

Nvision:

Remote sensing to visualize AND
CORRECT nitrogen (N) deficiency in
corn



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An aerial photograph of a vast agricultural landscape. The foreground and middle ground are dominated by large, green fields, likely corn or soybeans, with some variations in color suggesting soil variability. A light-colored road or path runs diagonally across the lower portion of the image. In the distance, there are more fields, some trees, and a few buildings under a clear, light blue sky.

Uses:

- **Rescue N decisions**
- **Variable-rate N to manage soil variability**

An aerial photograph of a large agricultural field, likely corn, in Northwest Missouri during August 2008. The field is divided into several sections by a road and a fence. The corn plants appear somewhat sparse and yellowish-green, indicating a widespread nitrogen deficiency. The text "There was widespread N deficiency 2008-2011 across the Corn Belt" is overlaid in white at the top of the image. The text "Northwest Missouri, August 2008" is overlaid in yellow at the bottom left.

There was widespread N deficiency 2008-2011 across the Corn Belt

Northwest Missouri, August 2008

I estimate that we lost 2 billion bushels of potential yield 2008-2011



In a wet year, N must be applied in-season

Planned in-season N 

Rescue N in-season 

No in-season N 

Central Missouri 2008:

in-season N kicks butt

+ 44 bu/ac

180 N

at planting

110 N

sidedress knee-high

Central Missouri 2009: in-season N kicks butt again

+ 68 bu/acre

153 N sidedress
153
Post knee-high

180 N
180
Pre at planting

140
PRE

180
PRE

147
SIDE

100
PRE

80 bu difference

**Central Missouri 2010:
Can you believe a 3-peat?**

0

197
SIDE

124
PRE

202
SIDE

Central Missouri 2013: In-season N wins big

N timing	N rate	Yield
Knee-high	160 (chlorophyll meter)	213
Knee-high	144 (crop sensor, VR 67 to 191)	207
Knee-high	116 (soil nitrate test)	196
Preplant	180	126
Preplant	140	101
Preplant	140 (soil nitrate test)	94
Preplant	100	72
-----	0	51

**In-season N benefit in this
experiment 2007-2013 totals
about 265 bushels/acre**

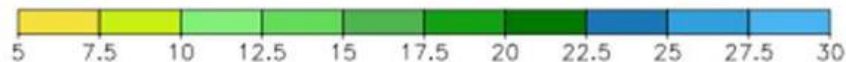
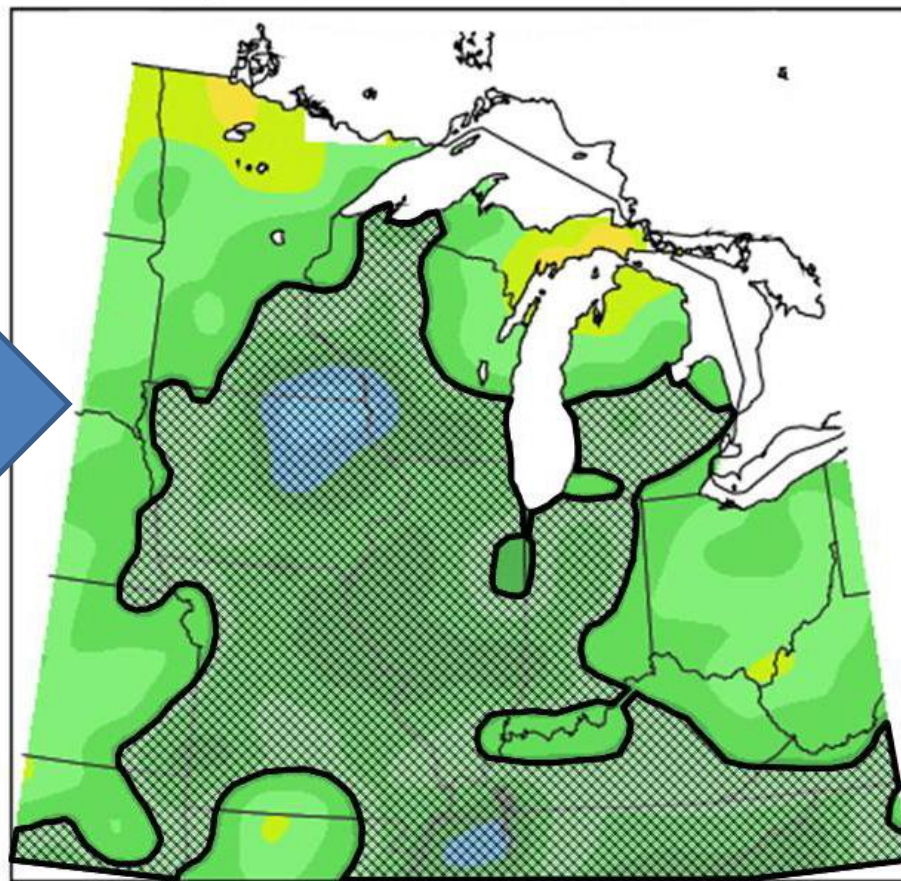
With 120 lb less N/acre

All in the wet years: 2008, 2009, 2010, 2013

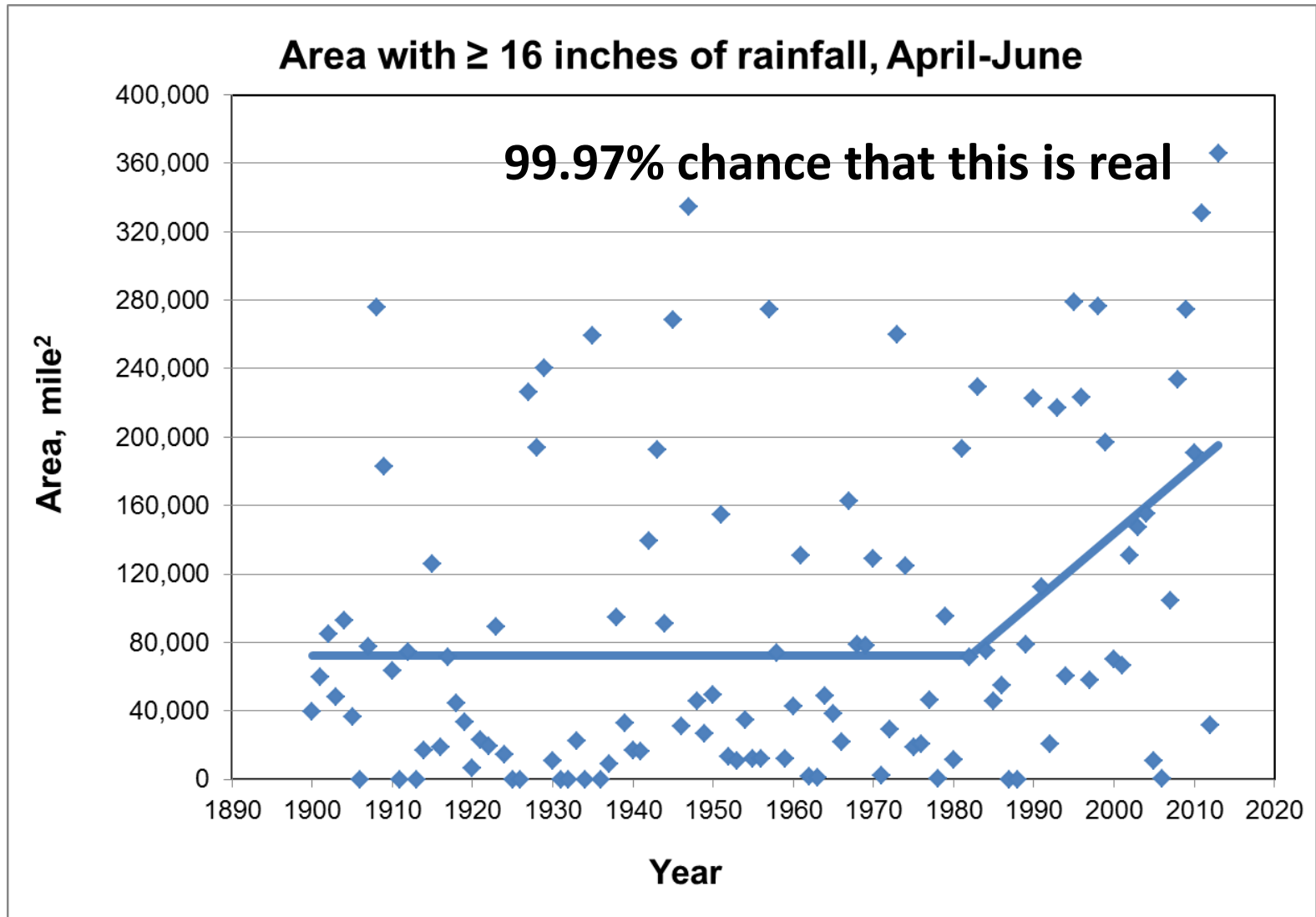
2013: Largest wet spring in history

- My rule of thumb: more than 16" of rain April-June = high risk of N deficiency
- Areas that wet in 2013 are shown in crosshatch
- We made maps like this one going back to 1900

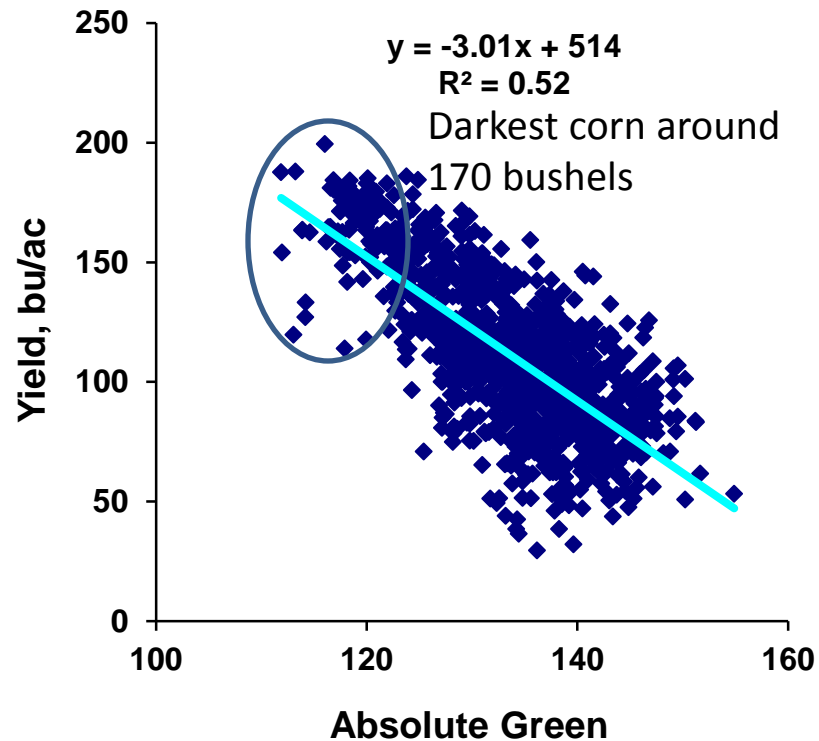
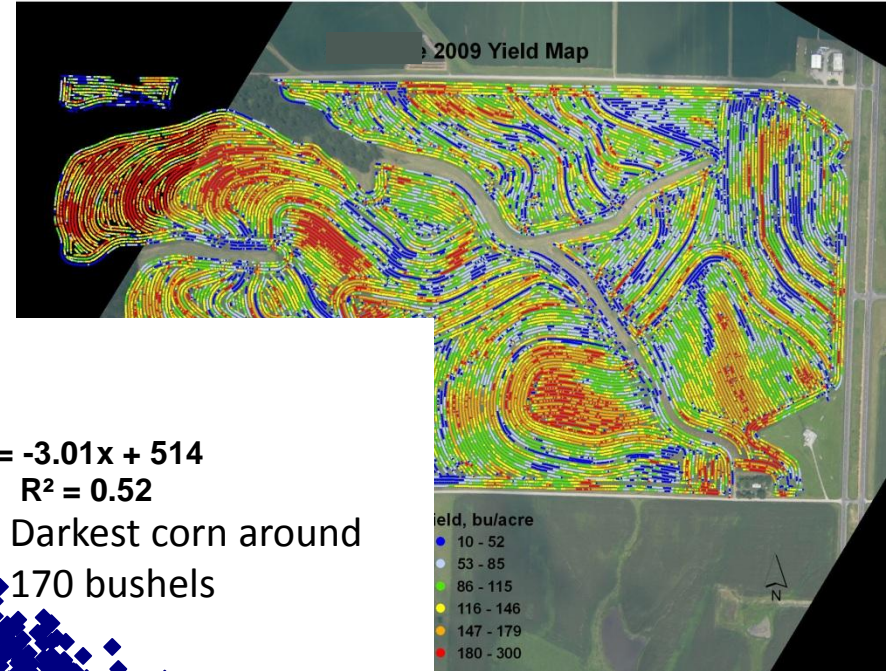
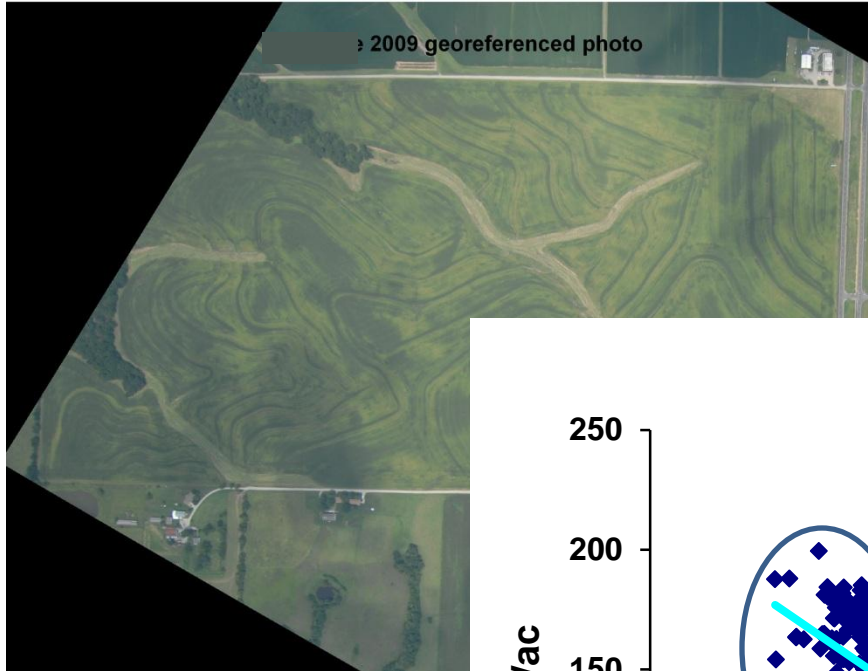
Accumulated Precipitation (in)
April 1, 2013 to June 30, 2013



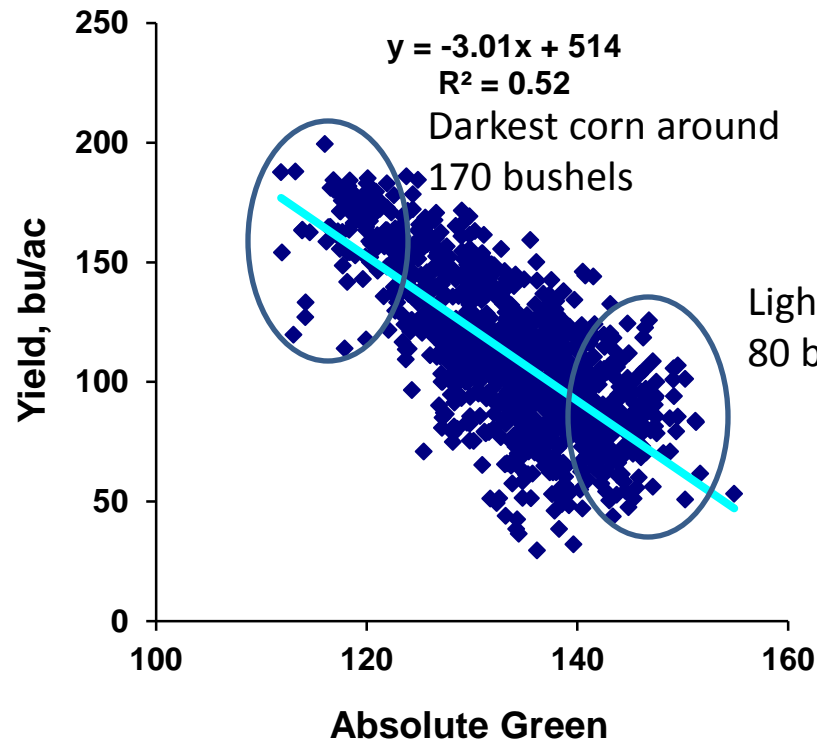
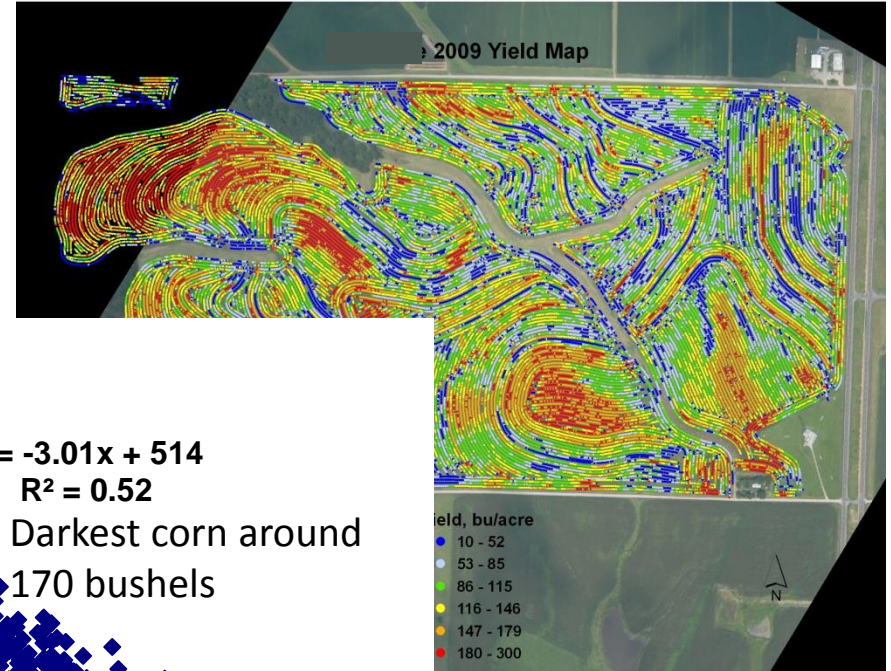
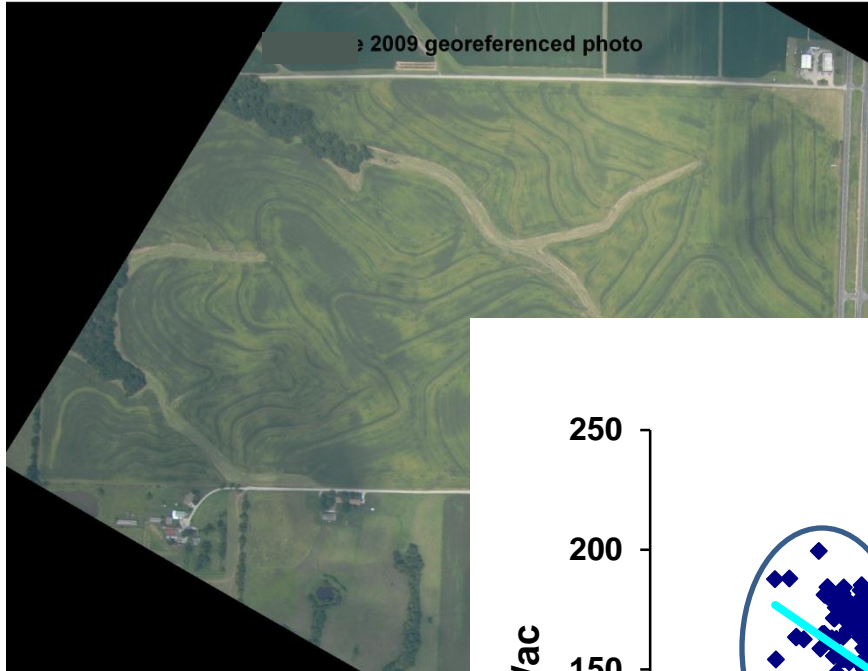
More wet area in the central U.S.



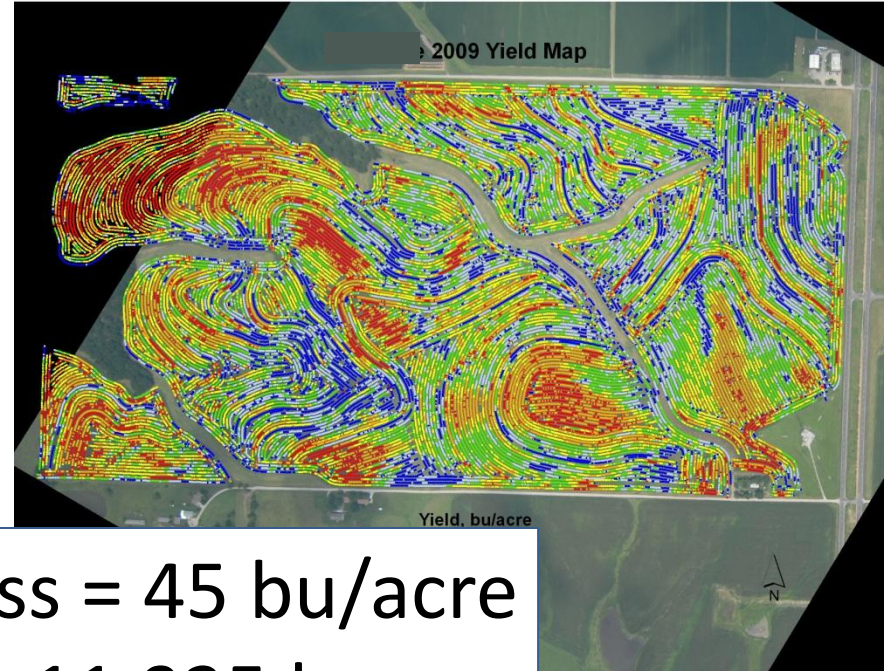
Yield map: yellow corn yields poorly



Yield map: yellow corn yields poorly



N Deficiency costs a lot!



Average yield loss = 45 bu/acre

Total yield loss = 11,925 bu

(45 bu/ac x 265 acres)

Total economic loss = **\$44,720**

(11,925 bu x \$3.75/bu)

Yellow corn can be rescued



- Fully fertilized fields but producers concerned
- N applied anywhere from thigh-high to tassel

Rescue N outcomes

- **Average yield response 34 bu/acre (11 fields)**
- **Yield response depended on visible stress**
 - High stress: 57 bushels (2 tests)
 - Medium stress: 41 bushels (5 tests)
 - Low stress: 14 bushels (4 tests)

Rescue N timing

- **How late is too late?**
 - Six tests in 2010, all applied at tasseling, ave 34 bu response
 - Tasseling is NOT too late
 - Give up by 2 weeks after tassel?

**How do I know
whether I need to
apply rescue N?**

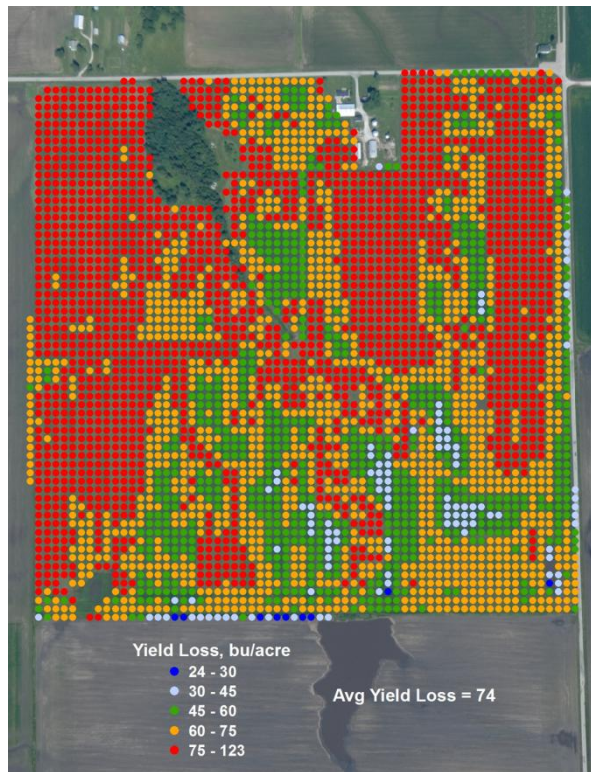


NVision:

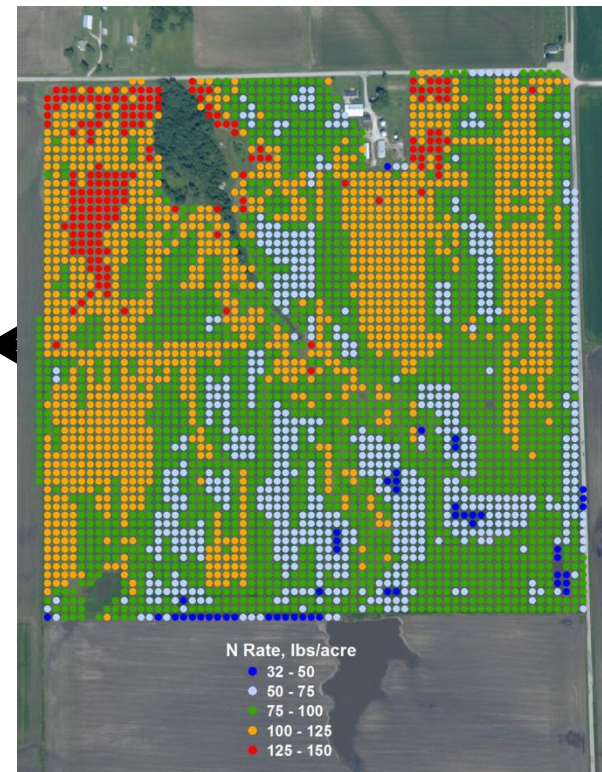
quantitative decision support



aerial photo



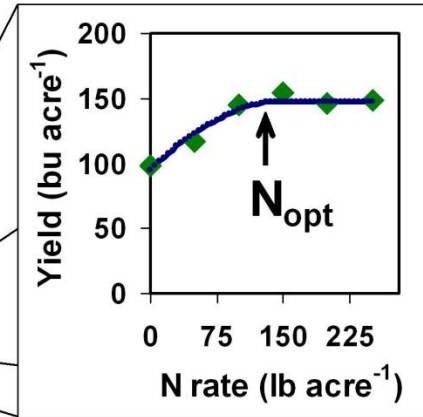
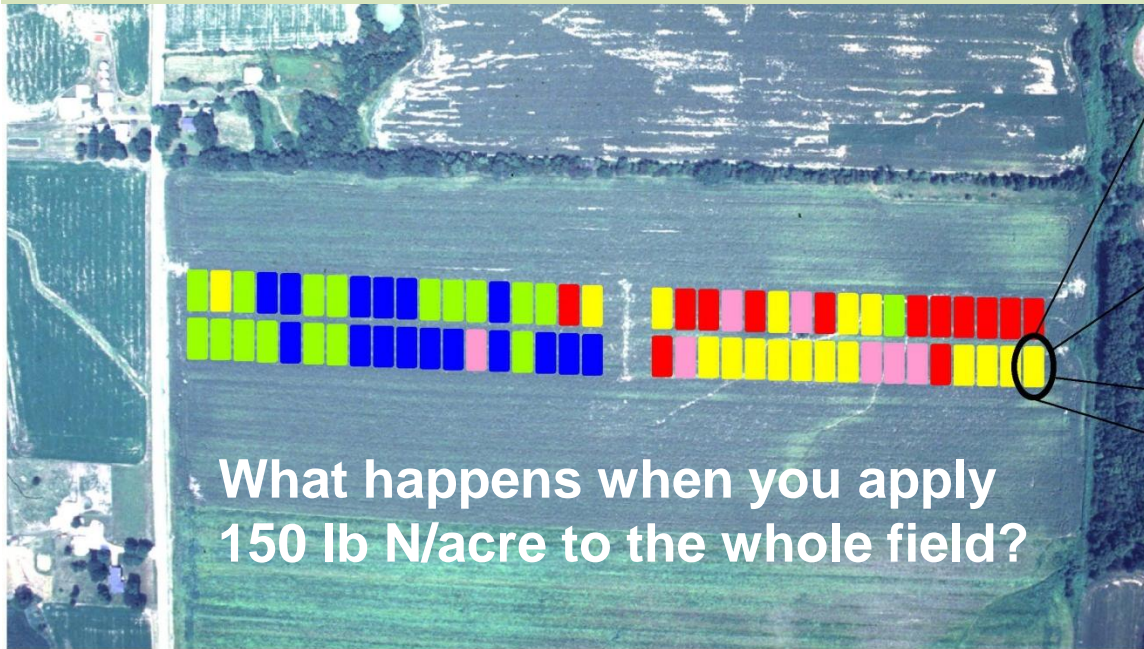
yield loss map
(ave 74)



N rate map:
fix the problem

**Is there any reason
I'd use NVision in a
normal year?**

Optimal N rate varies widely



Optimal N rates (lb acre⁻¹) **Blue** 0 to 80 **Green** 80 to 120 **Yellow** 120 to 160 **Pink** 160 to 200 **Red** 200 to 250

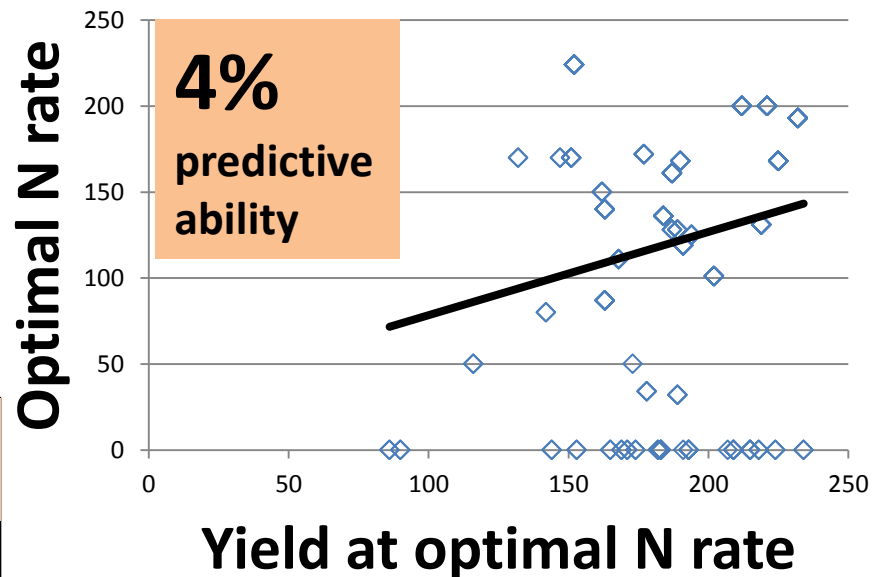
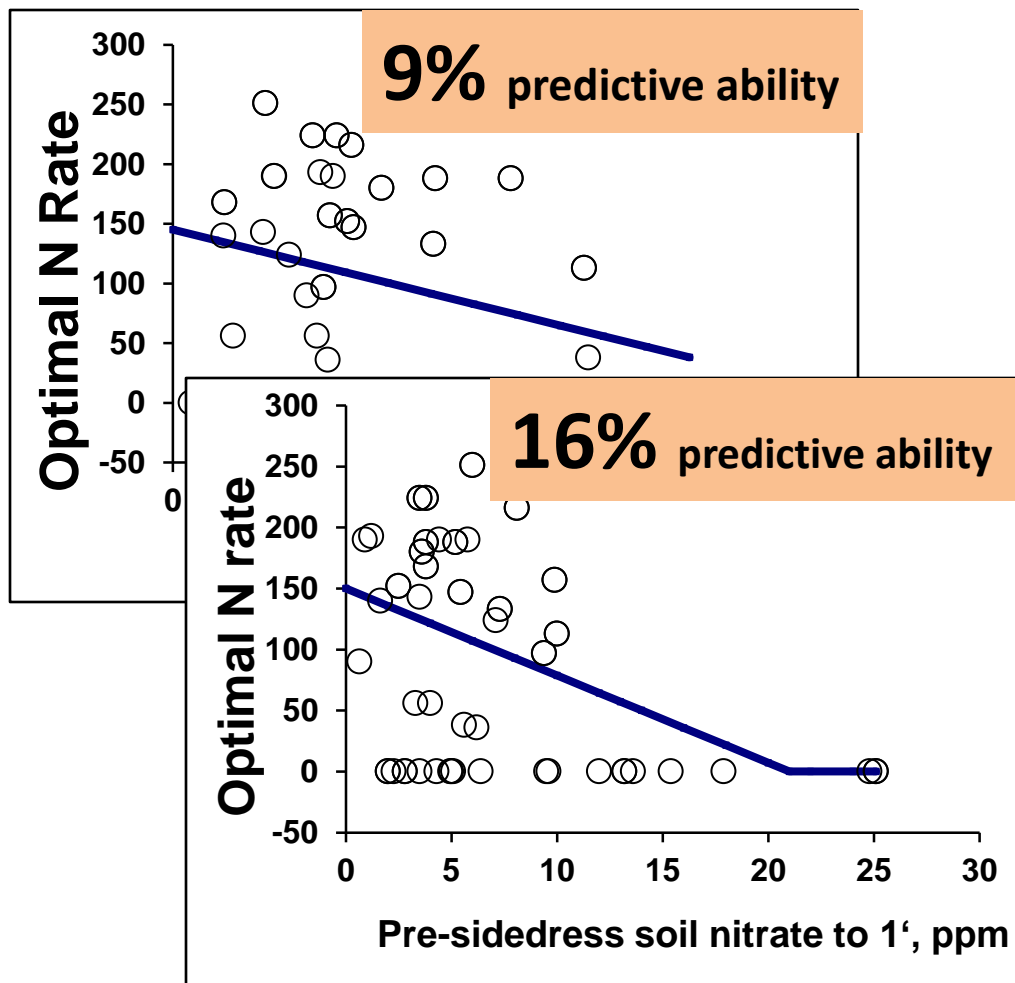
We studied eight fields this way—seven were as variable as this one

In one field, average best rate was 65;
In another field it was 200

Yes: Minnesota, Kansas,
Missouri, Pennsylvania
No: Wisconsin

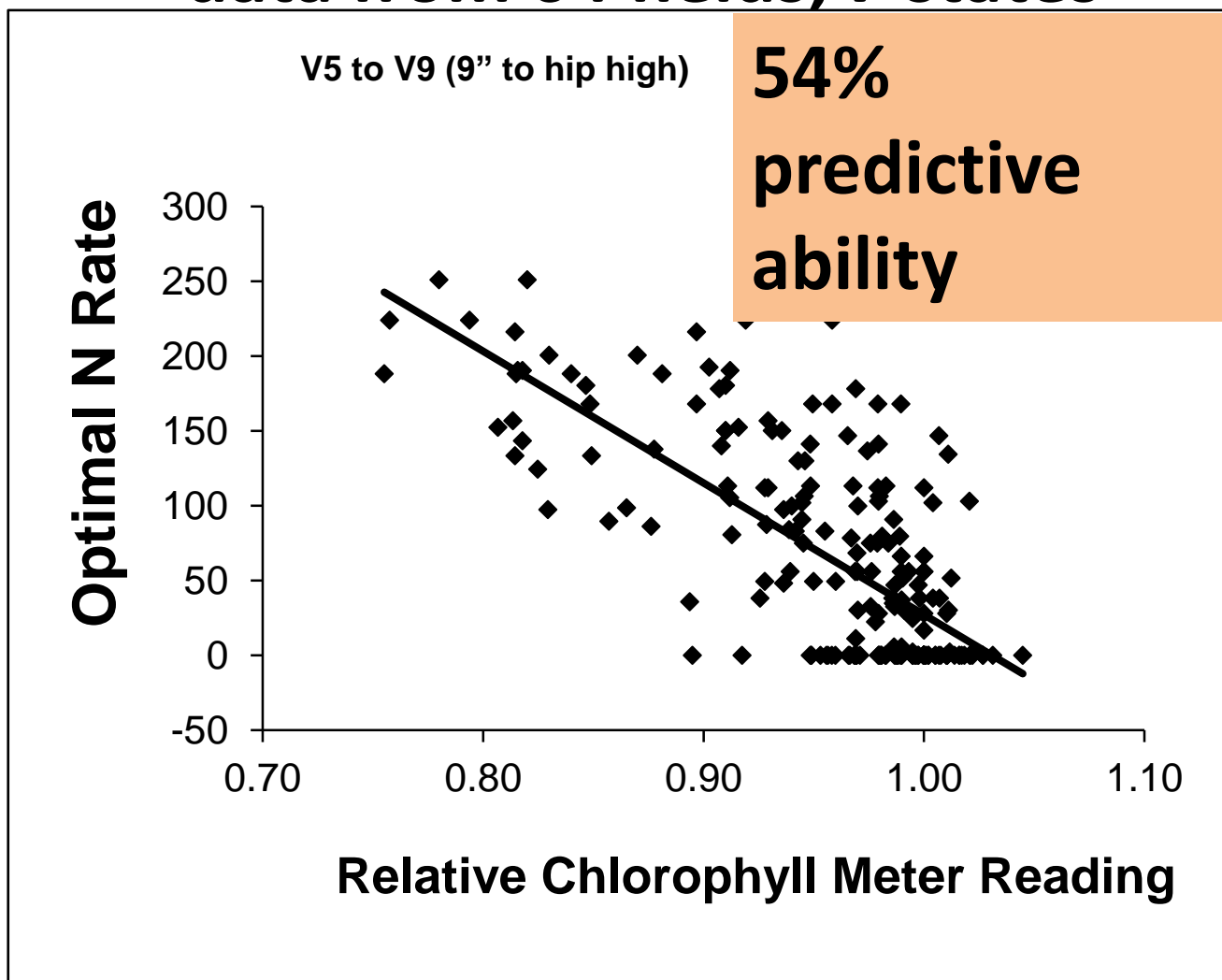
Color predicts N rate better than soil tests or yield

data from 64 fields, 7 states



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2013: Far more in-season N than ever before

- Pioneer agronomist webinar June (mainly IA/MO)
 - On average expected 50% of acres to get in-season N
- Phone calls July: a dozen consultants, extension agronomists, and retailers in MO/IA/IL
 - On average thought 45% of acres had received in-season N
- Field day wagons northwest MO in August
 - $22/63 = 35\%$ of corn producers had applied in-season N
- I don't think it had ever been above 5% before

An aerial photograph of a lush green agricultural landscape. A network of roads and a stream are visible, crisscrossing the fields. The text is overlaid on the center of the image.

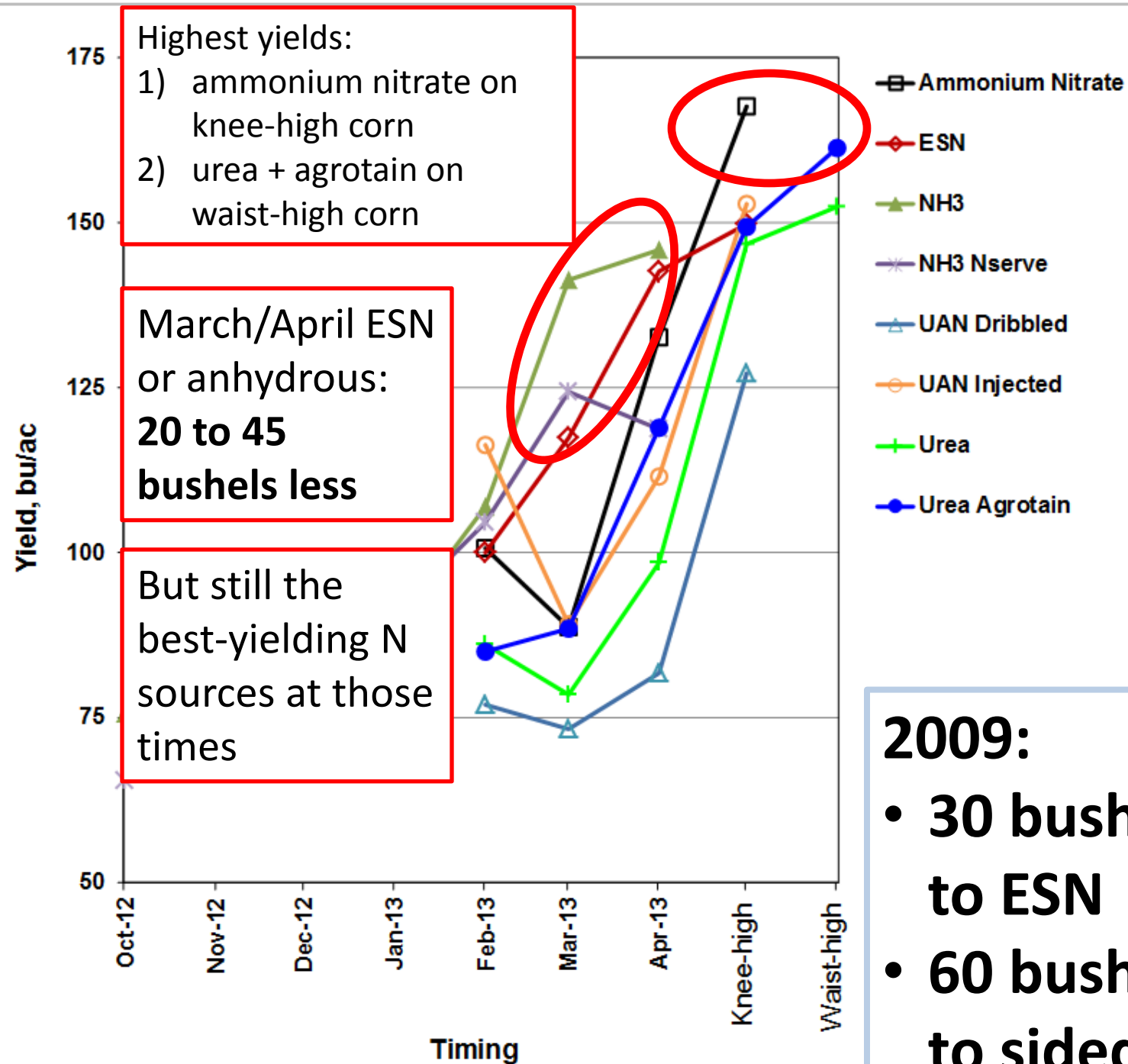
Questions? Comments?

**Near Craig, Missouri
August 2, 2008**

Can we get by with applying all N pre-plant?

- I've had this question several times from producers & advisors in the delta region
- If we use N sources resistant to loss?
 - Anhydrous ammonia
 - ESN

central Missouri 2013



Highest yields:
1) ammonium nitrate on knee-high corn
2) urea + agrotain on waist-high corn

March/April ESN or anhydrous:
20 to 45 bushels less

But still the best-yielding N sources at those times

2009:

- 30 bushel response to ESN
- 60 bushel response to sidedress

**ESN and anhydrous
ammonia are the best
preplant N sources in a
wet year...**

**...but not as good as
sidedress**