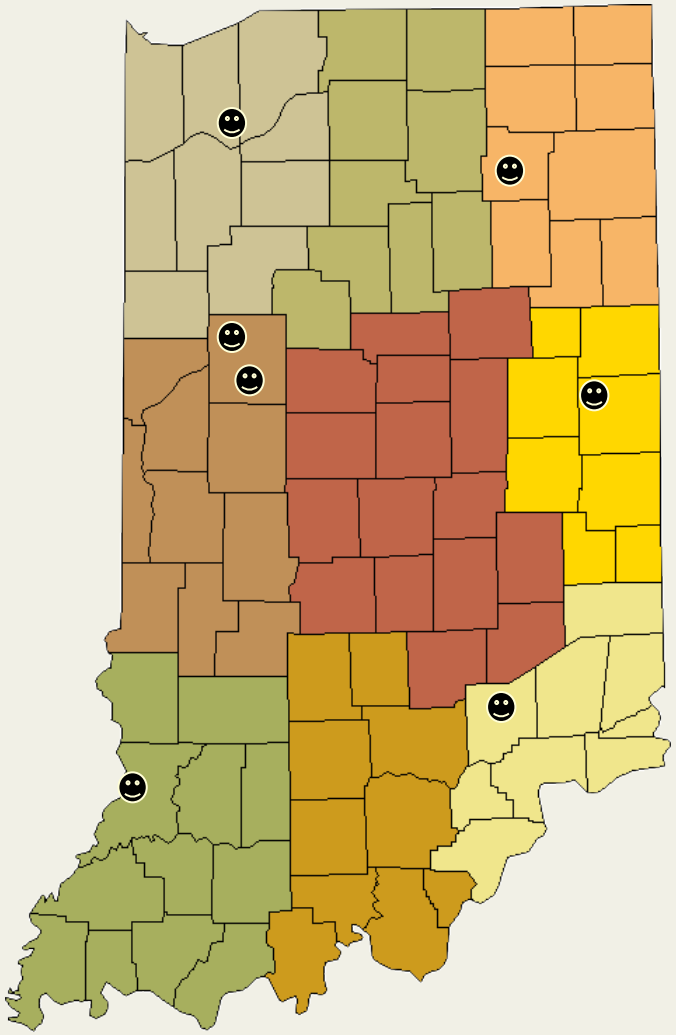
Jim Camberato
Purdue Univ.
jcambera@purdue.edu

Implementing on-farm research

Goals of on-farm research

- Provide unbiased answers to important practical crop production questions under “real world” conditions
  - University or industry research farms are not enough!

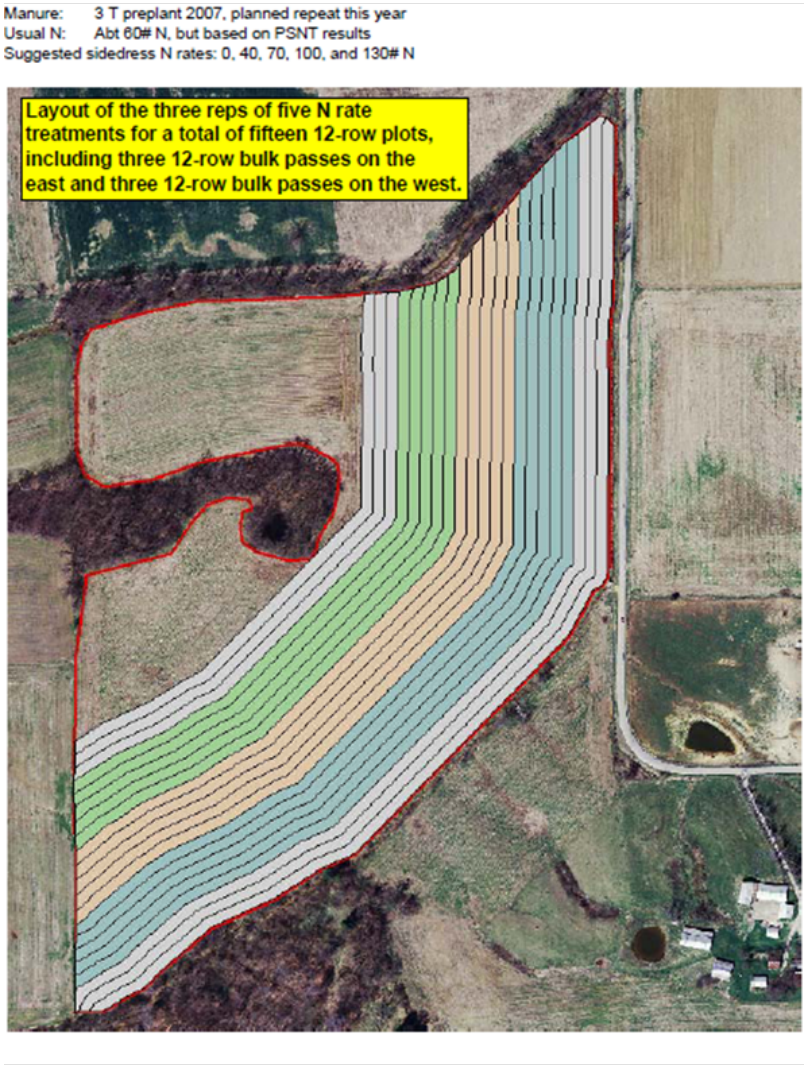


Benefits of on-farm research

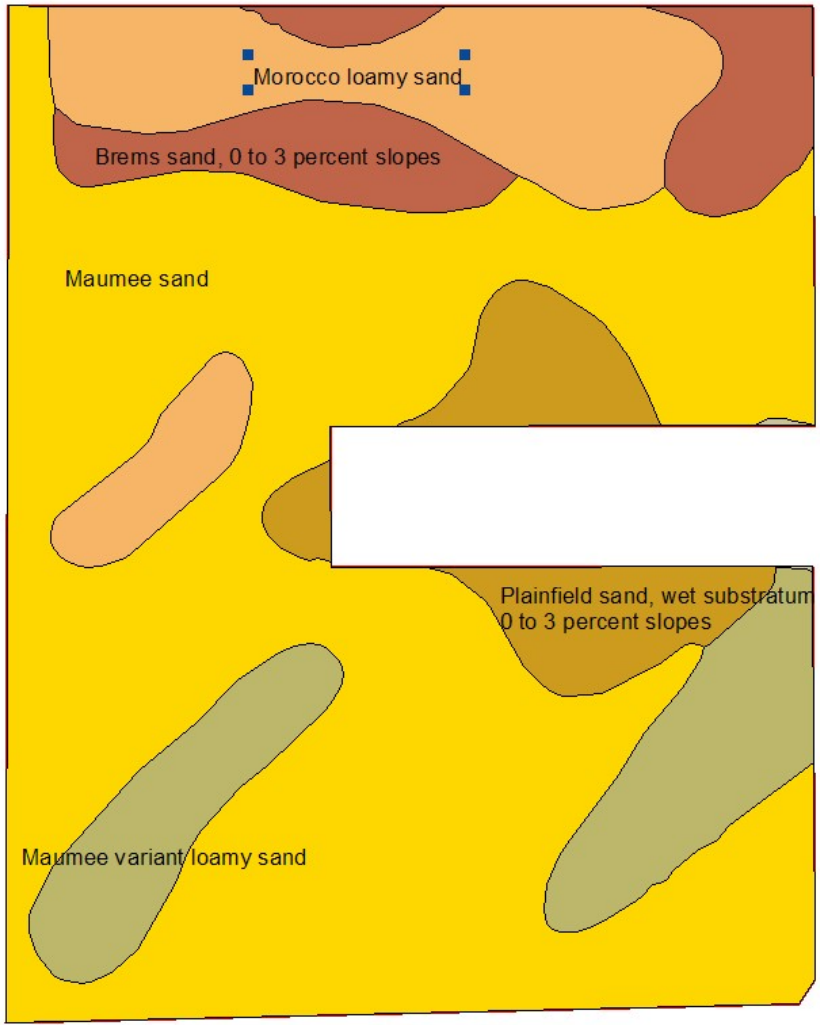
- Opportunity to address practical question in agricultural production
- Greater confidence in recommendations arising from research
- Greater understanding among all that are involved, closer cooperation in general

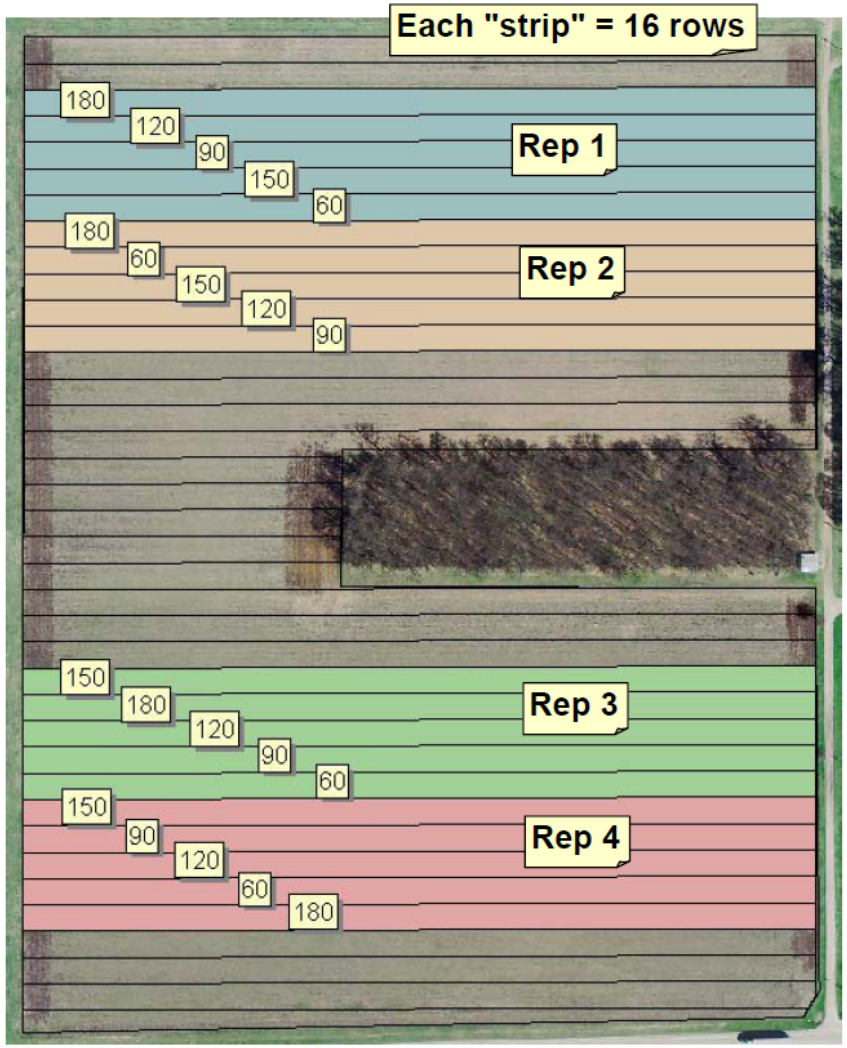
Technology makes it easy!

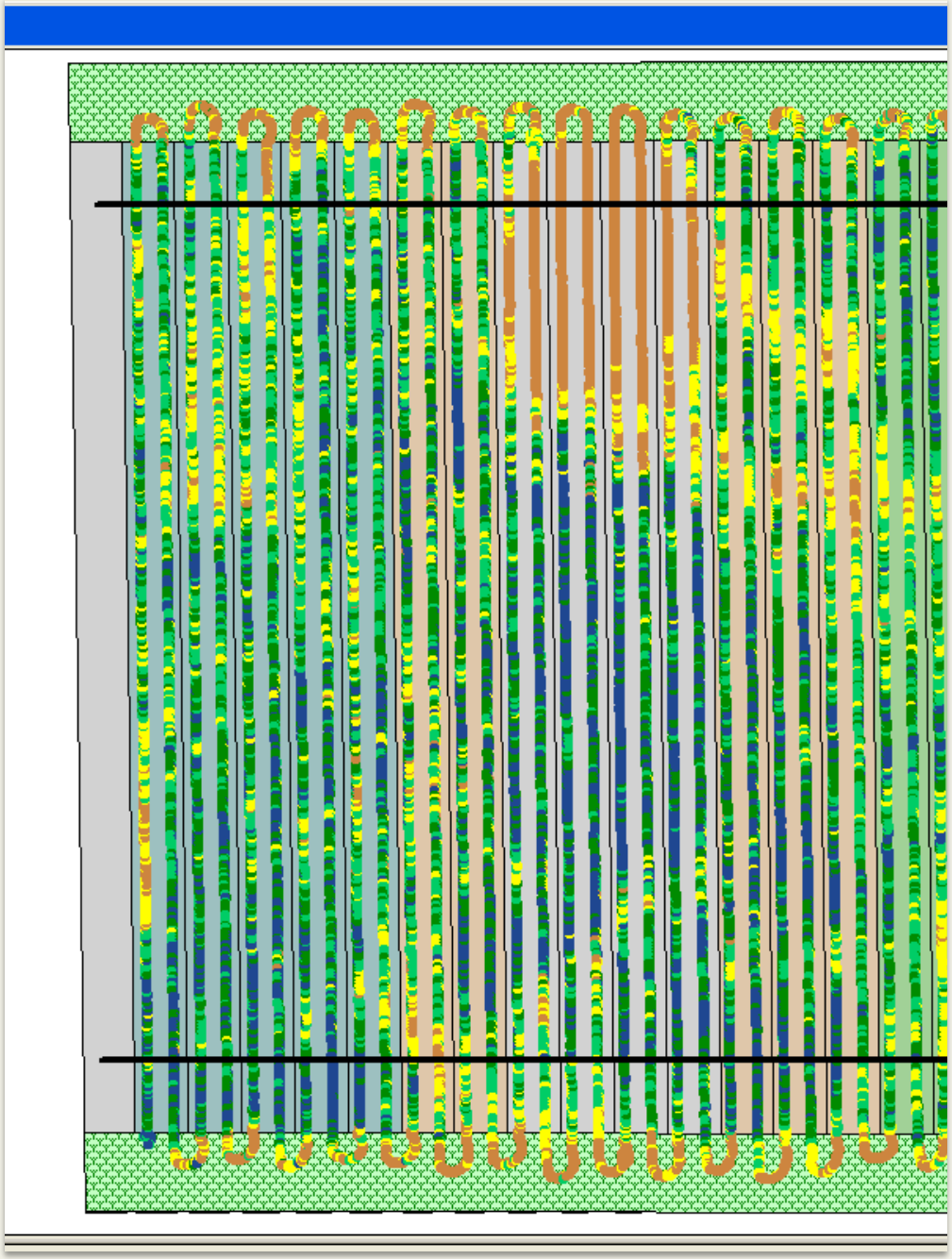
- GPS, aerial photography, digital soil maps
  - Identify field and laying out the trial
- Calibrated yield monitor (use strips reflecting range in grain flow to calibrate)
  - much faster than weigh wagon



Soil Maps and Smart Layout



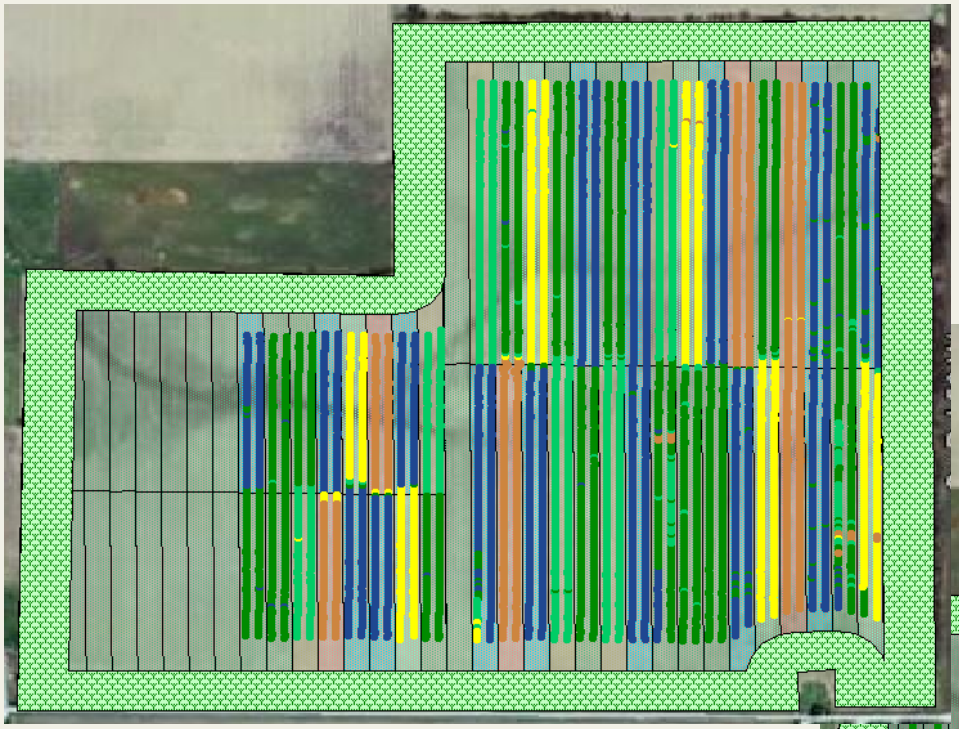




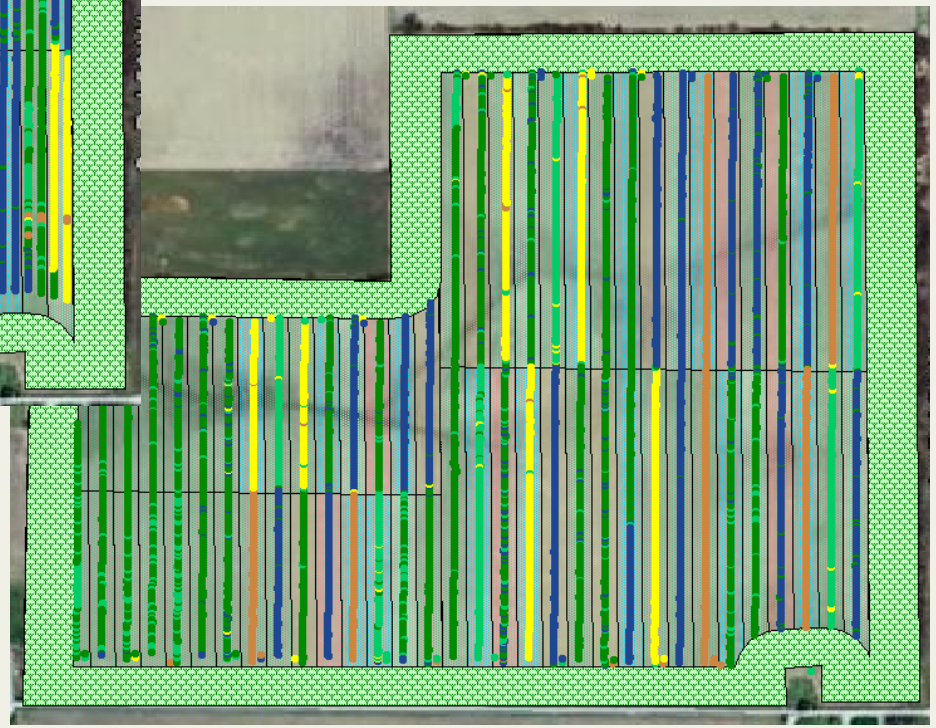
GIS (Geographical Information Systems)

- can use irregular shaped fields
- delete “bad spots” from load weights
- separate response by soil types or other factors

Prescription/application maps



Five seeding rates



Five sidedress N rates

Technology increases capabilities!

- Prescription and application maps
  - Makes it easy to apply multiple treatments without flagging and operator concern
  - Confirms application of treatments and identifies errors
- RTK
  - All of one treatment can be applied without flagging or cleaning out the tank or planter box

Requirements for Research

- **Objective:** conduct an experiment that results in an answer that one can be confident in
- Replication and randomization
  - More than one of each treatment
  - Scattered through the field, not in a repeated order
  - Statistical analysis

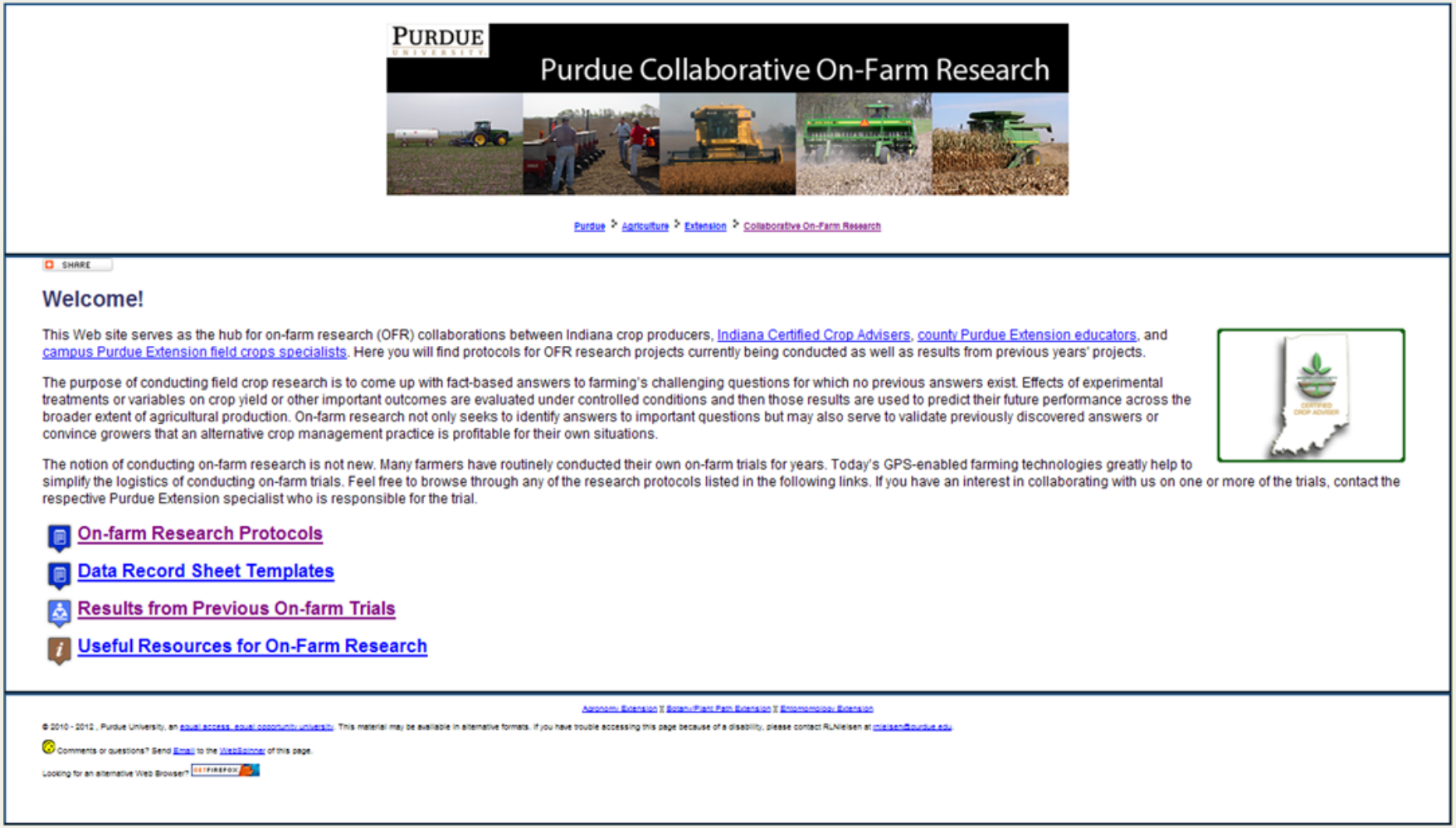
Yes or No Questions

- Is ‘it’ a benefit to my system
  - Row cleaners
  - In-furrow nematicide
  - Foliar fungicide
  - Starter fertilizer
  - Any product

Optimum Rate Questions

- How much do I need, define an optimum rate
  - Nitrogen or other fertilizer
  - Seeding rate

On-Farm Research Web Page



http://www.agry.purdue.edu/ext/ofr/

On-Farm Research Protocols

Listed below are several on-farm research projects for which Purdue Extension specialists are cu
more of these trials are encouraged to download and read the protocol(s), then contact the listed

While the exact details for each on-farm research project may be negotiable, potential cooperator
aggregate the results from all the cooperating farmers much more easily than if folks head off in d
happens in individual fields.

- Evaluating Early-Applied Foliar Fungicide to Corn
  - Kiersten Wise (Purdue Botany & Plant Pathology)
    Extension plant pathologist
    kawise@purdue.edu

- Soybean Seeding Rate Trials
  - Shaun Casteel (Purdue Agronomy)
    Extension soybean specialist
    scasteel@purdue.edu

- Soybean Row Spacing Trials
  - Shaun Casteel (Purdue Agronomy)
    Extension soybean specialist
    scasteel@purdue.edu

- Corn Seeding Rate Trials
  - Bob Nielsen (Purdue Agronomy)
    Extension corn specialist
    rnielsen@purdue.edu

- Nitrogen Rate Trials for Corn
  - Jim Camberato, Bob Nielsen, Brad Joern (Purdue Agronomy)
    Extension soil fertility, corn, and nutrient management specialists respectively
    jcambera@purdue.edu, rnielsen@purdue.edu, & bjoern@purdue.edu

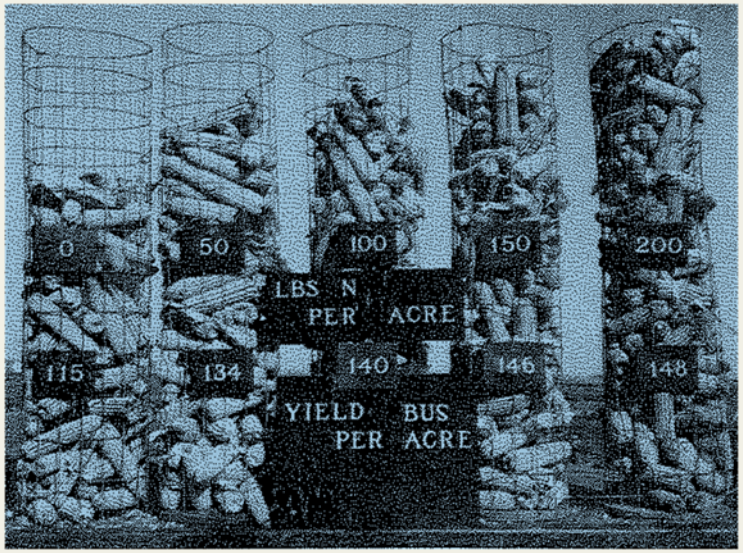
- Soybean Fungicide Efficacy Trials
  - Kiersten Wise (Purdue Botany & Plant Pathology)
    Extension plant pathologist
    kawise@purdue.edu

Purdue On-Farm Nitrogen Rate Trial Protocol

Bob Nielsen (rnielsen@purdue.edu, 765-494-4802) and Jim Camberato (jcambera@purdue.edu, 765-496-9338), Purdue Agronomy

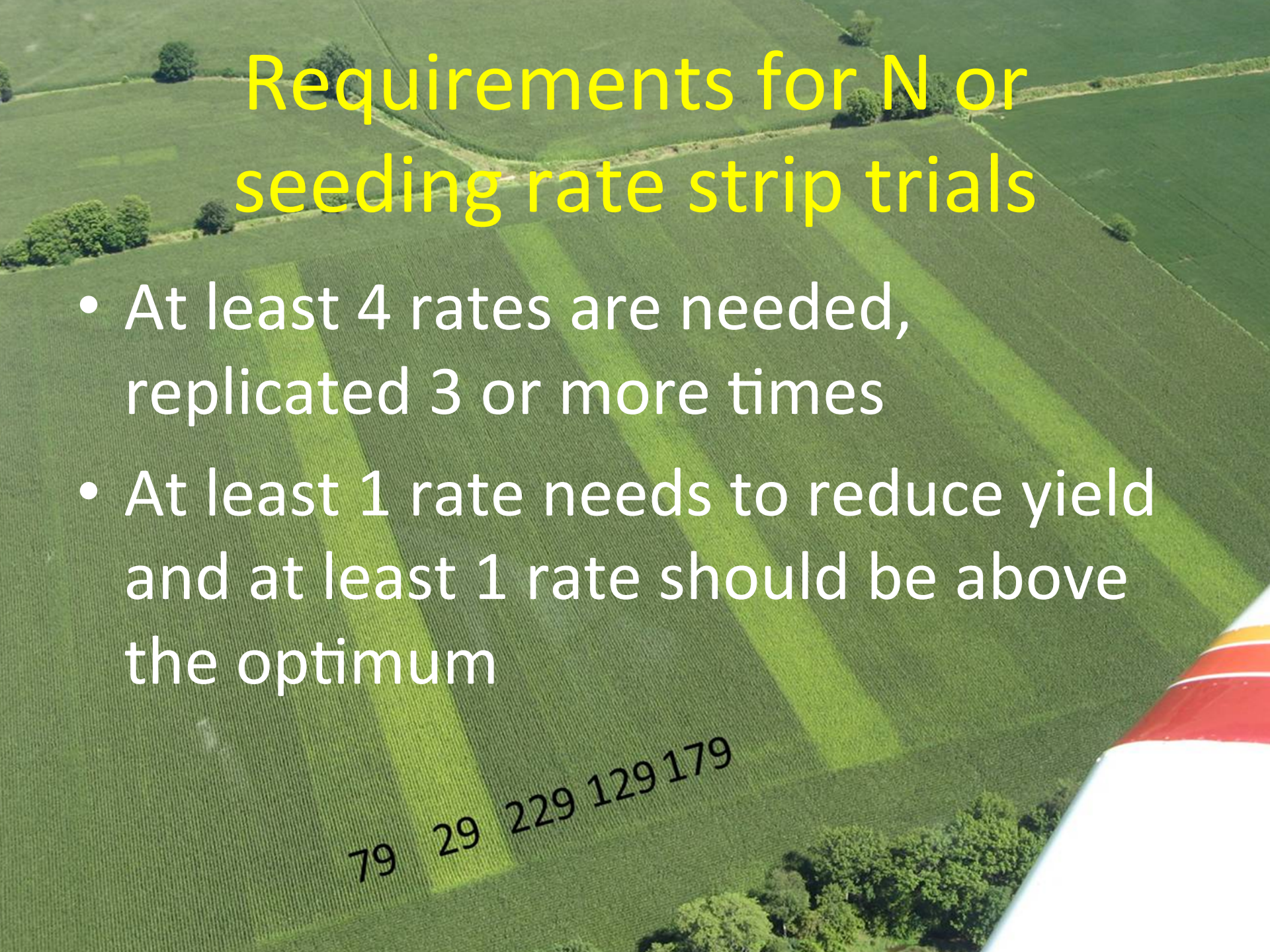
This protocol describes the design and conduct of on-farm, field-scale research trials with the objective of identifying agronomical and economical optimum nitrogen (N) rates for corn production in Indiana. The power in participating in this on-farm research is not simply what you may learn from your plots, but more what you will gain by pooling your response data with those of other cooperators in area of the state. Our ultimate goal with this project is to develop N rate recommendations on a regional, if not soil-specific, basis.

While the protocol is fairly simple, the actual logistics of conducting the trial often require further discussion, so please do not hesitate to contact us with questions.



Requirements for N or seeding rate strip trials

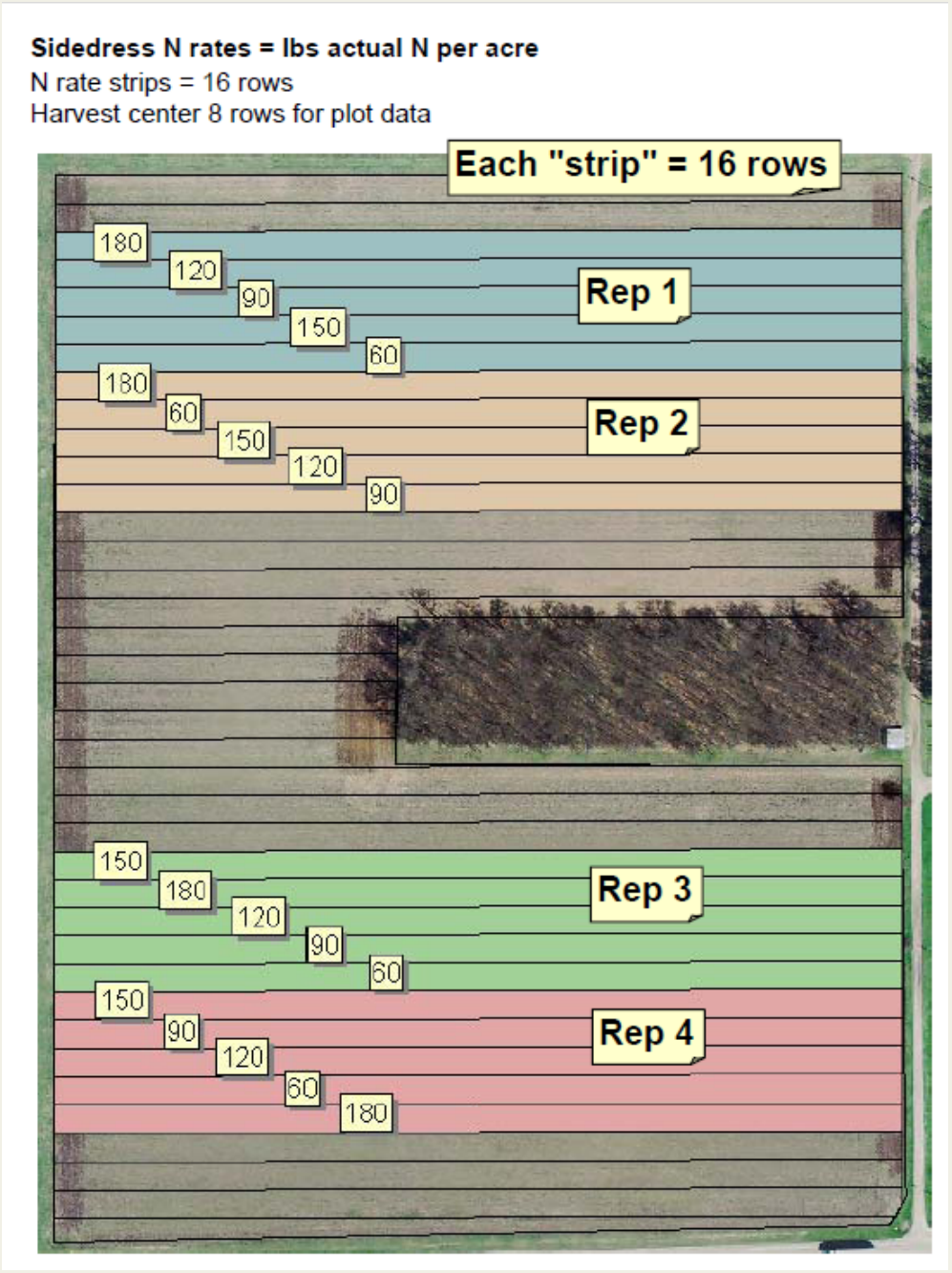
- At least 4 rates are needed, replicated 3 or more times
- At least 1 rate needs to reduce yield and at least 1 rate should be above the optimum



Making it all work easily!

Table 1. Plot width options for different combinations of planter width, N applicator width, and combine header width. Examples are for 30-inch row spacing equipment.

Implement	Example 1	Example 2	Example 3
Planter:	12 row	16	12
Applicator:	12 row	8	12
Combine:	6 row	8	8
Compatible plot size:	12 row	16	24



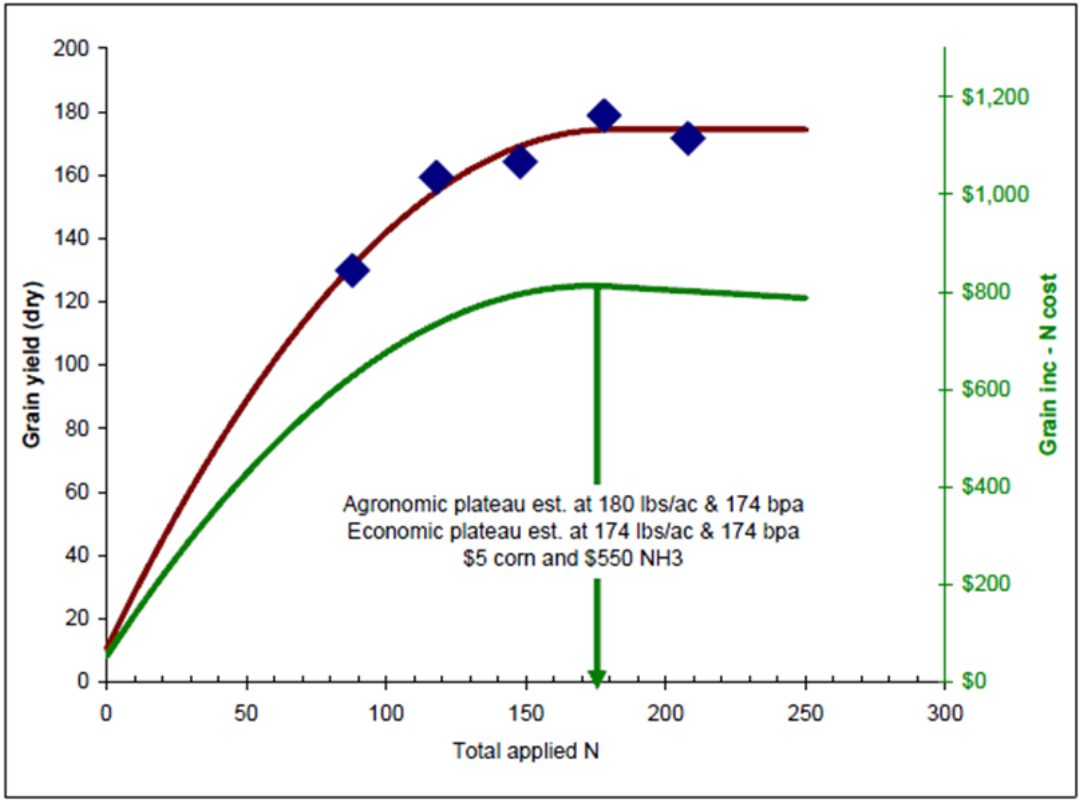
16-row no-till planter
8-row NH_3 sidedress applicator
8-row combine header, GPS yield monitor

No-till corn following soybeans
Starter fertilizer 15 gpa
17-14-0 (28 #N)

2010 Purdue On-Farm Nitrogen Rate Trials

Soils: Morocco, Brems, Maumee (sand to loamy sand)
Prevcrop: Soybean
Tillage: No-till
Hybrid: Heritage 4602 (south 1/2) Heritage 8585 (north 1/2)
Rates & reps: 5 rates, 3 reps
Planter: 16-row no-till planter; auto-steer
Seedrate: 34,588
Planted: 27-Apr
Starter N: 28 15 gpa 17-14-0
Sidedressed: 8-Jun
Sidedress N: NH3
SD applicator: 9-knife, 8-row NH3 sidedress applicator
Fungicide:
Harvested: 21-Oct
Combine: 12-row combine header
Yield Monitor: JD GS2
Plot size: 18 rows x 1000 ft (harvest center 12)

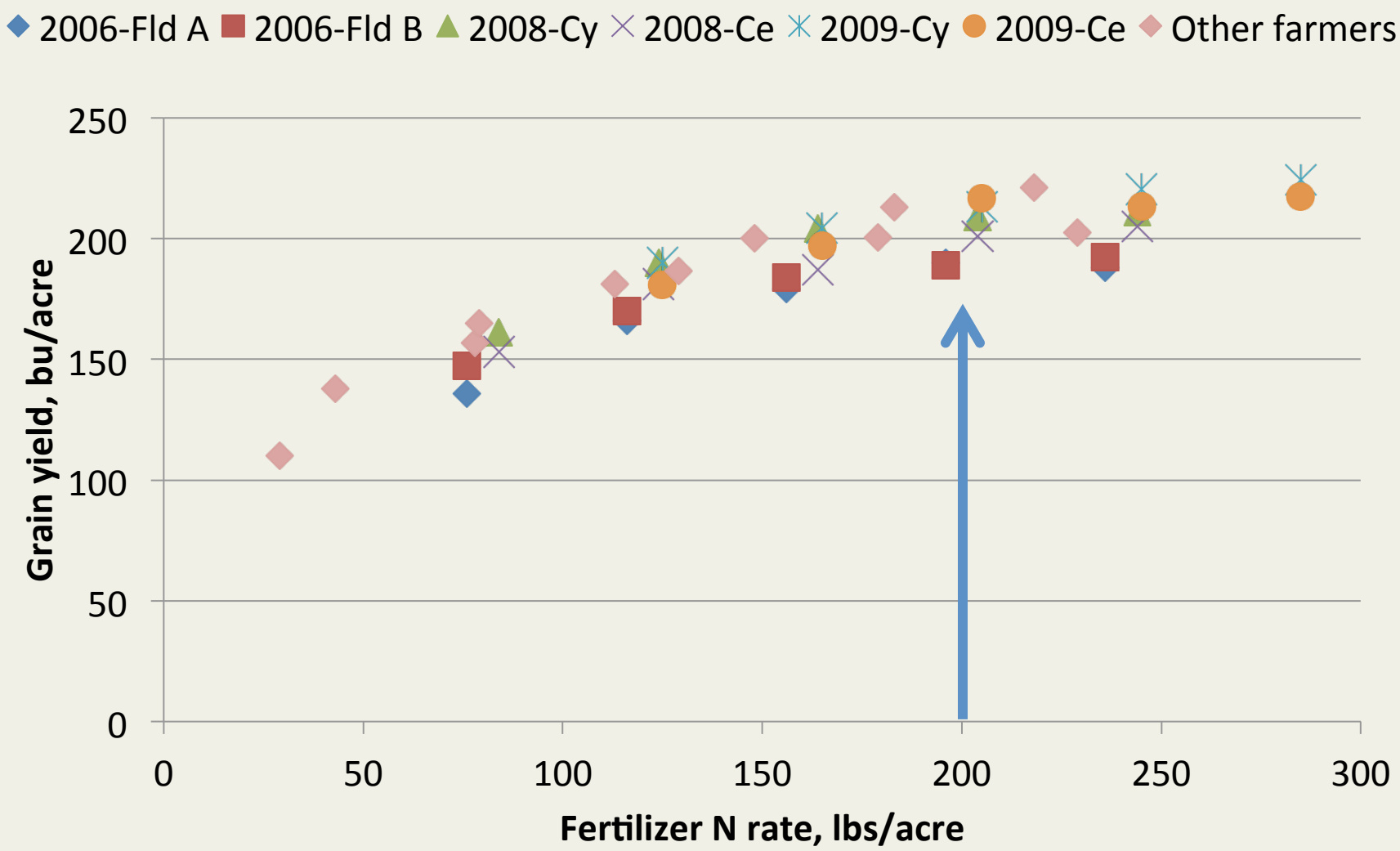
TotalN	GrnMst	GrnYld	
88	na	129.9	c
118	na	159.3	b
148	na	164.2	ab
178	na	178.8	a
208	na	171.6	ab
LSD 0.10		**17.2**	
C.V.		**7.1**	



Definitions

GrnMst: Grain moisture
GrnYld: Grain yield, adjusted to 15% moisture
LSD 0.10: Least Significant Difference at alpha = 0.10, Values within same column followed by same letter are statistically similar.
C.V. "Coefficient of variation"; a measure of the variability within the study, low values = low variability & better data.
na Not available

Strip Trial Example



Corn Nitrogen Rate Calculator

Finding the Maximum Return To N and Most Profitable N Rate

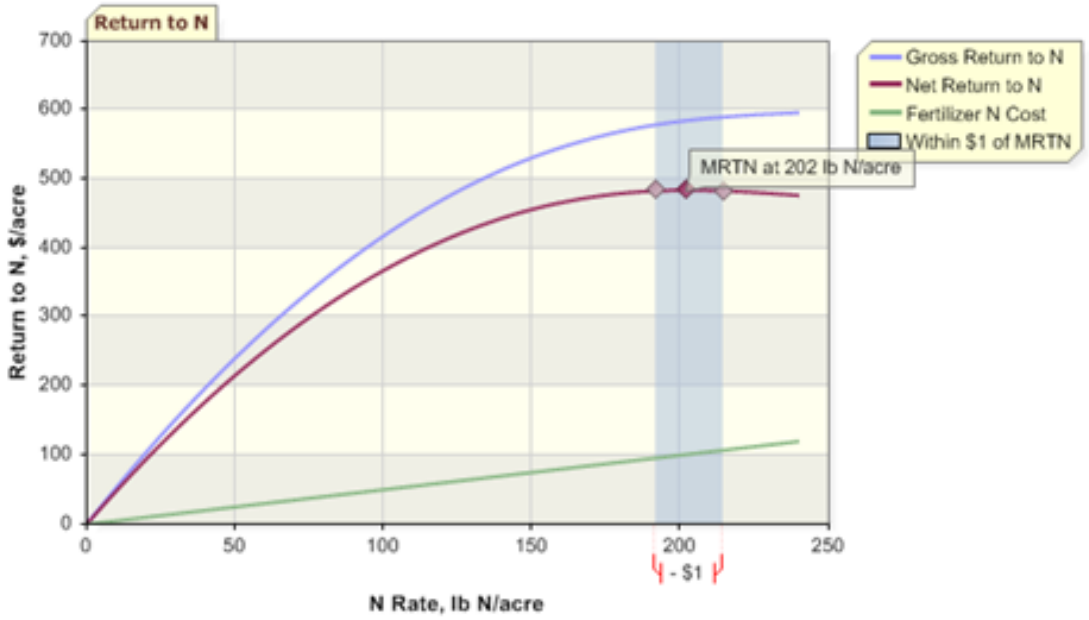
A Regional (Corn Belt) Approach to Nitrogen Rate Guidelines

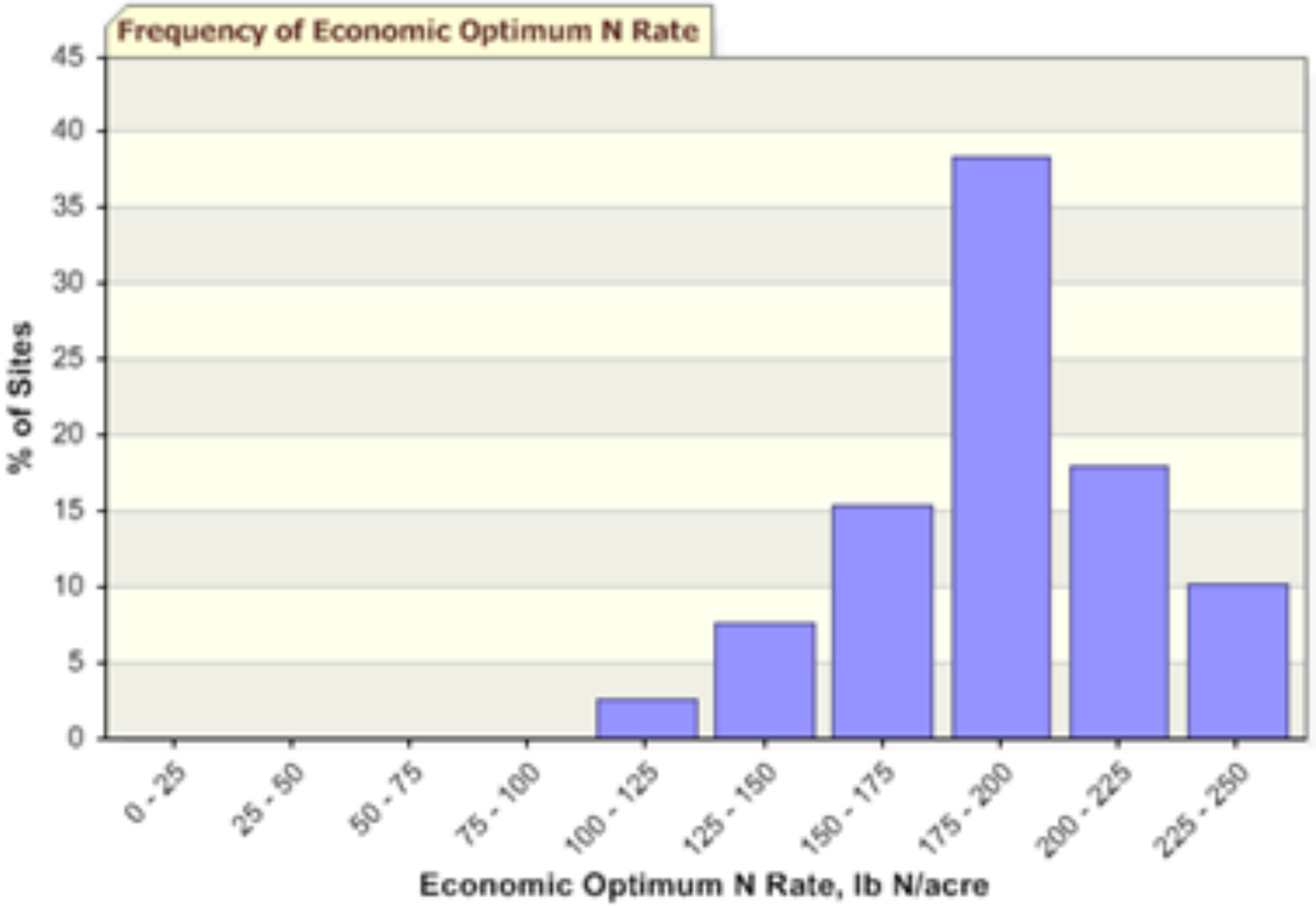
State: Indiana - East & Central
Number of sites: 39
Rotation: Corn Following Soybean
Non-Responsive Sites Not Included

Nitrogen Price ($/lb): 0.50
Corn Price ($/bu): 5.00
Price Ratio: 0.10

MRTN Rate (lb N/acre):	**202**
Profitable N Rate Range (lb N/acre):	191 - 214
Net Return to N at MRTN Rate ($/acre):	$484.04
Percent of Maximum Yield at MRTN Rate:	99%
Anhydrous Ammonia (82% N) at MRTN Rate (lb product/acre):	246
Anhydrous Ammonia (82% N) Cost at MRTN Rate ($/acre):	$101.00

Most profitable N rate is at the maximum return to N (MRTN).
Profitable N rate range provides economic return within $1/acre of the MRTN.




Frequency of Economic Optimum N Rate
% of Sites
45
40
35
30
25
20
15
10
5
0
0 - 25
25 - 50
50 - 75
75 - 100
100 - 125
125 - 150
150 - 175
175 - 200
200 - 225
225 - 250
Economic Optimum N Rate, lb N/acre

Nitrogen Management Guidelines for Corn in Indiana

Jim Camberato, R.L. (Bob) Nielsen, & Brad Joern
Agronomy Dept., Purdue Univ.
West Lafayette, IN 47907-2054

8-YEAR SUMMARY OF CORN RESPONSE TO NITROGEN FERTILIZER

This report summarizes the yield response of rotation corn to fertilizer nitrogen (N) rate in field-scale trials conducted around the state of Indiana since 2006. These results are applicable to situations that implement efficient methods and timings of N fertilizer application. The average Agronomic Optimum N Rate (AONR) for 37 trials conducted on medium- and fine-textured soils in westcentral, southwest, and southcentral Indiana was approximately 182 lbs N / ac. The AONR for 33 trials conducted on medium- and fine-textured soils in northwest, northcentral, and southeast Indiana was approximately 194 lbs N / ac. The AONR for 54 trials conducted on medium- and fine-textured soils in medium- and fine-textured soils in northeast, eastcentral, and central Indiana was approximately 217 lbs N / ac. The average AONR for 10 rotation corn trials around Indiana conducted on non-irrigated sandy soils was 184 lbs N / ac. At the five Purdue locations where we conducted paired trials of corn/soy and corn following corn (corn/corn) in 2007-2010, the average AONR for corn/corn was 44 lbs greater than for corn/soy while average corn/corn yields were 18 bu/ac less than the corn/soy yields.

Economic Optimum N Rates (EONR) for various combinations of N cost and grain price are listed in Tables 1-3 for regions of the state. If you want to determine EONR for other N and grain prices, use the on-line N calculator for Indiana at this web site: http://extension.agron.iastate.edu/soilfertility/nrate.aspx.

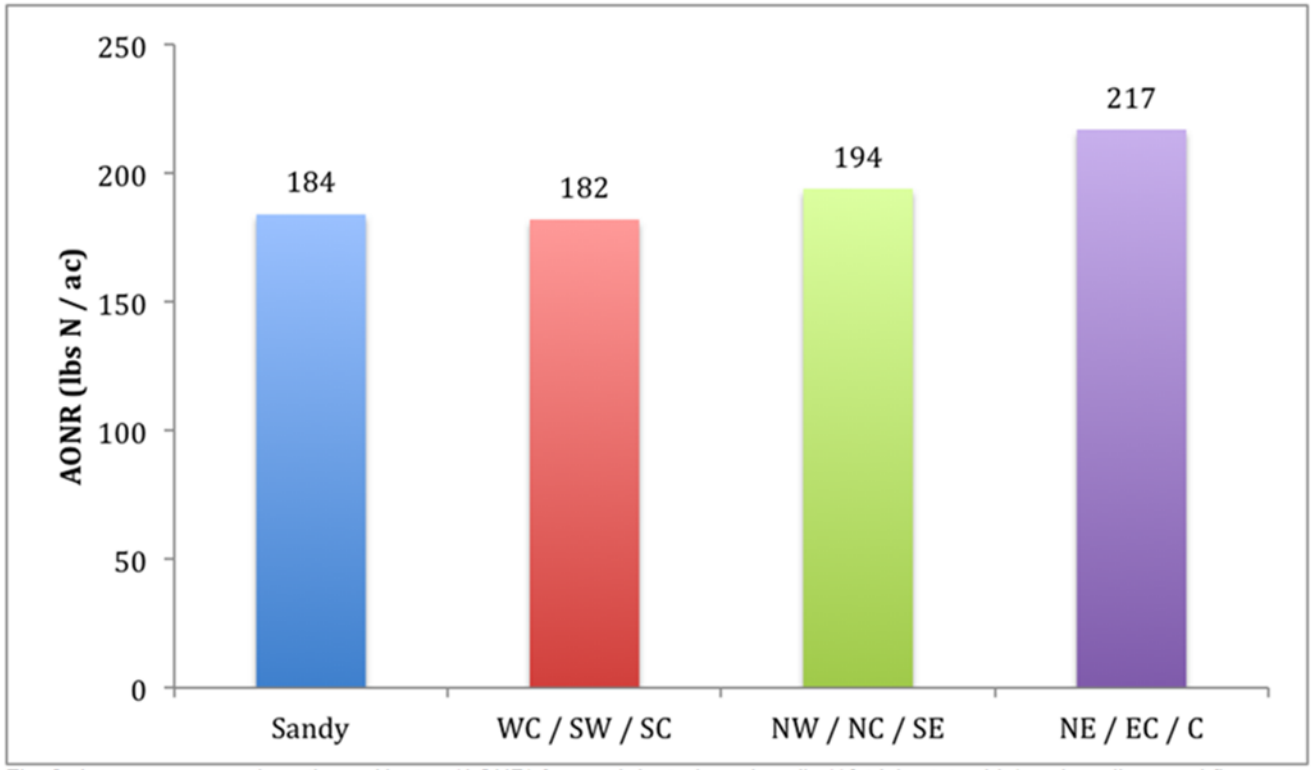


Fig. 2. Average agronomic optimum N rates (AONR) for non-irrigated sandy soils (10 trials statewide) and medium- and fine-textured soils in three geographic regions in Indiana (127 trials statewide) with corn following soybean to date since 2006.

http://www.agry.purdue.edu/ext/corn/news/timeless/NitrogenMgmt.html

Yield Response to Plant Population for Corn in Indiana

R.L. (Bob) Nielsen, Jason Lee, & Jim Camberato
Agronomy Dept., Purdue Univ.
West Lafayette, IN 47907-2054
Nielsen's email: rnielsen at purdue.edu

Summary
Results from 58 field-scale trials around Indiana since 2001 (45 since 2010) suggest that optimum plant populations for 30-inch row corn grown under typical yield levels and growing conditions are in the neighborhood of 31,400 PLANTS per acre (ppa) or seeding rates of about 33,000 SEEDS per acre (spa). The results further suggest that corn grown under challenging conditions (e.g., severe drought stress) may perform best at PLANT populations no higher than 25,500 ppa and perhaps as low as 21,000 ppa under truly severe growing conditions (actual drought, non-irrigated center pivot corners, non-irrigated sandy fields with minimal rainfall, etc.).

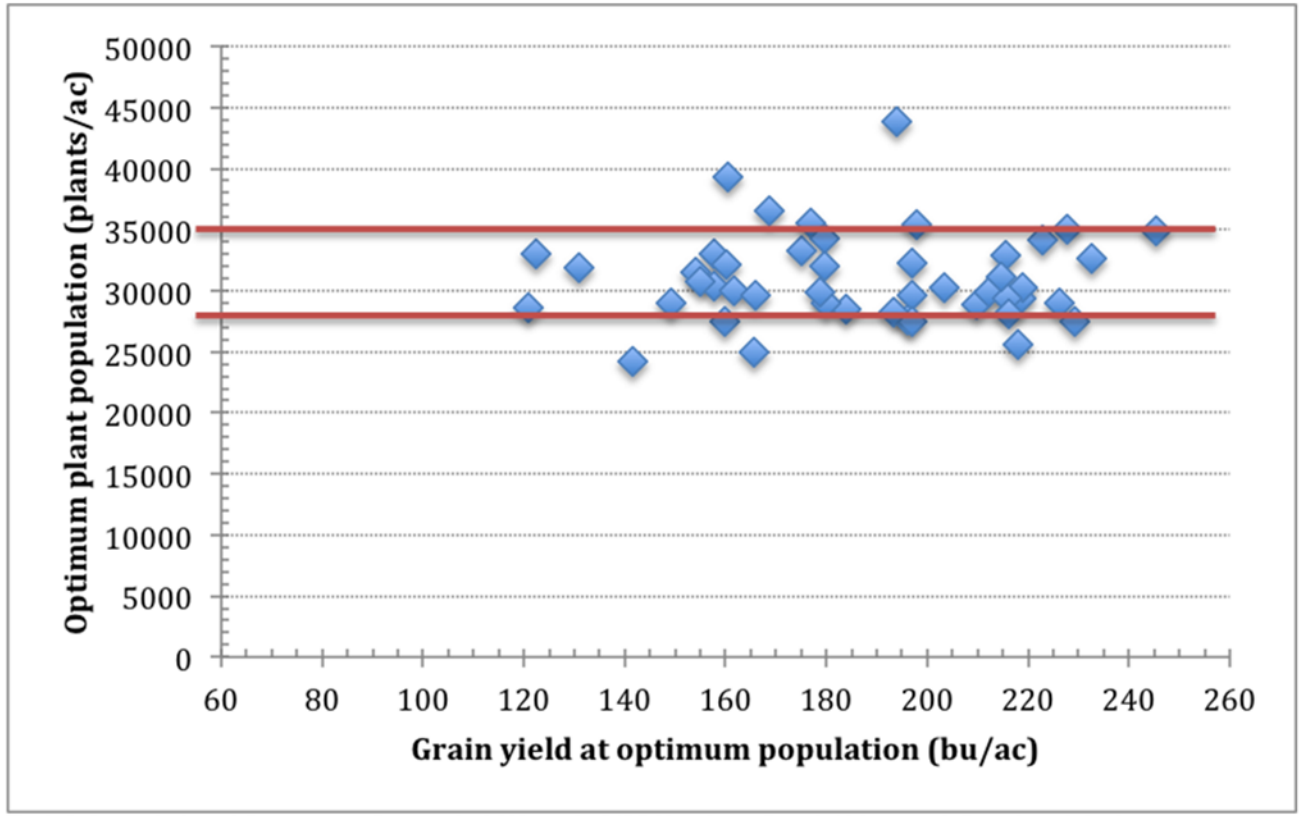


Fig. 1. Optimum plant populations versus optimum grain yield for each of 46 field-scale seeding rate trials across Indiana characterized as experiencing a normal range of growing conditions (moderate to low stress), 2001 – 2013. The average optimum plant population was 31,400 ppa and 74% of the individual trial optimum plant populations were between 28,000 and 35,000 ppa (indicated by dark lines on graph).

http://www.agry.purdue.edu/ext/corn/news/timeless/SeedingRateGuidelines.html


Questions?