Nitrogen Management & Other Corny Stuff for 2010

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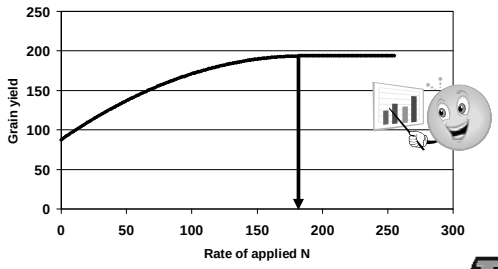
Thoughts on Nitrogen Management

An optimum fertilizer N rate…

- Can be easily identified after the fact.



But, an optimum fertilizer N rate…

- Cannot easily be predicted for next year because your fertilizer N does not represent the entire amount of N available to the crop.
- Total N available to the crop =
  - The amount of N fertilizer you apply

  +
  - The amount of N the soil supplies to the crop

The soil nitrogen balancing act

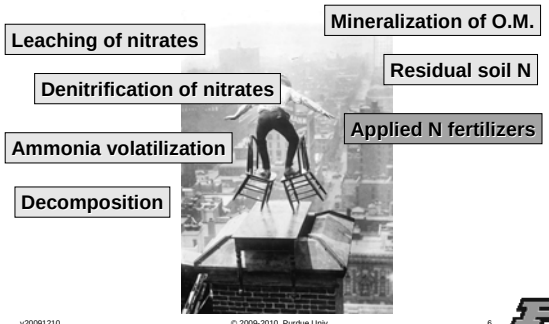
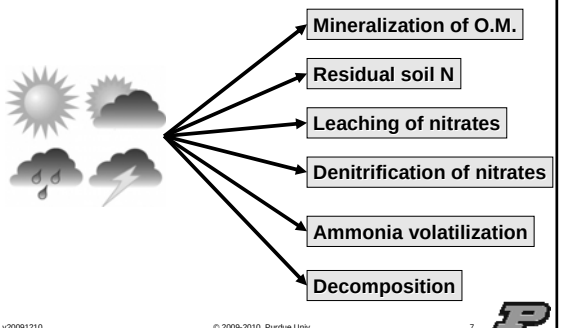


Image: http://lascannerdorky.files.wordpress.com/2007/07/balancing-act-001.jpg

Weather impacts soil N supply



Consequently,

- An optimum fertilizer N rate cannot easily be predicted for next year, primarily because we cannot reliably predict the weather.

Weather forecasting:
The science of explaining tomorrow why the predictions you made yesterday did not come true today.
…some unknown cynic

Nevertheless, what do we know?

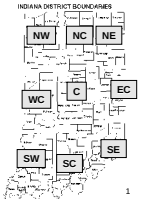
- Jim Camberato and I have been coordinating field-scale N rate trials throughout the state since 2006.
  - 71 corn/soy trials statewide.
  - 35 corn/corn trials statewide
- Purdue trials & on-farm trials.

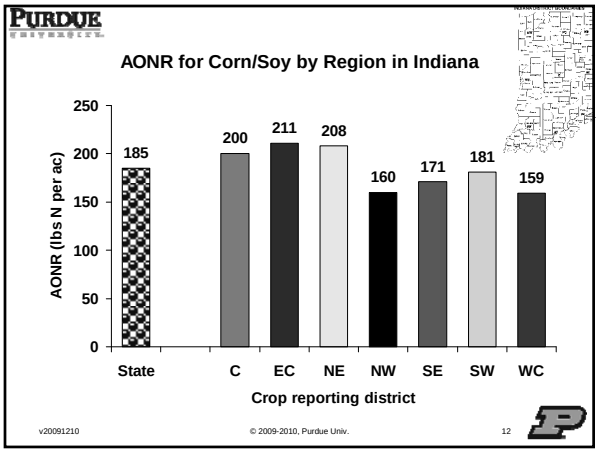
Thumbs up to…

- Indiana Corn Marketing Council
- Pioneer Hi-Bred Int'l (seed)
- Beck's Hybrids (on-farm trials)
- Individual farmer cooperators.
- Industry agronomists for coordinating tests.
- A&L Great Lakes Laboratories for reduced costs on soil & plant analyses.
- Purdue Univ for partial funding of this research.

So, what have we learned?

- 71 corn/soy trials statewide since 2006
  - Average AONR (Agronomic Optimum N Rate) = 185 lbs/ac statewide
- But, the AONR value varies by region.
  - Fewer trials per region, so not as confident of regional AONR values.





What if?

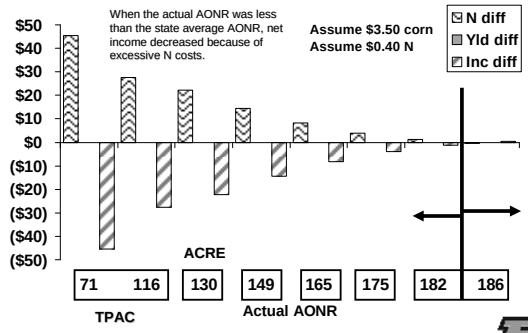
- So, what are the risks of simply using the statewide average AONR or one of the regional average AONRs?
  - Depends on the actual AONR value for that year, which you cannot yet predict with what we know today.
  - But, we can get an idea by looking back at our trial data and asking "What if?".

Intro to following charts

- The next two charts address the question "What if I had applied the statewide average AONR of 185 lbs N/ac (1st chart) or the westcentral Indiana regional AONR of 159 lbs N/ac in each of 4 years at 2 locations in westcentral Indiana?"
- The actual or "hindsight" AONR at each site-year are listed across the bottom.
- The effects on N cost, grain income, and grain income minus N cost are displayed in the bars.

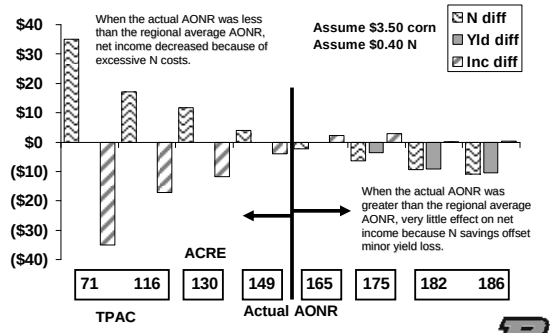
State AONR = 185 lbs/ac

Westcentral Indiana "what if"



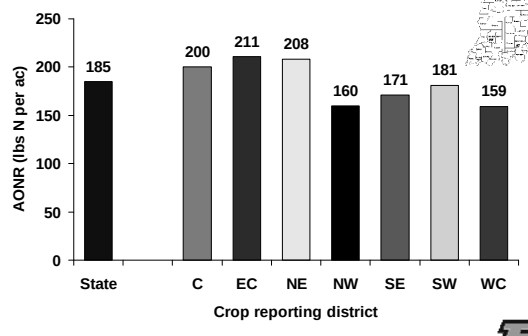
Regional AONR = 159 lbs/ac

Westcentral Indiana "what if"



One last look…

AONR for Corn/Soy by Region in Indiana



Conduct your own trials

- Several years of yield response data from your own N rate trials may help you further pinpoint the "ballpark" optimum N rate for your farming operation.
- Contact me if you would like to collaborate on some on-farm N rate trials in 2010.
  - rnielsen@purdue.edu
  - 765.494.4802

Work towards N use efficiency

- Avoid fall N applications.
- Avoid broadcast N without incorporation.
- Use nitrification inhibitors or urease inhibitors with early spring N applications.
- Consider slow-release N products, but ask Camberato about their effectiveness.
- Work towards a sidedress N program.

Crop sensor tools with potential

- OptRx™ (AgLeader)
- GreenSeeker™ (Trimble)
  - Both emit NIR and visible wavelengths, then measure reflectance of each, that then correlates with plant N status.

Optical sensor strategy…

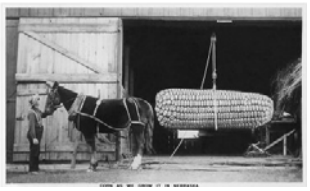
- For each field and (maybe) hybrid:
  - Preplant N at ~ 50% of typical total amount.
  - A separate "high N" reference strip.
  - Ratio of low N to high N reflectance used to determine how much to "top off" the field.

Correlation with plant N status…

- Accurate beginning not much earlier than about leaf stage V8~V9 (thigh high).
  - Consequently, sensor use in predicting N rates will likely require high-clearance N applicators or fertigation potential.

Image source: http://www.millerstn.com

Thoughts on Hybrid Selection

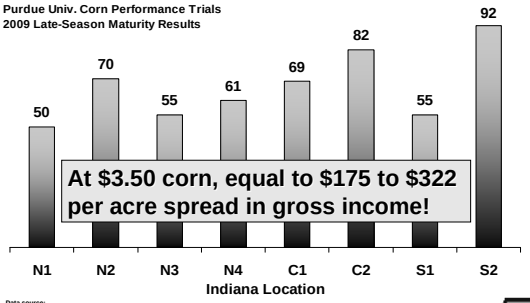


Hybrid selection is important

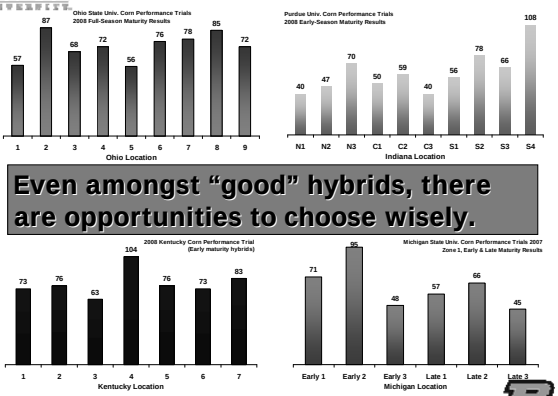
- Can we agree that there is a lot of money to be made or lost in corn farming simply by how wisely you select hybrids?
- How do we know this?
  - Look at the range between the highest & lowest yielding entries in any variety trial.
    - Assuming that companies typically avoid entering crappy™ hybrids in variety trials.

Range in Hybrid Yields

(Highest yield minus lowest yield)



Data source: http://www.ag.purdue.edu/agry/PCPP/Pages/default.aspx



Bottom Line…

- There is no such thing as a perfect hybrid.
  - Else, there would not be so many in the marketplace.
- In the absence of stresses, hybrids yield differently because of genetic yield differences.
- CONSISTENCY of yield over years and across locations is based primarily on the abilities of hybrids to tolerate unforeseen stresses.
  - i.e., hybrid traits other than yield

Stress Tolerance Traits

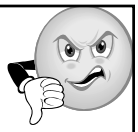
- Diseases
- Insects (transgenic traits)
- Drought, excessive heat
- Soggy soils
- Soil compaction, "tight" soils
- Nutrient deficiencies
- Cold temperatures
- High plant populations

All of these stresses vary in frequency and severity within fields, among fields, among regions, and over years.

Hybrid information resources…

- Annual lists of "hot" hybrids published in farm magazines.
- Seed company sales literature.
- Seed company sales reps.
- Seed company trial **data**.
- Your own on-farm trial **data**.
- Other, third-party trial **data**.
- University variety trial **data**.

Avoid …



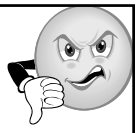
- Side-by-side comparisons, unless they are between pairs of hybrids you've already identified as top yielding genetics.

- In other words, just because my hybrid yielded better than your hybrid in 12,089 side-by-side comparisons across 10 states, does not mean that either hybrid is a good hybrid!

Avoid …

- Choosing hybrids based on "percent wins against the competition".
  - The companies rarely specify whether the "competition" includes competitors' top performers or competitors' "dogs".
  - What growers need to know is the "percent wins" against the BEST of the competition!

Avoid …



- Hybrids without documented yield performance data over multiple locations.
  - Growers should NOT buy simply based upon advertising or the fact that the hybrid is "new"!
    - Today's rapid "cycling" of new genetics to the marketplace makes it harder for growers to wisely select new hybrids because widespread performance data are often more limited.

This includes your own trials

- Do not dwell on how well a hybrid yielded in your own test plot last year.
  - Your single test plot represented only a minuscule sampling of possible future weather conditions and plant stresses.
  - The yield results of your one test plot do not accurately predict the **consistency** of future performance by a hybrid.
    - Why not?

Because, as I said earlier…

- There is no such thing as a perfect hybrid.
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↓

Thus, your single on-farm trial is not a good predictor of the consistency of future yield performance.

Because stresses are unpredictable…

- Hybrids are evaluated across multiple locations with the hope that they will be exposed to a wide range of types and severity of stresses over one or two years.
  - Thus, the value of multiple location variety testing for evaluating and predicting the **CONSISTENCY** of hybrid performance.

Identify consistency

- Look for hybrids that routinely appear within the upper group of hybrids that cannot be differentiated from the highest yielding hybrid by the L.S.D. value of the trial.

2009 Purdue Northern Mid Corn Trial
Average of 4 locations

Brand-hybrid	Yield bu/A	Moist. %	Lodg. %
Campbell Seed X656-98	**244 ***	**23.3**	**3**
EBBERTS X2007	**243 ***	**22.9**	**4**
WELLMAN W2007 VT3	**243 ***	**23.2**	**3**
EBBERTS 2909VT3	**241 ***	**26.4**	**4**
Stewart Seeds 7T630	**241 ***	**25.9**	**1**
Kruger K-6107VT3	239 *	24.7	2
Dyna-Gro 57V40	238 *	25.2	4
DEKALB DKC59-64	237 *	26.0	1
iCORN.com 108.1R	237 *	25.7	1
iCORN.com 109.9VT3	237 *	25.5	1
Bio Gene BG79V10	**235 ***	**27.2**	**2**
Bio Gene BG76V10	**234 ***	**23.2**	**4**
Kruger K-6010VT3	**234 ***	**25.9**	**4**
Wabash Valley TLX3344	**234 ***	**26.6**	**2**
Campbell Seed 65-76VT3	**232 ***	**25.9**	**1**
Specialty 4939 VT3	232 *	26.2	1
BECK/XL 5354HXR(TM)	231 *	25.4	0
Dairyland Stealth 9410	231 *	26.6	1
iCORN.com 110.2VT3	231 *	24.4	2
Rupp XR8439 VT3	231 *	21.9	10
Seed Consultants 11HR00	**231 ***	**28.5**	**0**
DEKALB DKC59-35	**230 ***	**25.7**	**1**
iCORN.com 109.5VT3	**230 ***	**25.7**	**6**
Kruger K-6408VT3	**230 ***	**25.5**	**3**
Wyckoff 2599	**230 ***	**26.4**	**1**
Campbell Seed 591-76VT3	229	25.3	1
Kruger K-6410VT3	229	24.1	5
Bio Gene BG77V10	228	23.8	5
Bio Gene BG80W10	228	26.4	2

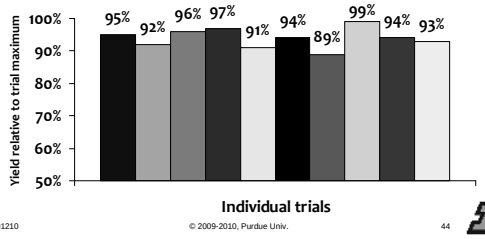
Another way to identify consistency

- **RELATIVE** hybrid yield performance across multiple trials.
  - Relative yield of a hybrid = Yield divided by the highest yield in the trial.
  - Example:
    My Hybrid = 200 bu/ac
    Top Hybrid = 220 bu/ac

    My Hybrid = (200/220) = 91% relative yield

Consistency of Yield

- Aim to identify hybrids whose yields are consistently within 10% of the highest hybrid yield in every variety trial they are entered.



After you identify a group of consistent high yielders…

- Then further "weed out" those hybrids with low ratings for traits important to your farming operation.

Hybrid traits

- Many to consider, but not all are important for your specific farming operation.
- Do you know what are your most common important yield limiting factors?
  - Diseases? Which ones?
  - Insects? Which ones?
  - Poorly-drained soils?
  - Sandy, drought-prone soils?

Overview of SmartStax™

- In July 2009, the US-EPA approved SmartStax™ for U.S. commercialization.
- Cross-licensing agreement between Monsanto and Dow AgroSciences.
- For 2010, seed will be available for about 4% of U.S. acres.
- What is it & should I be excited?

SmartStax™ trait categories?

1. Resistance to "moths", including
   - ECB, SWCB, western bean cutworm, fall armyworm, corn earworm, black cutworm
2. Resistance to corn rootworm
3. Tolerance to glyphosate (RoundupReady™)
4. Tolerance to glufosinate (LibertyLink™)

Specific SmartStax™ traits

- Monsanto VT Pro
  1. Cry1a.105
  2. Cry2Ab

  } "moths"
- Monsanto VT RW/RR
  3. Cry3Bb1 } rootworms
  4. Cp4 epsps } glyphosate
- Dow Herculex I
  5. Cry1Fa2 } "moths"
  6. pat } glufosinate
- Dow Herculex RW
  7. Cry34Ab1
  8. Cry35Ab1

  } rootworms
  - pat

A "pyramid" strategy

- Multiple transgenes for control of similar insects represents a "pyramid" strategy designed to minimize the risk of developing resistance within insect populations.
  - Multiple "modes of action", or at least different targets of action in the insect midgut.

Effect on refuge needs

- Consequently, the US-EPA reduced the refuge area requirement for SmartStax™ hybrids to only 5% instead of the traditional 20% for single trait or "stacked" trait hybrids.
  - Important to recognize that this reduction in refuge acreage applies ONLY to SmartStax™ hybrids.

Benefits of SmartStax™ ?

- Control of a broader range of insect pests.
  - Yield gains if better than your past hybrids.
- Overall farm yield gain because of fewer refuge acres.
  - Yield gain only if your refuge acre yields were less before.
- Longer term benefit if this strategy truly delays or prevents development of trait resistance within insect populations.

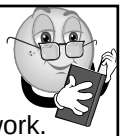
Cost/Benefit of Trait Pkg?

- Profit or loss =
  (Additional yield x price) – cost of trait pkg

- Hard to predict insect pressure
  - Field to field variability
  - Year to year variability
- Little public data to date on SmartStax™ performance per se
- Your success or not w/ refuge areas

- Varies year to year

Wise hybrid selection…



- Requires a lot of research & homework.
- Can be challenging because multiple location data are often difficult to obtain.
- Can be challenging because yield data often require further analysis & scrutiny.
- Can dramatically improve net income due to higher and more consistent yields for growers.

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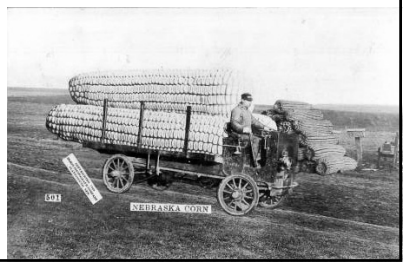
Thoughts on Seeding Rates for Corn



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Bottom line w/ corn…

- Current data suggest that many growers should be targeting **economic FINAL stands** no less than ~ 30,000 ppa; equal to a seeding rate of ~ 33,000 spa.
- Exceptions being…
  - Lower yielding environments (e.g., 130 bpa or less) where growers should target final populations between ~ 24 to 30,000 ppa.
  - More northern areas where final stands may need to be 33,000 ppa or greater.

Image source: http://www.webwhispers.org/newspics/apr05/target.jpg

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Balancing act for corn…

- More plants per unit area equals more ears per unit area. (that's good)
- But, ear size per plant decreases with increasing plant density. (that's not good)
- The optimum final stand is that which best balances the decrease in ear size per plant with the gain in ears per unit area.
- Furthermore, stalk health & integrity at higher populations sometimes falters.

Image: http://oscannerdorky.files.wordpress.com/2007/07/balancing-act-001.jpg

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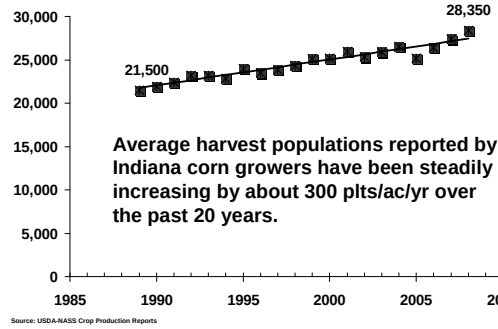
Harvest populations - Indiana



Source: USDA-NASS Crop Production Reports

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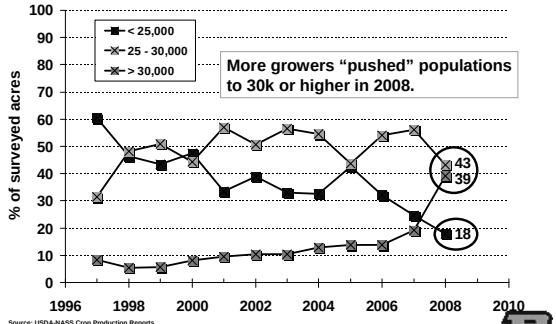

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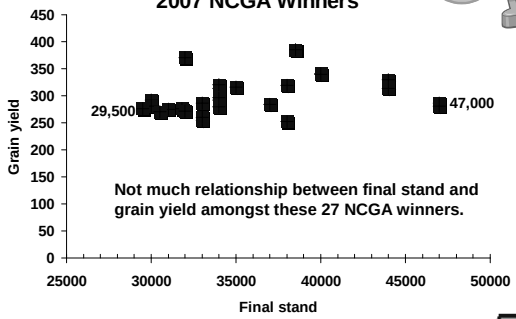
Grain Yield vs Final Stand 2007 NCGA Winners



Today's elite hybrids?

- Some claim that today's elite multiple biotech trait hybrids respond better to higher seeding rates than today's elite non-biotech hybrids.
  - However, there is little, if any, public data to support the claim.
  - Today's hybrids are simply more stress tolerant across the board than those of 20 years ago.

Seeding rate decisions…

- Are not influenced very much by hybrid.
- Today's hybrids in general have much better population tolerance than their predecessors.
  - Improved ability to maintain ear size at higher plant densities.
  - Less tendency to remobilize stored stalk carbohydrate reserves during stressful grain fill; thus less tendency for stalk lodging at higher plant densities.

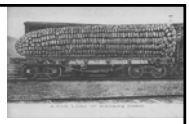
Image: http://ascannerdorky.files.wordpress.com/2007/07/balancing-act-001.jpg

Stalk health concern…

- Remains an issue for hybrids with moderate or worse stalk strength or stalk rot resistance.
- Such hybrids should be planted at more moderate seeding rates to minimize the risk of severe stalk lodging prior to harvest.

Image source: http://www.sil.si.edu/imagegalaxy/imageGalaxy_SearchResult.cfm

Bottom line w/ corn…



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