# Factors to Consider for Variable Rate Seeding

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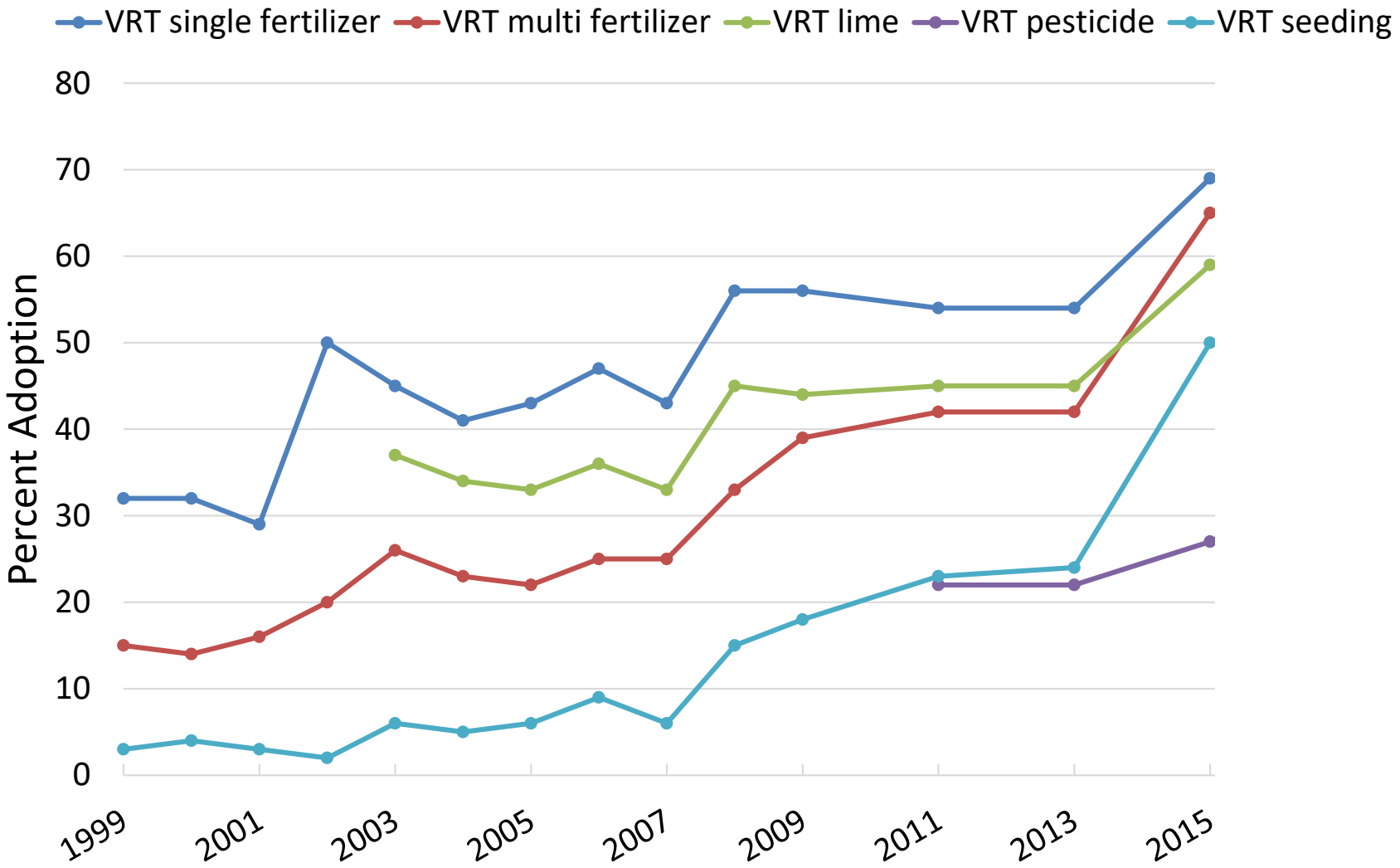
Precision agriculture is based on the premise of using field information and advances in technology to manage crop requirements and agronomic practices in a site-specific manner to account for spatial and temporal variability.

(Bouma, 1999; Hoeft et al., 2000; Mulla and Schepers, 1997; Rawlins, 1996; Searcy, 1995)

# Adoption of Precision Technologies






* 2018 is predicted use

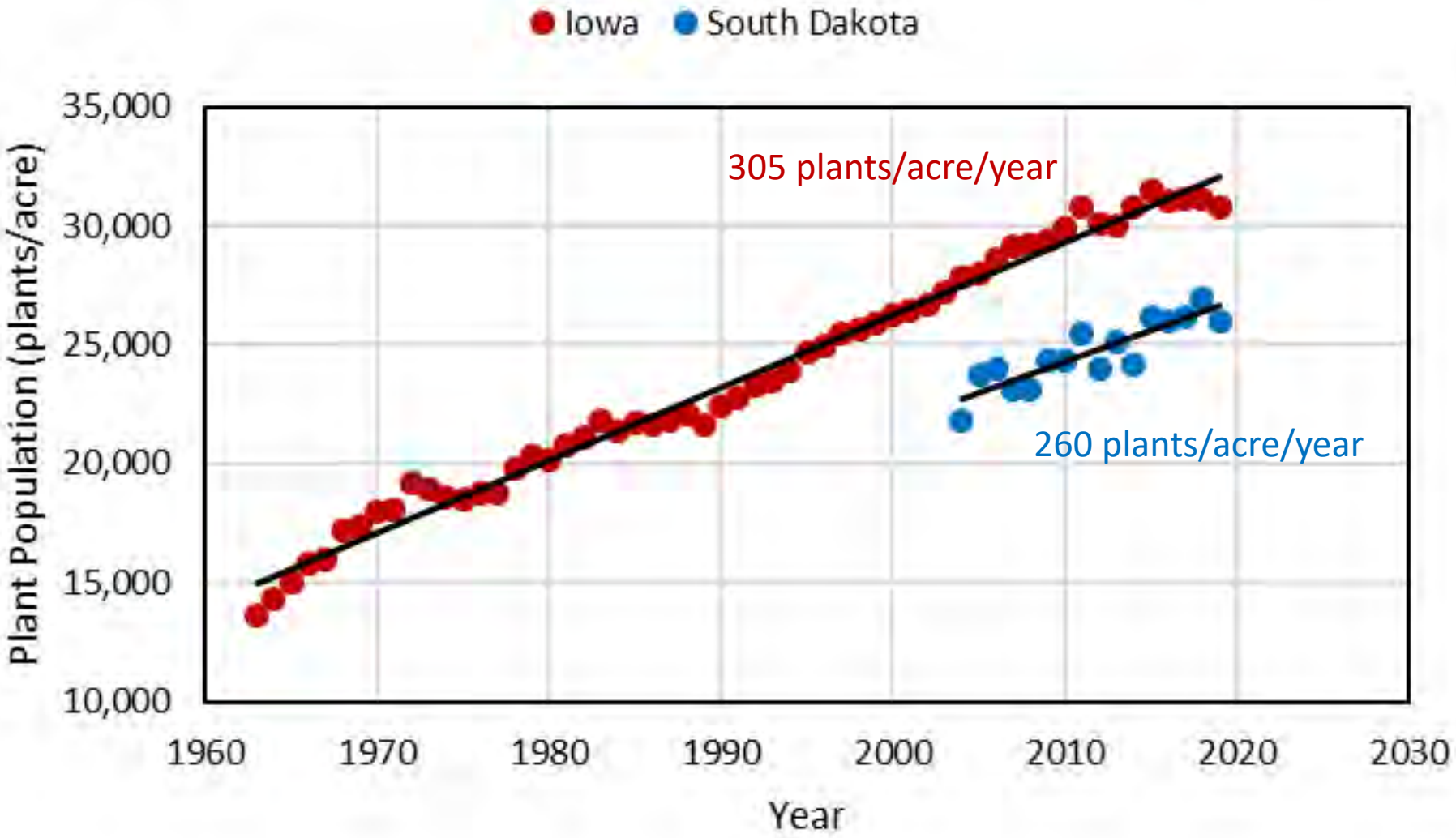
Adapted from Erickson and Widmar, 2015

# Turn to your neighbor

What's holding back adoption of the use of variable rate seeding?

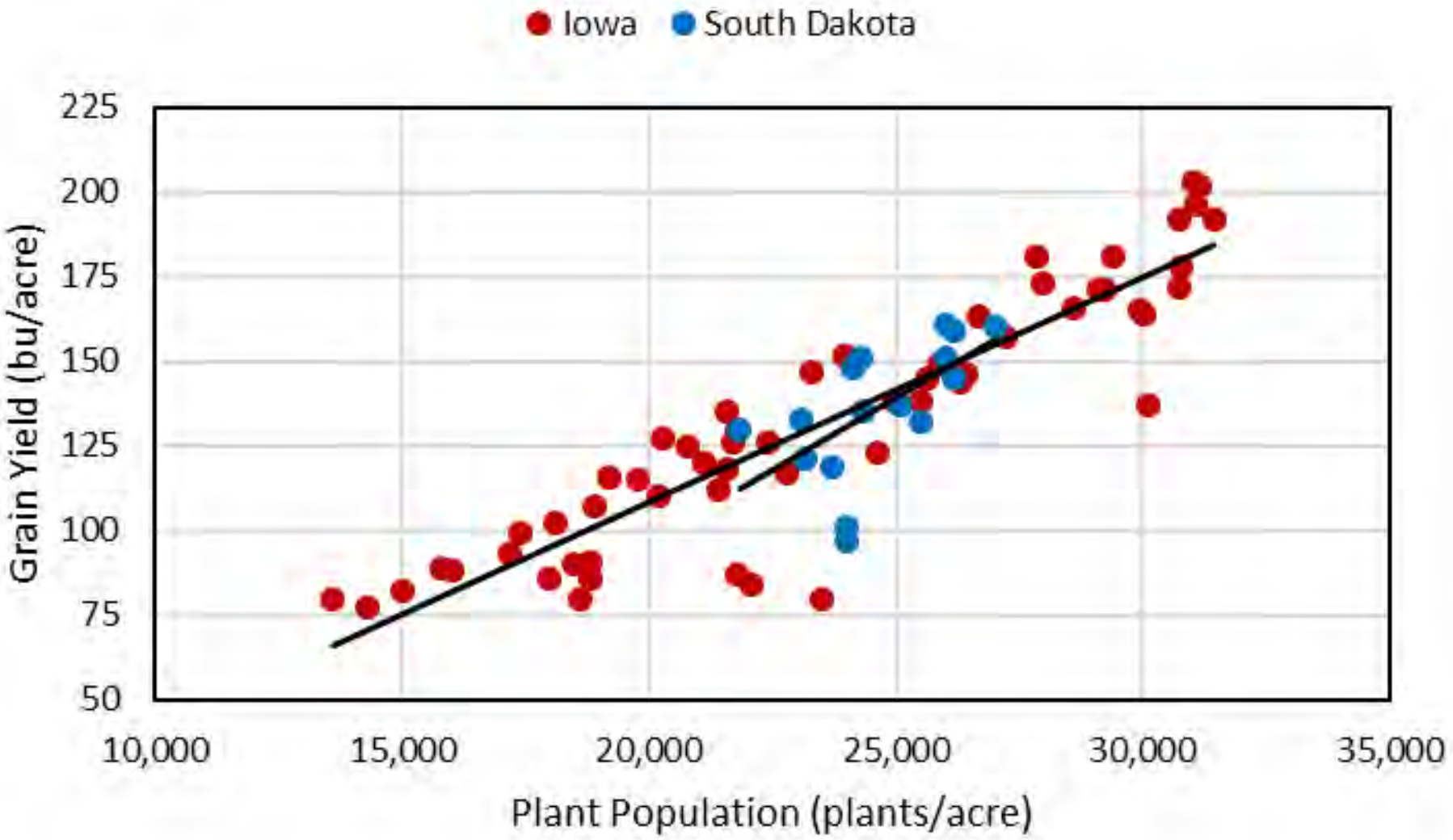
For VRS to be profitable and productive there needs to be a relationship between plant density and yield as well as the influence of topographic and soil properties on the relationship between grain yield and plant density.

(Bullock et al., 1998)


Iowa
South Dakota
35,000
30,000
25,000
20,000
15,000
10,000
Plant Population (plants/acre)
305 plants/acre/year
260 plants/acre/year
1960
1970
1980
1990
2000
2010
2020
2030
Year



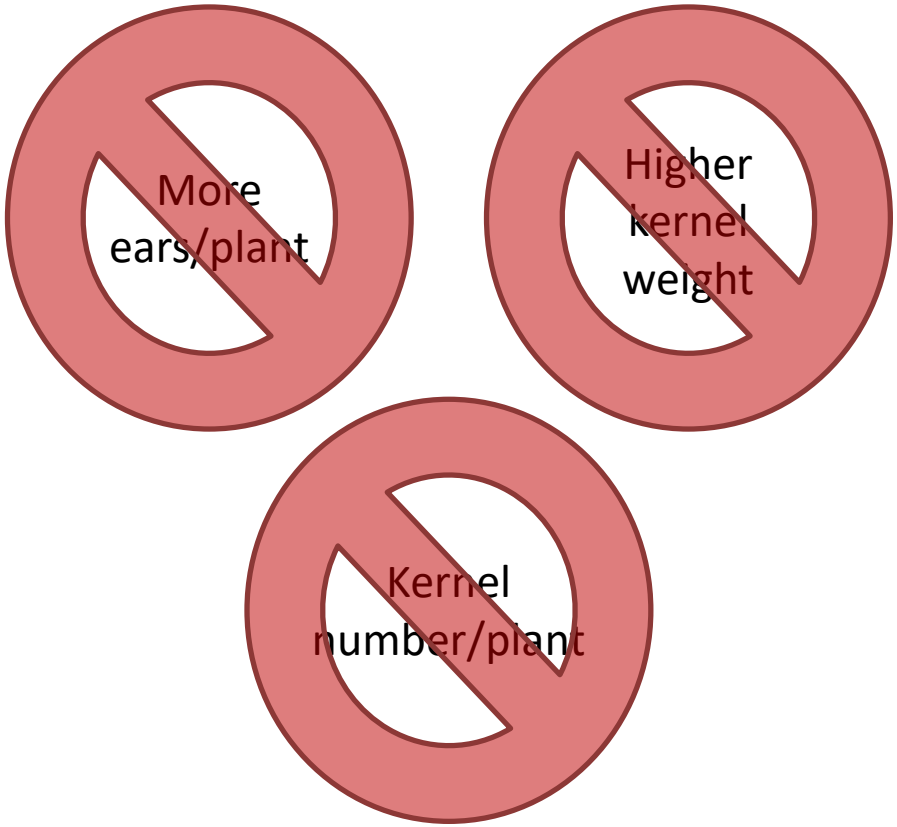
USDA, NASS

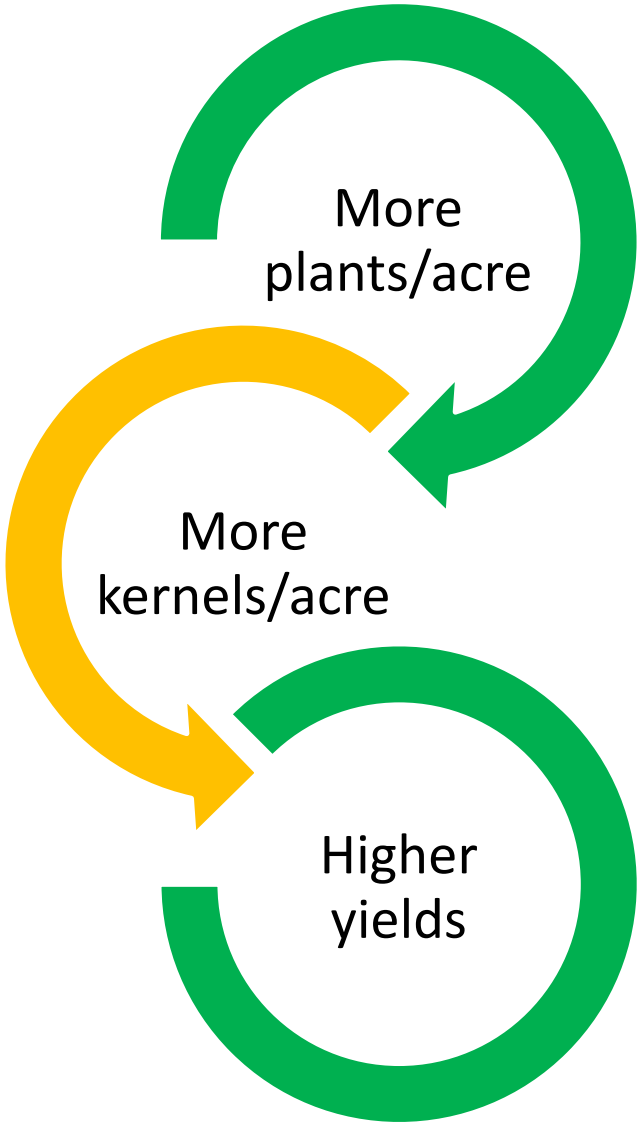

Iowa
South Dakota
225
200
175
150
125
100
75
50
Grain Yield (bu/acre)
10,000
15,000
20,000
25,000
30,000
35,000
Plant Population (plants/acre)

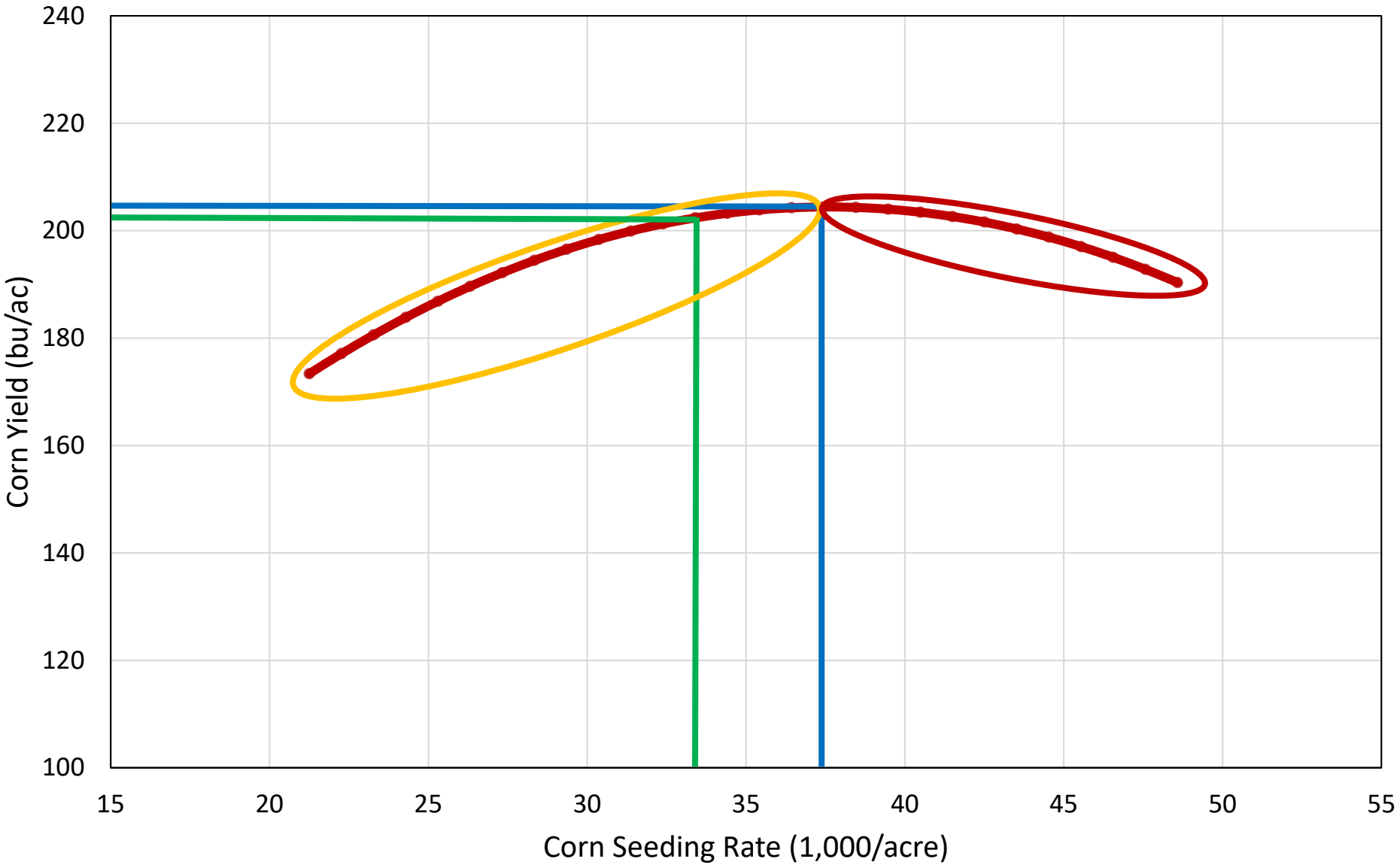


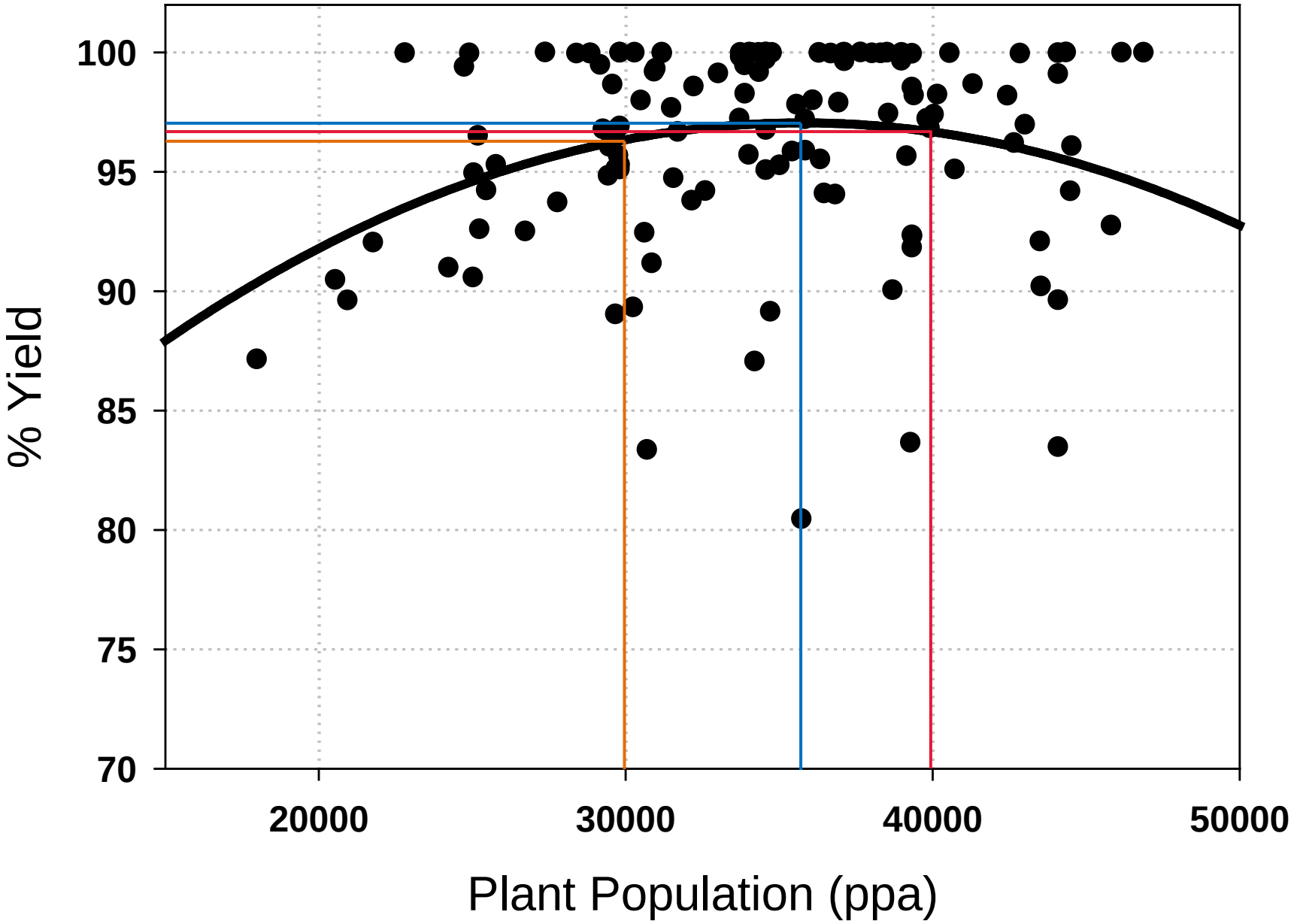
USDA, NASS

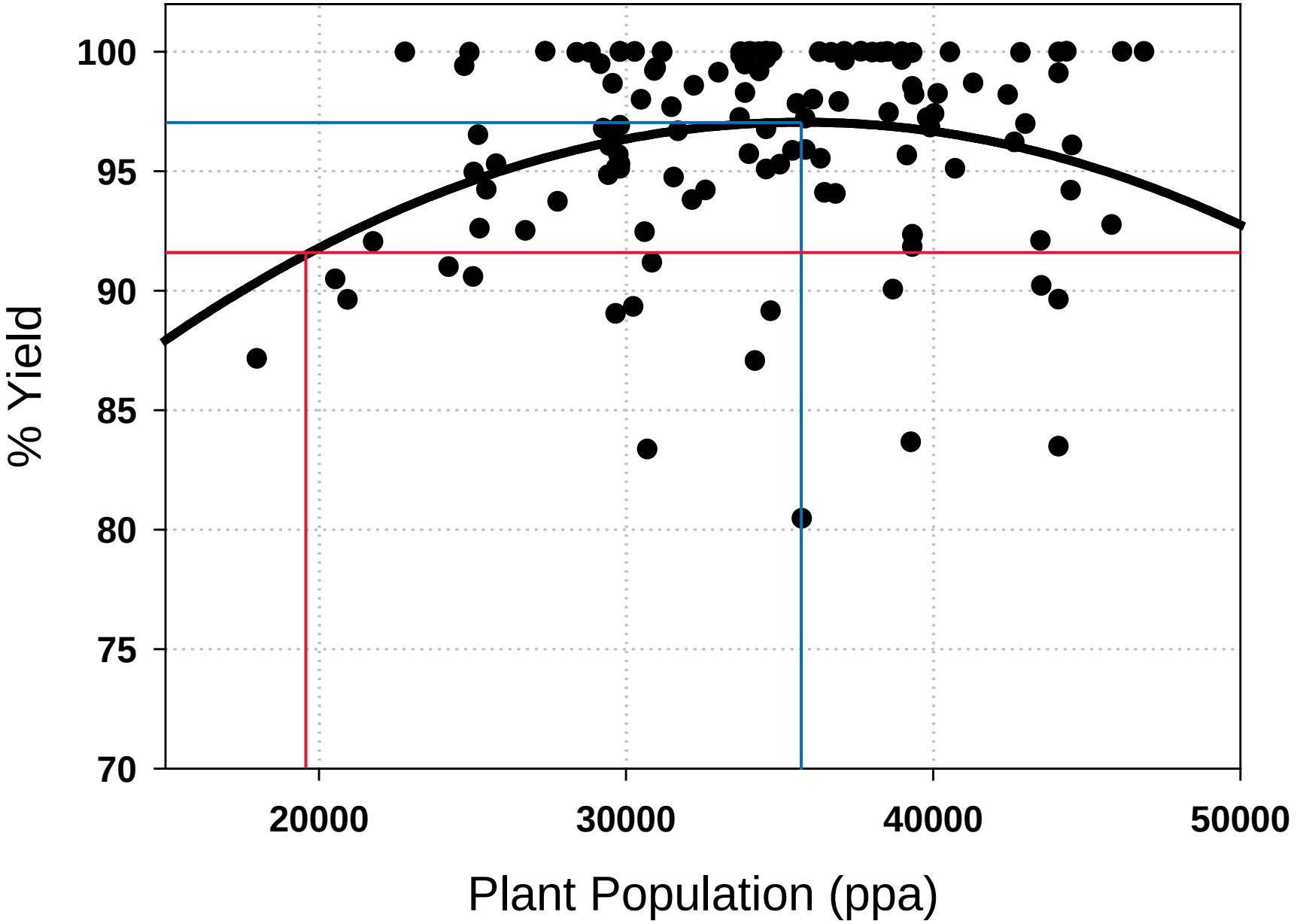
# Why More Plants?



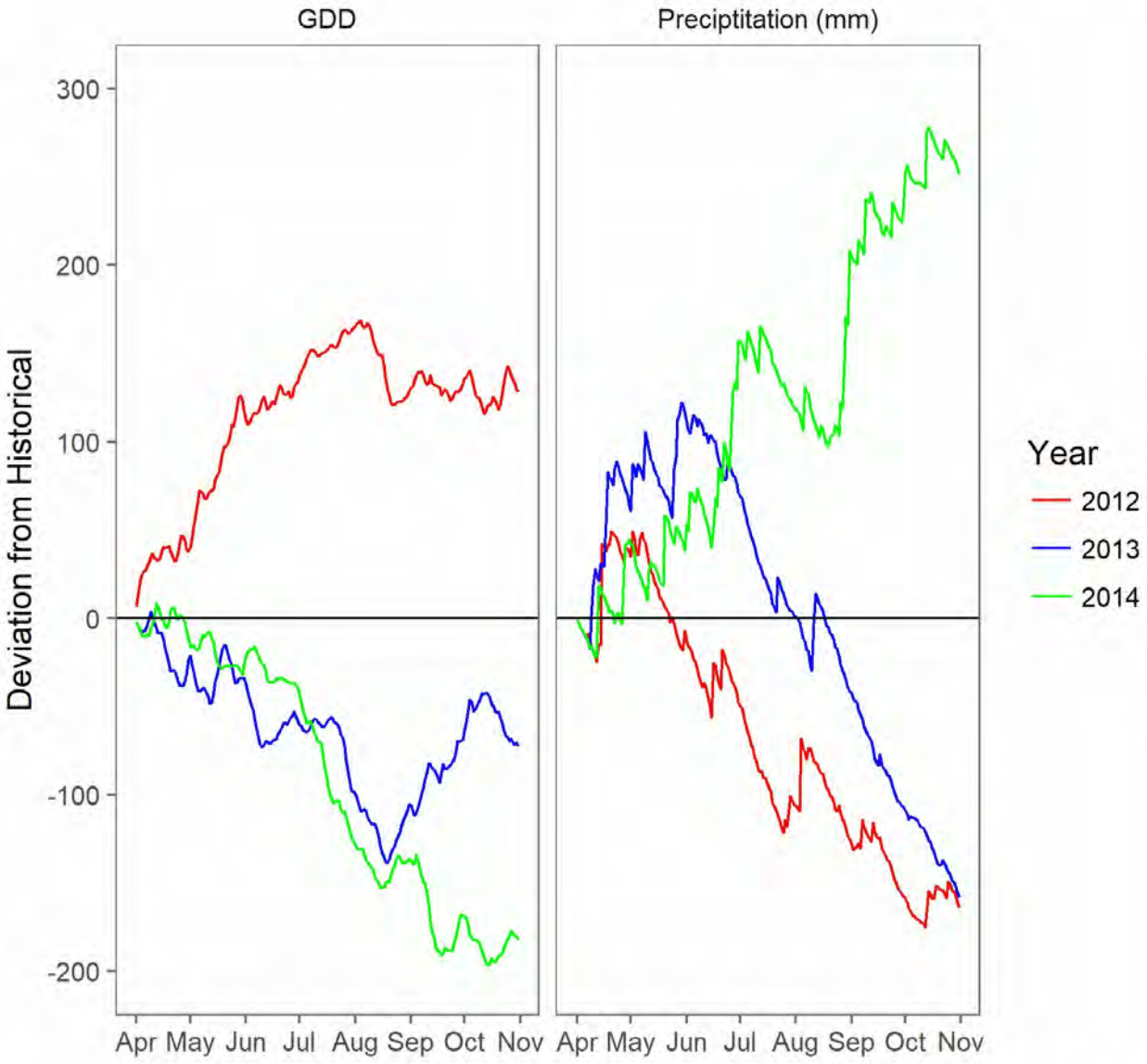

240
220
200
180
160
140
120
100
Corn Yield (bu/ac)
15
20
25
30
35
40
45
50
55
Corn Seeding Rate (1,000/acre)


100
95
90
85
80
75
70
% Yield
20000
30000
40000
50000
Plant Population (ppa)


100
95
90
85
80
75
70
% Yield
20000
30000
40000
50000
Plant Population (ppa)

For VRS to be profitable and productive there needs to be a relationship between plant density and yield as well as the influence of topographic and soil properties on the relationship between grain yield and plant density.

(Bullock et al., 1998)

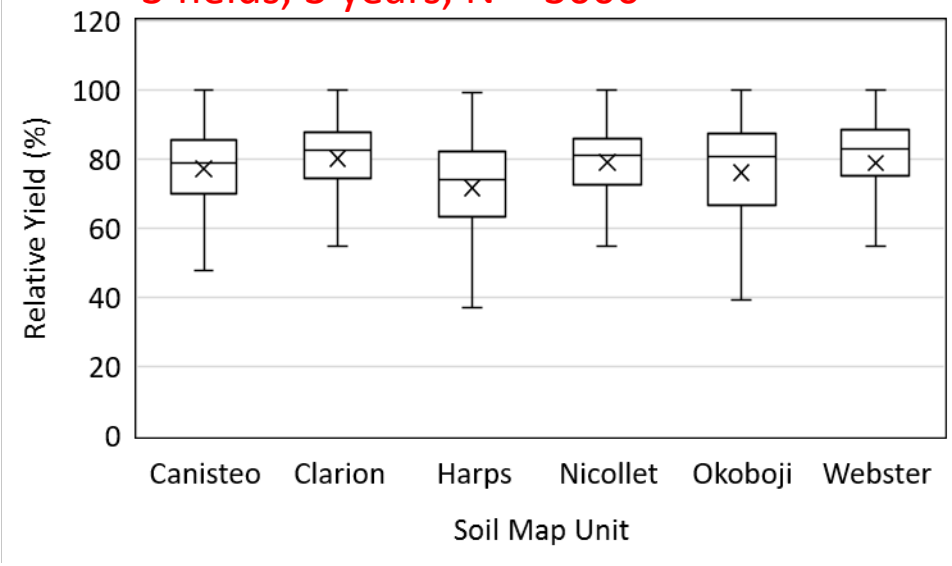



2012
warmer & drier

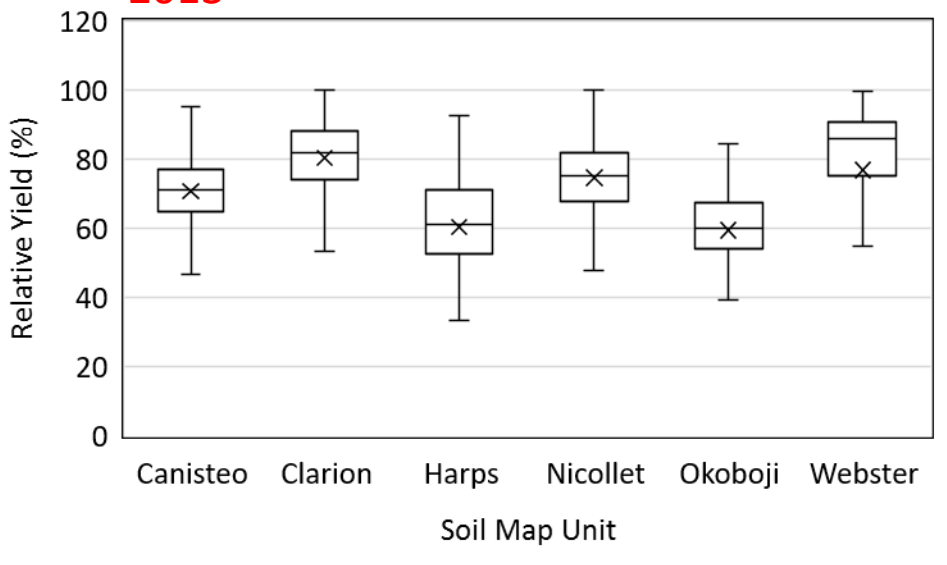
2013
cooler & wetter;
turned drier

2014
cooler & wetter

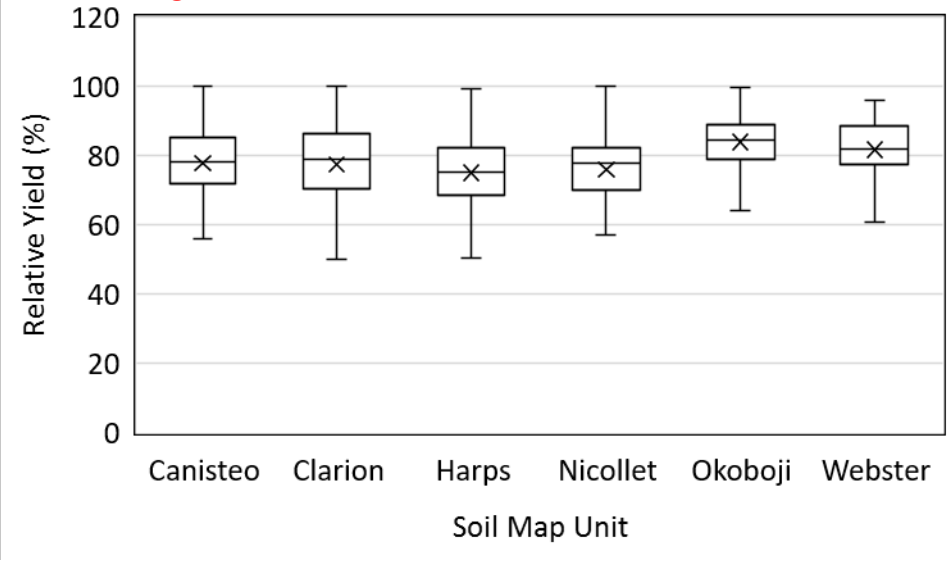
3 fields, 3 years, N=~3000



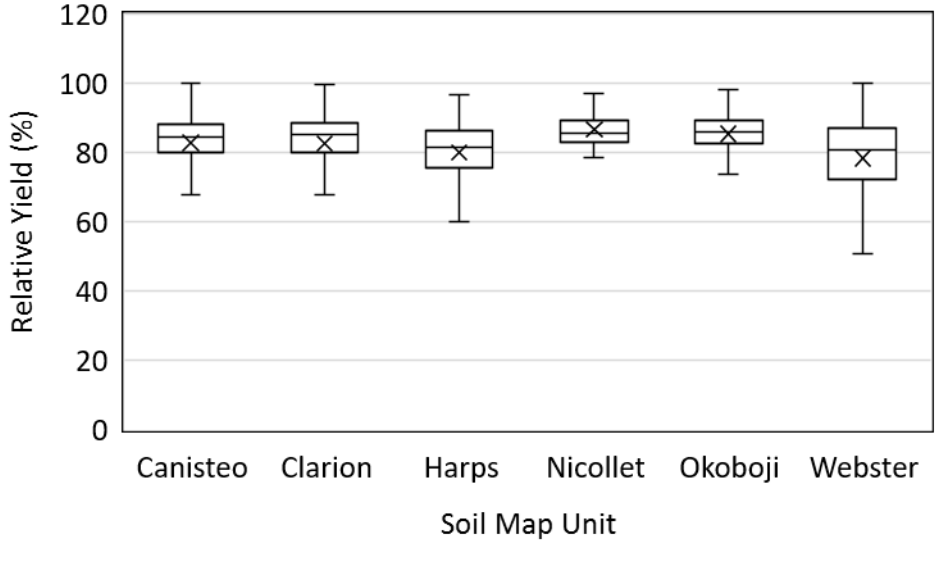

2013



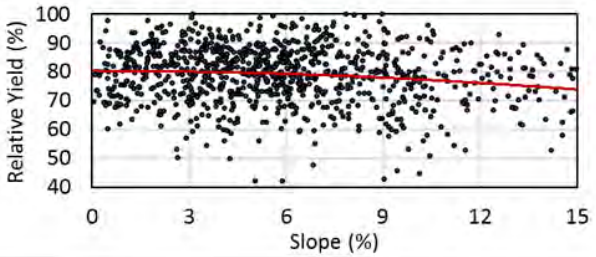

2012

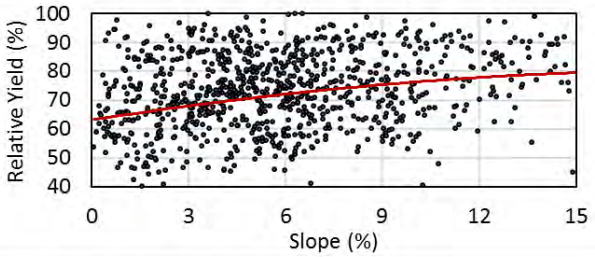


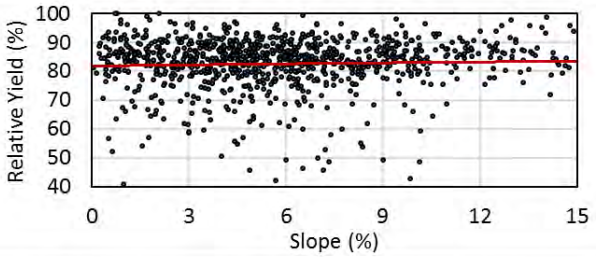

2014

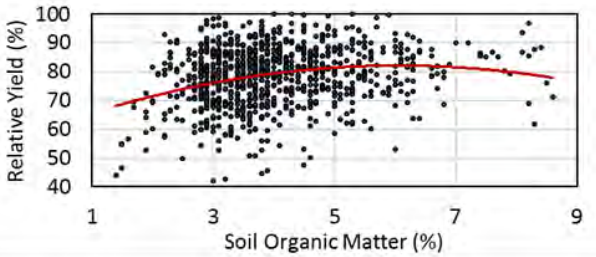


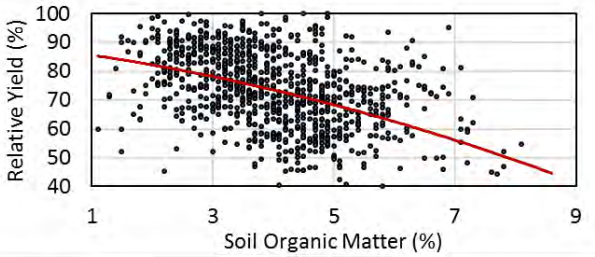
2012 2013 2014

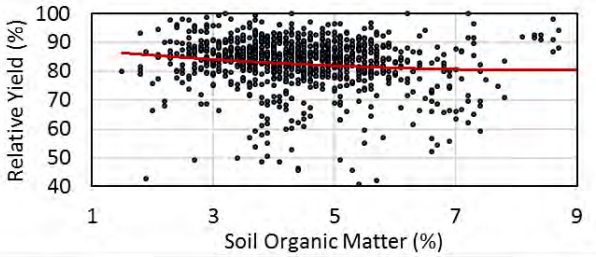


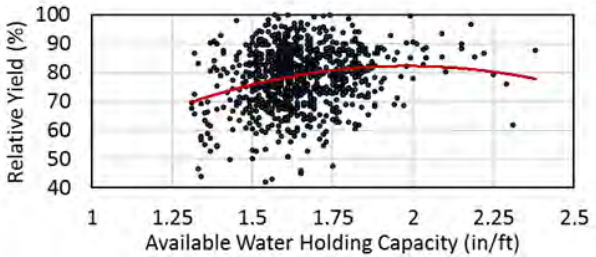



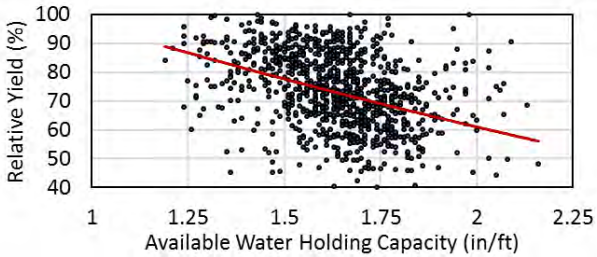



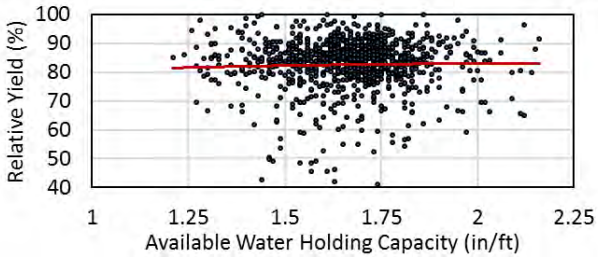



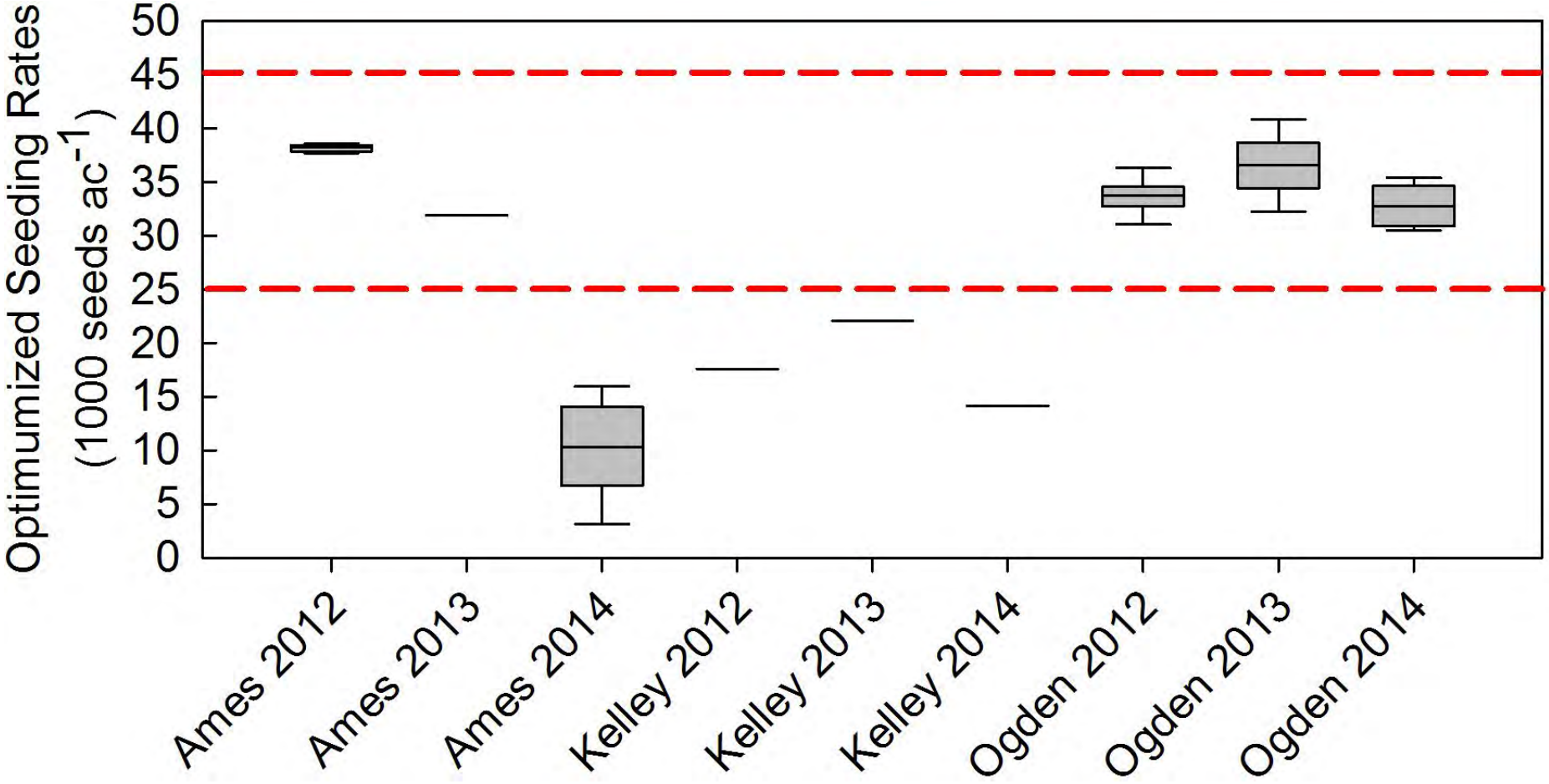



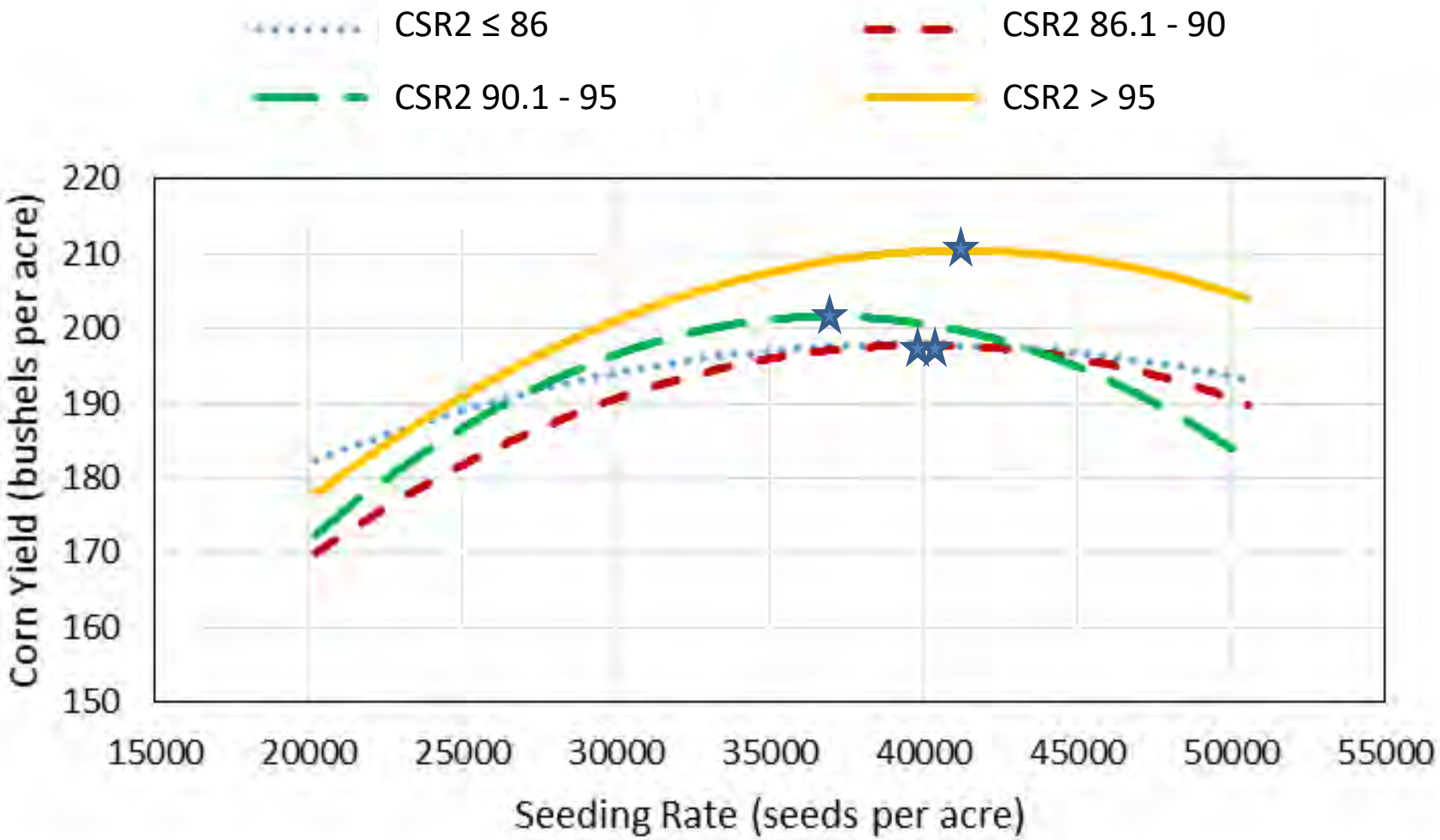



# Seeding Rate Optimization

$$Yield = SR^2 + SR(f_{soil/topo}) + soil/topo$$

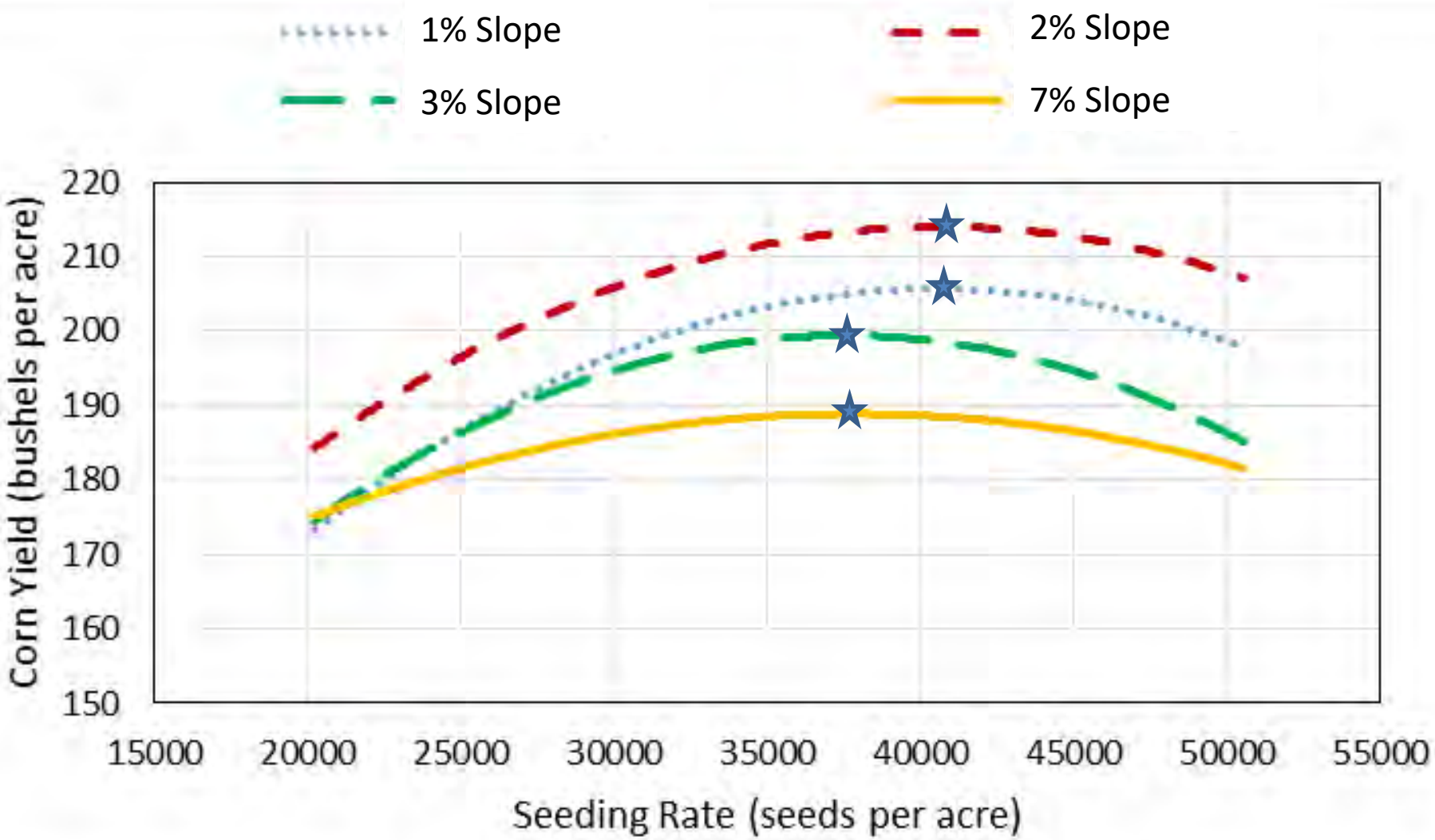
Stepwise regression to add/subtract soil and topographic attributes to find optimum seeding rate based on soil and topographic attributes.


Optimumized Seeding Rates
(1000 seeds ac-1)
50
45
40
35
30
25
20
15
10
5
0
Ames 2012
Ames 2013
Ames 2014
Kelley 2012
Kelley 2013
Kelley 2014
Ogden 2012
Ogden 2013
Ogden 2014






Woli et al., 2014






Woli et al., 2014

- Optimal plant densities increase from areas of low to high productivity and elevation was influential (Shanahan et al., 2004)

- Elevation influence is dependent on environmental conditions;
  - Higher elevations with low SOM, steeper slopes, and convex slopes are detrimental in dry conditions
  - Depressions are detrimental in adequate to surplus rainfall conditions

(Kravchenko and Bullock, 2000; Kravchenko et al., 2003; Kaspar et al., 2004)

# Summary

- Temporal weather variability is the largest contributing factor in determining SR
- Spatial soil/topography variability definitely influences plant density response curves

- Great opportunity to use data analytics for variable rate seeding… just the keys haven’t been found yet

# VRS for Soybean

- Soybean compensate for reduced stand by increasing branching

- Low seeding rates typically have lower bottom pod clusters

Decreased seeding rate applications:

- high yielding zones
- areas susceptible to white mold

Increased seeding rate applications:

- poor seedbed conditions
- adverse weather conditions
- increased insect/seedling disease

# What Questions Do You Have?

## THANK YOU!

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