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)

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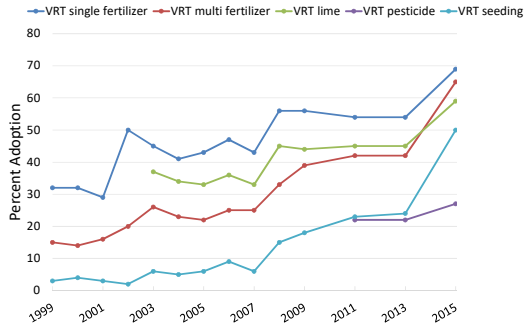

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* 2018 is predicted use
Adapted from Erickson and Widmar, 2015

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)

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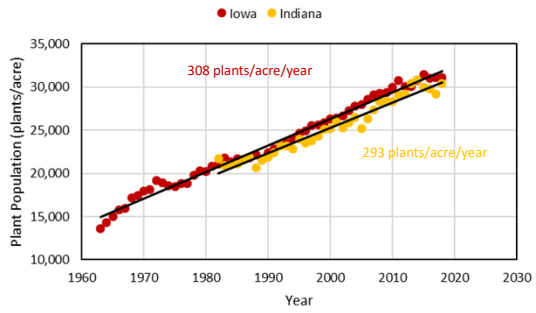

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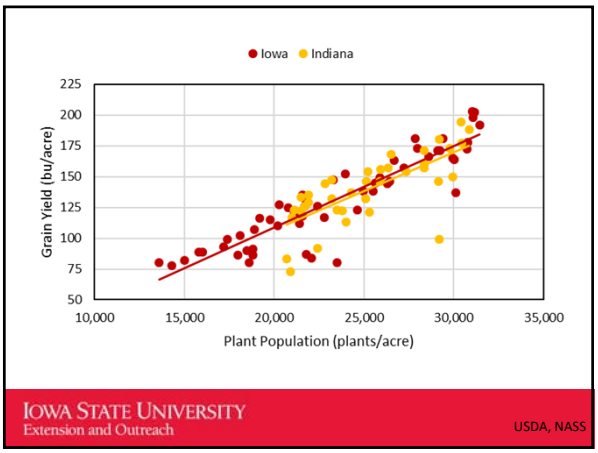

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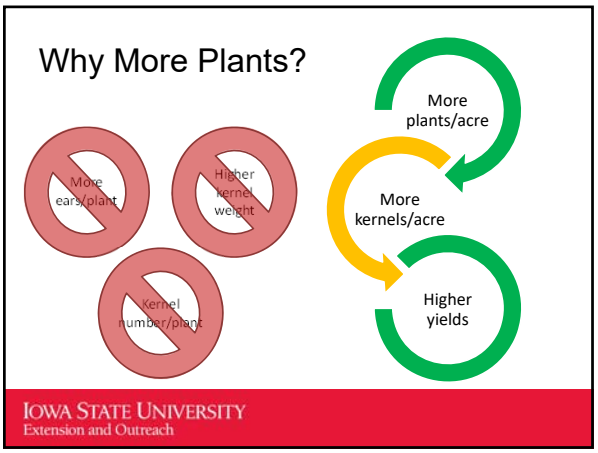

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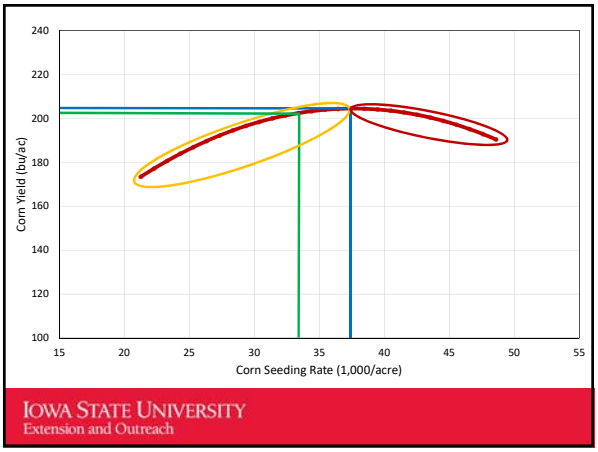

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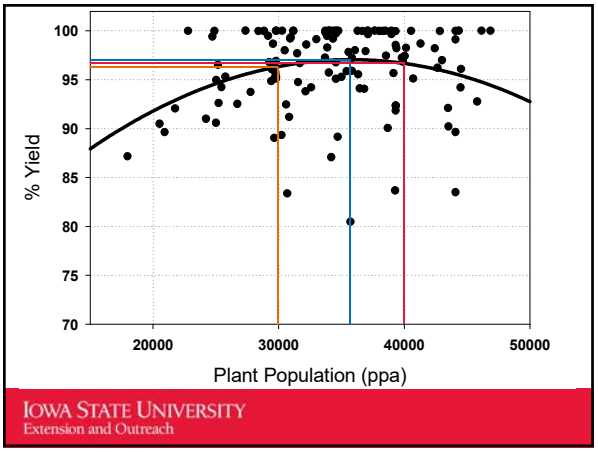

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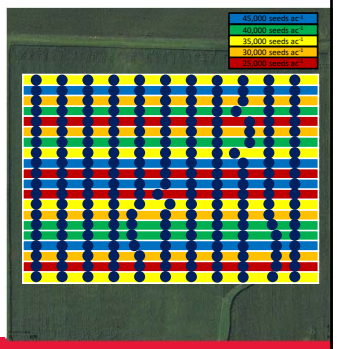
Methods

- 3 experimental fields in central Iowa
  - Ames, Kelley, Ogden
  - Clarion-Nicollet-Webster soil association
- 5 seeding rates
  - 25,000; 30,000; 35,000; 40,000; 45,000 seeds ac^{-1}



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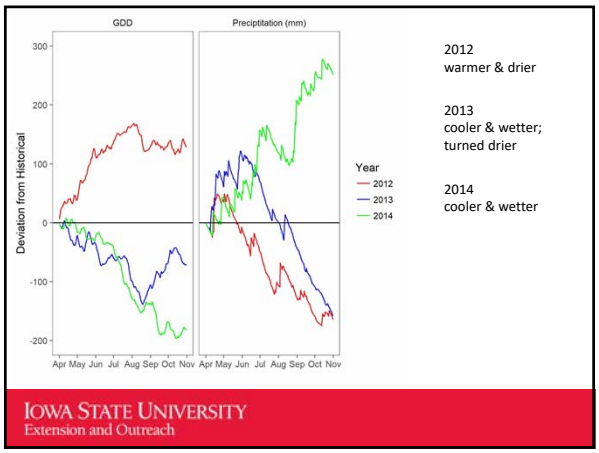

2012
warmer & drier

2013
cooler & wetter;
turned drier

2014
cooler & wetter

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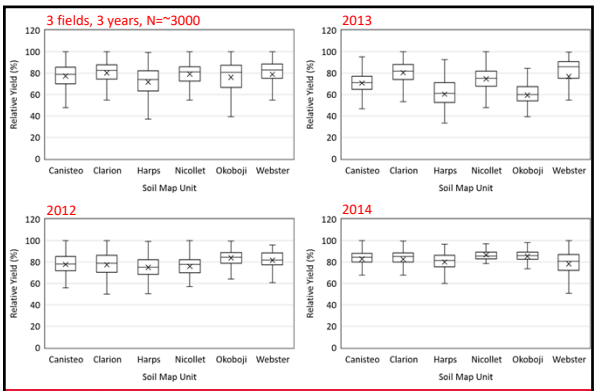

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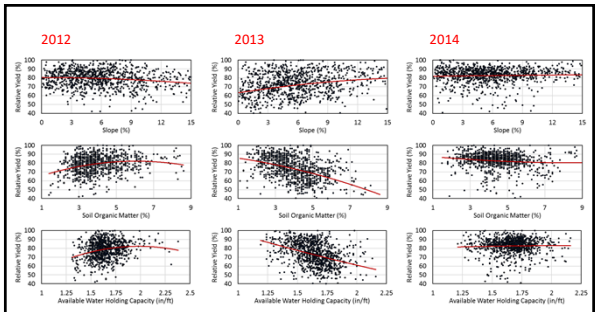

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Seeding Rate Optimization

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

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

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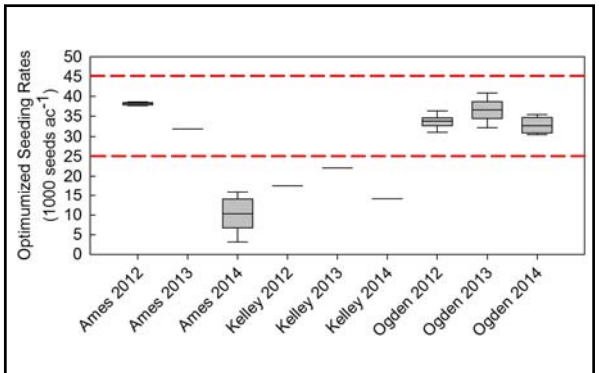

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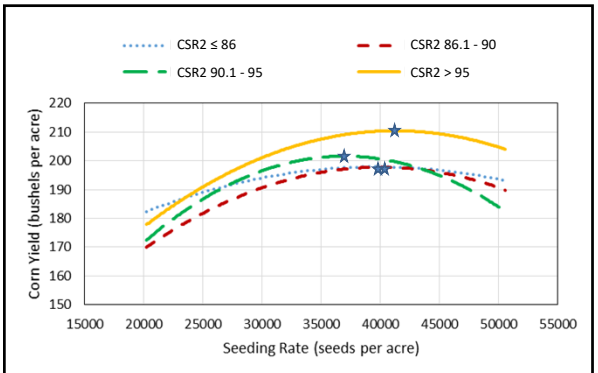

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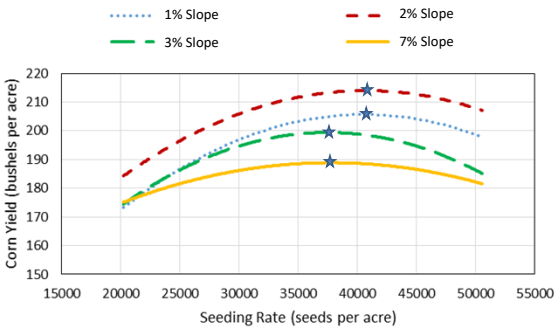
Woli et al., 2014



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)

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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

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VRS for Soybean

- Soybean compensate for reduced stand by increasing branching
- Low seeding rates typically have lower bottom pod clusters

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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

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What Questions Do You Have?

THANK YOU!

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