Chadron
Harrison
Rushville
Valentine
Springview
Ainsworth
Bassett
Butte
Center
Hartington
Ponca
Dakota City
LAKE OAHE
MISSOURI
NIOBRARA

Experimental Design – RCBD, split plot, 4 replications

Main plots

6 N Rates: 0 – 200 lbs N / acre

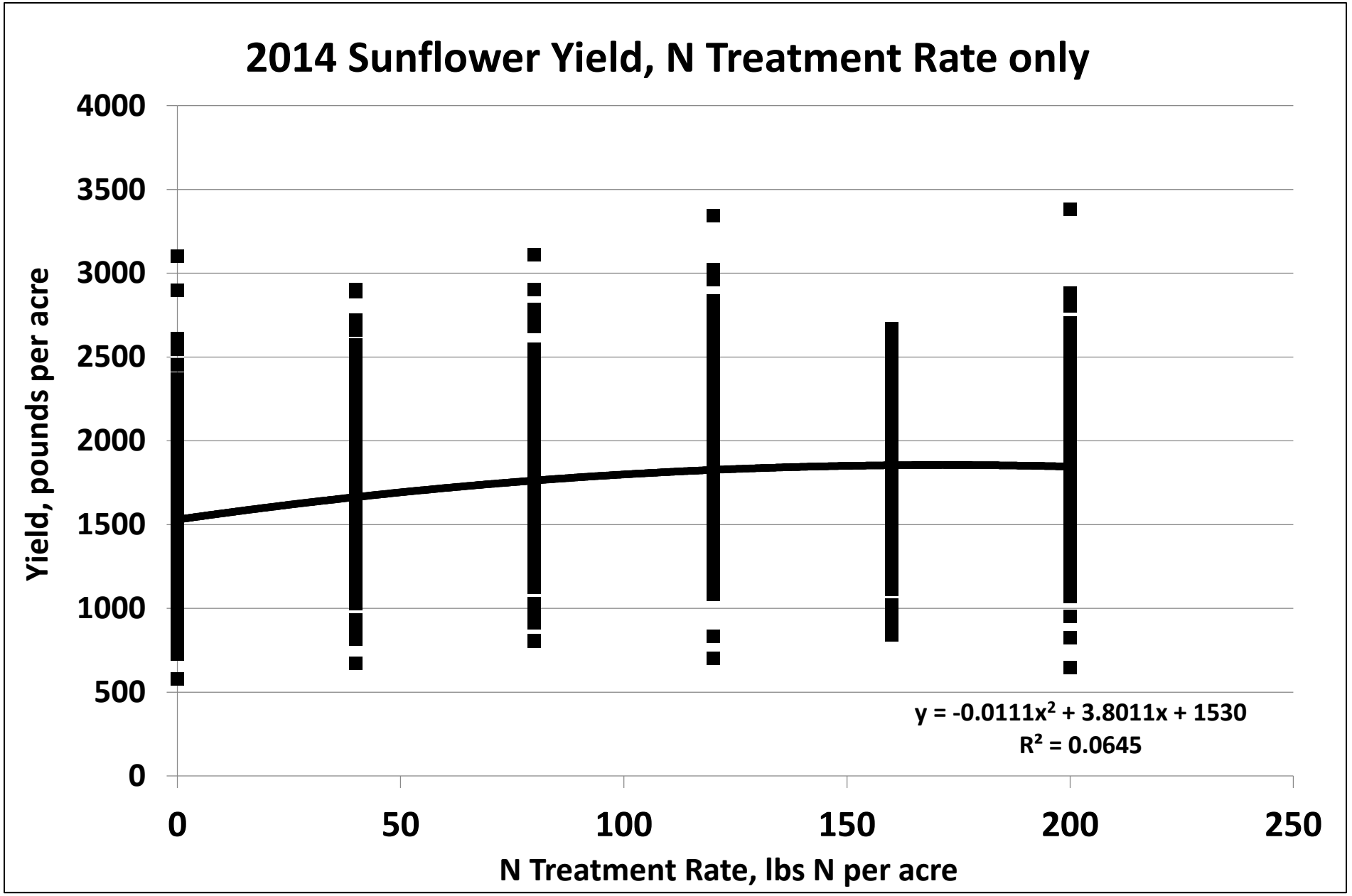
ammonium nitrate or Agrotain + urea

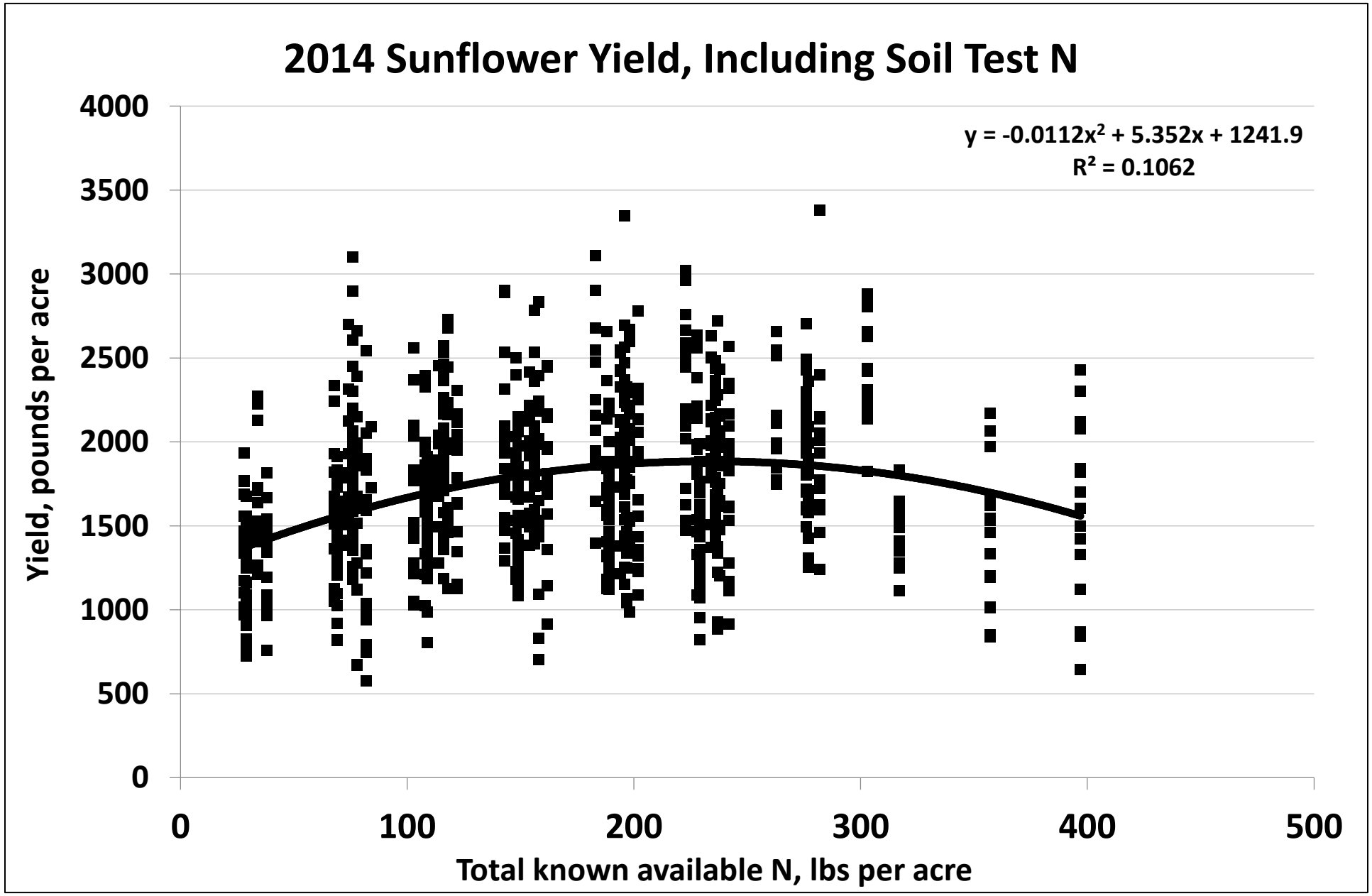
Sub plots

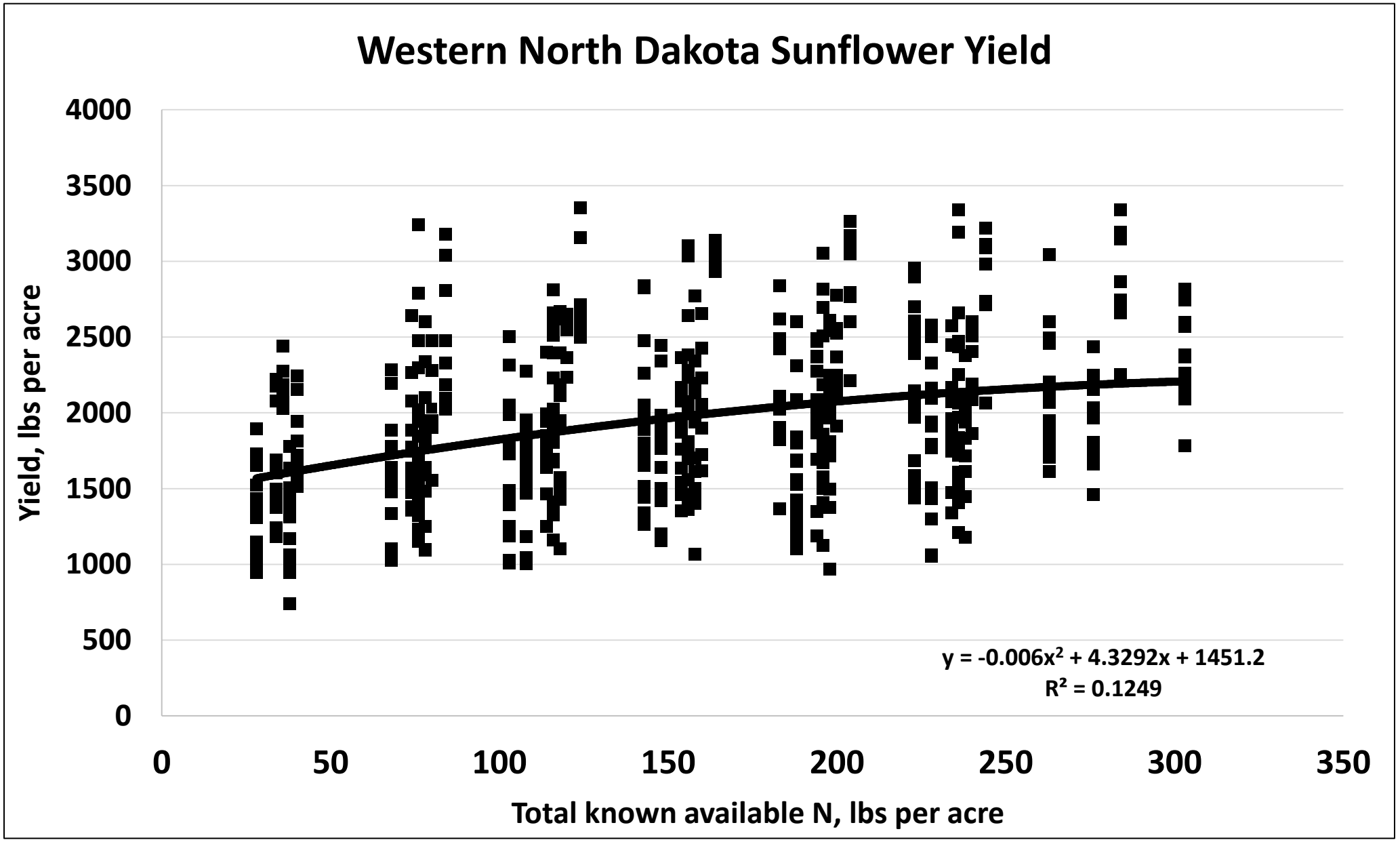
2014: 4 P Rates: 0 – 90 lbs P_2O_5 / acre

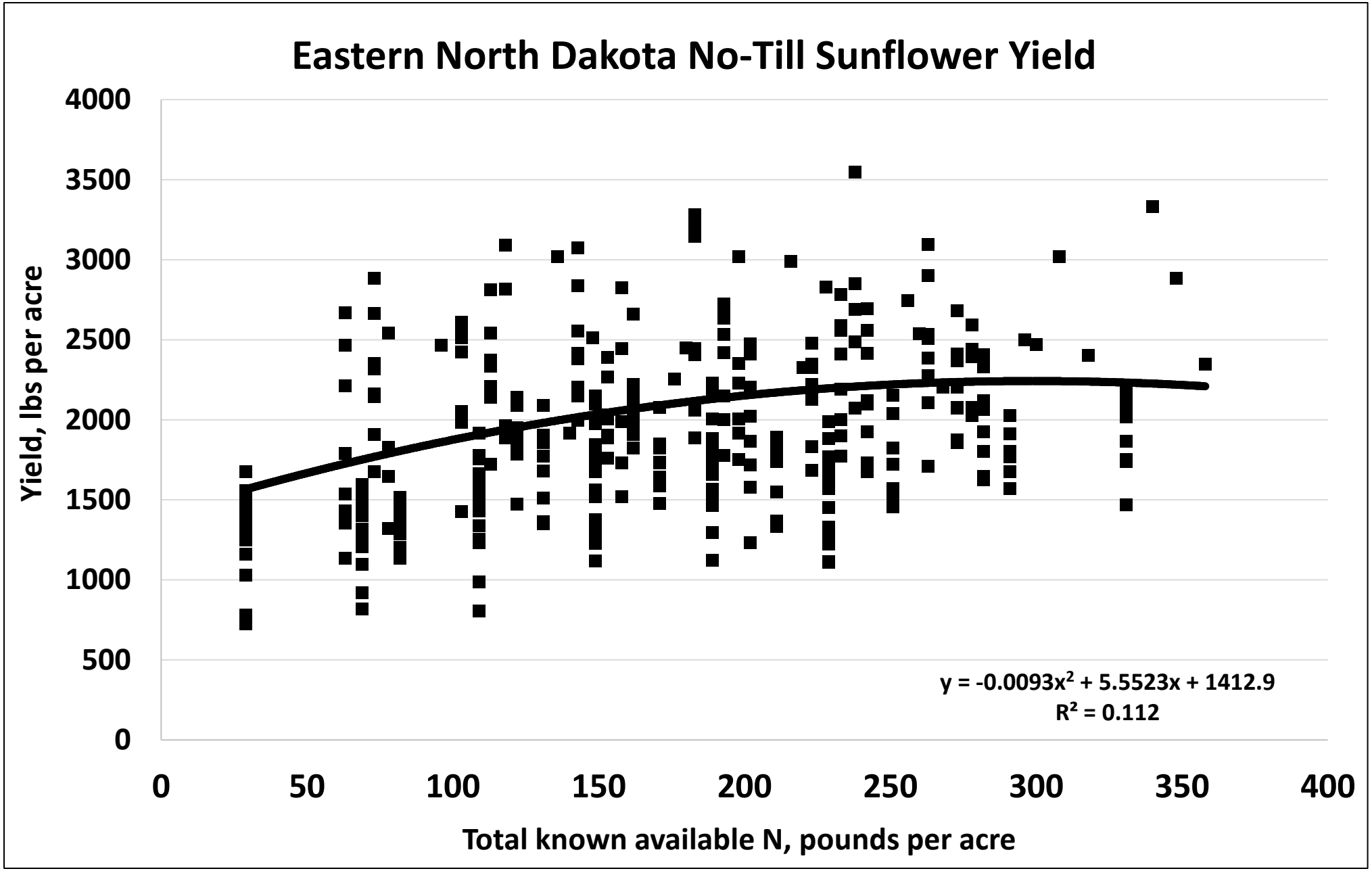
2015: 2 P Rates: 0, 60 lbs P_2O_5 / acre

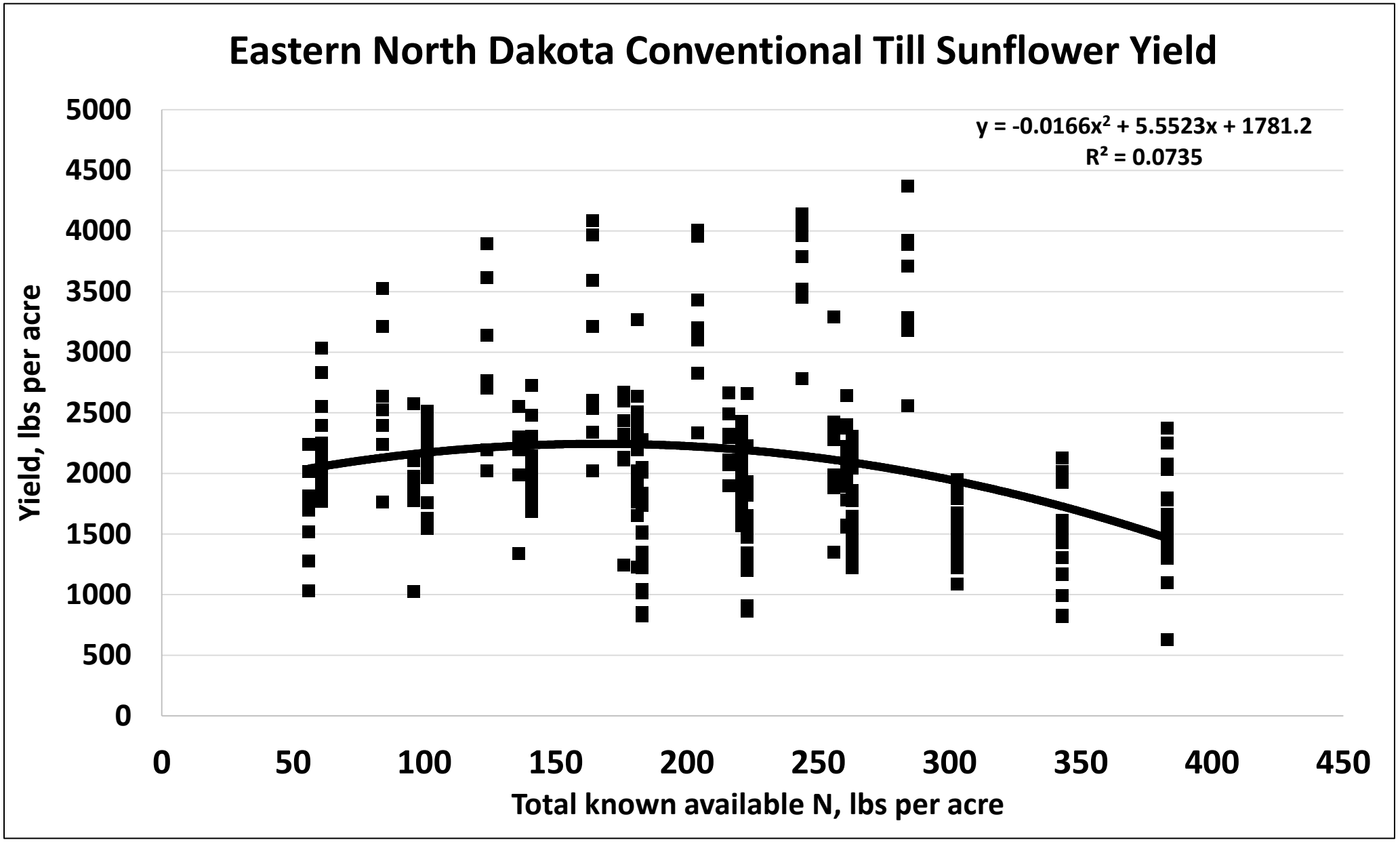
triple superphosphate

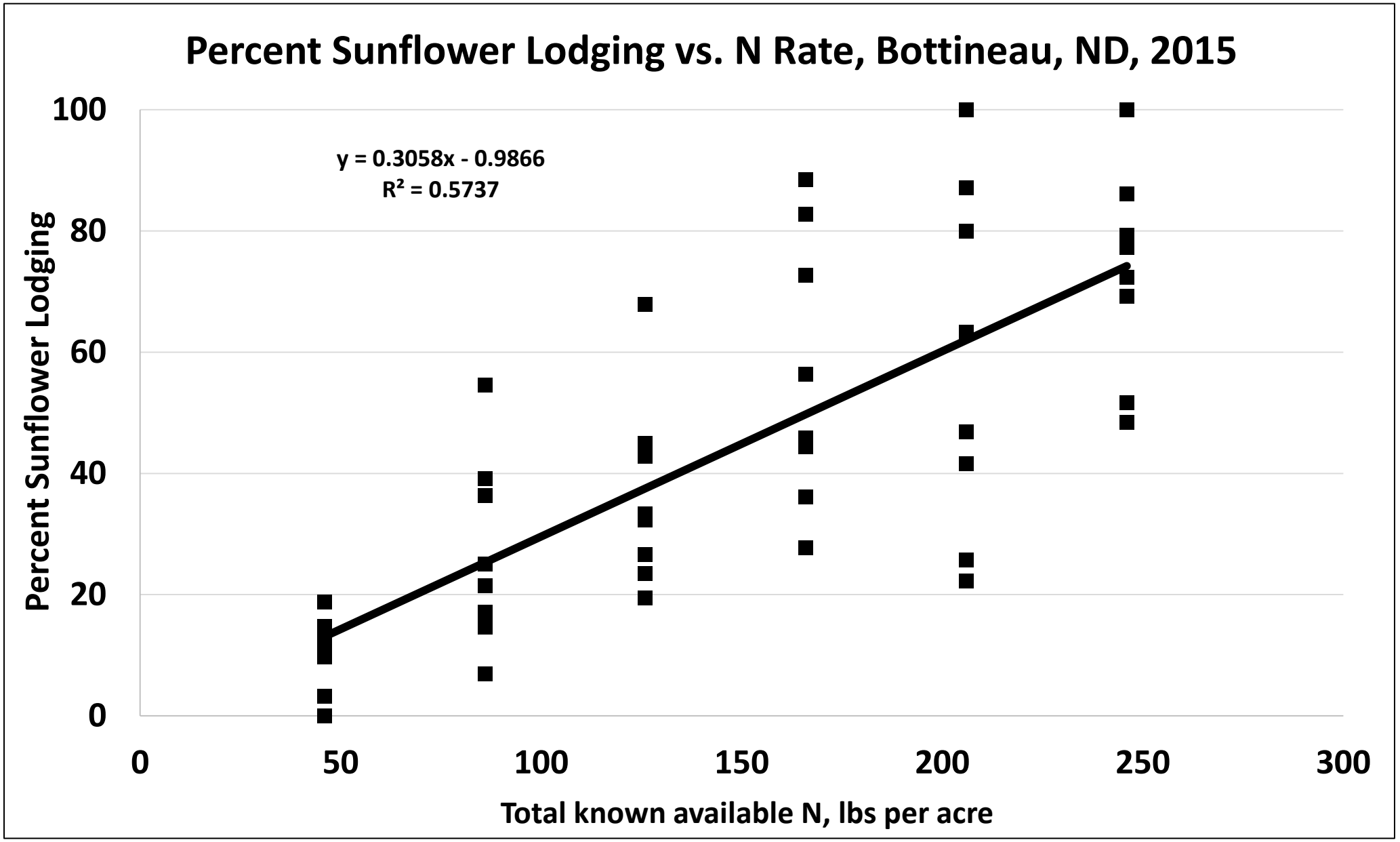

2014 Sunflower Yield, N Treatment Rate only
Yield, pounds per acre
4000
3500
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250
N Treatment Rate, lbs N per acre
y = -0.0111x² + 3.8011x + 1530
R² = 0.0645

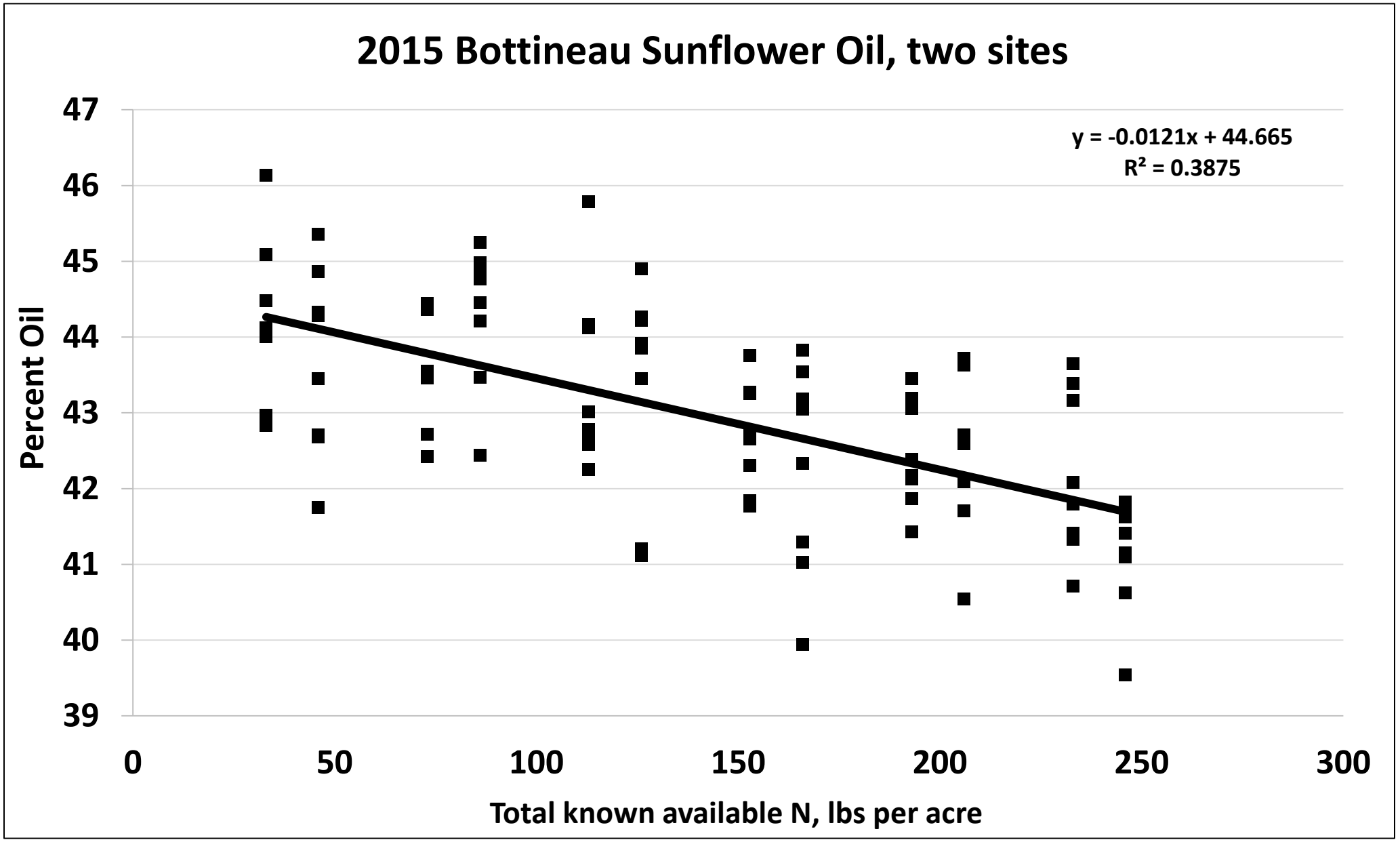

2014 Sunflower Yield, Including Soil Test N
y = -0.0112x² + 5.352x + 1241.9
R² = 0.1062
Yield, pounds per acre
4000
3500
3000
2500
2000
1500
1000
500
0
0
100
200
300
400
500
Total known available N, lbs per acre


Western North Dakota Sunflower Yield
Yield, lbs per acre
4000
3500
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250
300
350
Total known available N, lbs per acre
y = -0.006x² + 4.3292x + 1451.2
R² = 0.1249


Eastern North Dakota No-Till Sunflower Yield
Yield, lbs per acre
4000
3500
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250
300
350
400
Total known available N, pounds per acre
y = -0.0093x² + 5.5523x + 1412.9
R² = 0.112


Eastern North Dakota Conventional Till Sunflower Yield
y = -0.0166x² + 5.5523x + 1781.2
R² = 0.0735
Yield, lbs per acre
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
0
50
100
150
200
250
300
350
400
450
Total known available N, lbs per acre


Percent Sunflower Lodging vs. N Rate, Bottineau, ND, 2015
y = 0.3058x - 0.9866
R² = 0.5737
Percent Sunflower Lodging
100
80
60
40
20
0
0
50
100
150
200
250
300
Total known available N, lbs per acre


2015 Bottineau Sunflower Oil, two sites
y = -0.0121x + 44.665
R² = 0.3875
Percent Oil
47
46
45
44
43
42
41
40
39
0
50
100
150
200
250
300
Total known available N, lbs per acre

What about P??
Zero P.

3 responses out of 48 total field sites

- **only 1 economic response**

Numerous sites with <10 ppm STP in 2015

- **New sunflower recommendations are regionally and tillage based**
- **Include an Economic production function**

- **Allow sunflower growers to realize potential of still obtaining high yields with reduced fertilizer inputs**

Remaining:

- **Active optical sensors, algorithms to direct side-dress applications**