Profitable Corn Management Strategies & Production Practices

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Net income = (Yield \times price) - cost

- Increase net income by ...
  - Increasing yields
    - Also helps reduce production cost per bushel
  - Selling at higher price due to ...
    - Your marketing skills
    - Response to bad weather
    - Gov’t support
  - Reducing production costs
    - Cutting inputs directly or
    - Improving production cost efficiency
Cost efficiency requires ...

- Knowing your production costs
  - **WHAT** inputs were used
  - **QUANTITY** or input application rates
  - **UNIT COSTS** of inputs

- Applying or implementing inputs in a sound agronomic manner
Believe it or not ... 

Your neighbors do NOT keep detailed crop production records!

- Records are more likely to reside with their input supplier (esp. ag. chemicals) or crop consultant than with themselves.

- Consequently, most farmers do NOT know their production costs per bushel!
Furthermore ...

- Most of your neighbors do NOT intentionally plan to achieve a targeted rate of return on their investment!
- They don’t know what minimal market price, yield or production cost is required to assure a desired rate of return.
I’m not an economist ...

- But, it seems to me that it is hard to begin the process of fine-tuning production costs if you do not know what those costs are!
Input costs for Illinois farms

Source: http://web.aces.uiuc.edu/fbfm/results.htm

**Projected 2002 Costs**

<table>
<thead>
<tr>
<th>Variable cost per acre</th>
<th>Fertility</th>
<th>Pesticides</th>
<th>Seed</th>
<th>Drying</th>
<th>Machinery</th>
</tr>
</thead>
<tbody>
<tr>
<td>South</td>
<td>54</td>
<td>33</td>
<td>34</td>
<td>8</td>
<td>30</td>
</tr>
</tbody>
</table>

Source:
http://web.aces.uiuc.edu/fbfm/results.htm
A Crop Record-Keeping Tool

- “WinMax” software from Purdue
  - Manages crop input data, generates production cost and nutrient management worksheets, and allows sets of custom input costs to be created and used in all calculations.

Download Ver. 2.02 from the Web at:
http://www.agry.purdue.edu/max
WinMax capabilities ... 

- Various management options, such as tillage, pest control and fertilizer strategies, can be compared to help assess which practices are both economically efficient and environmentally sound.
Topics for discussion

- Nitrogen management
- P & K fertilizer mgmt
- Starter fertilizer mgmt
- Lime & micronutrients
- Stand establishment
- Weed & insect control
- Hybrid selection & Seeding rates
- Stalk rots & lodging
A Fact of Life...

“A young field of corn can look pretty darn uniform from the seat of your pickup tooling down the blacktop.”

-- Bob Nielsen
We’ve known for years...

- Variable stands of corn are costly in terms of bushels and lost revenue.

1920

2002


Image source: http://www.kinzemfg.com
Variable stands may be ...

- Plant spacing variability (PSV)
  - How uniformly were the seeds distributed within the row by the planter?
Consequences of variability

- Variable plant spacing
  - Yield losses for many of you in this room today are probably in the neighborhood of 5 to 7.5 bushels per acre or greater
  - 3 to 5 percent at 150 bu yield level
What causes variability?

- Germination of the seed
  - The germination of the seed we plant is rarely 100 percent.
    - Consequently, some larger than desired spacings will always occur.
  - Usually of little consequence.
What causes variability?

- Planter malfunction...
  - Worn out planter parts
    - Including seed meter
  - Incorrect planter settings & adjustments
  - Operator error
  - Excessive planting speed
    - Effect on singulation
    - Effect on seed travel
Variable stands can also be..

- Variability for time of seedling emergence throughout the field
Why is uniform desirable?

- Delayed plants cannot compete with older, more established plants.
  - At best, delayed emergers will contribute little to yield.

- Potential yield losses...
  - 8 to 20 % loss if 25 % or more of stand is 2 or more leaf stages “behind”
    - Univ. of IL data
Causes of delayed emergence...

- Variability in soil moisture
  - Soil variability for texture and natural or artificial drainage
  - Uneven seeding depths
  - Uneven distribution of crop residues
  - Soil drying patterns due to tillage traffic
Causes of delayed emergence...

- Variability in soil temperature
  - Variable soil color and texture
  - Variable seeding depths
  - Variable distribution of crop residues

- Especially important when soil temps. are hovering around 50F.
Causes of delayed emergence...

- Uneven seed to soil contact
  - Rough, cloddy seedbeds
  - Rocky seedbeds
  - Uneven distribution of crop residues
  - Coulter running too deep
  - Incorrect furrow openers adjustment
  - Incorrect furrow closers adjustment
The bad news is ...

- Yield loss from uneven stand establishment in corn begins as early as the day you plant!
  - Uneven plant spacing
  - Uneven emergence

- The combined yield loss can easily be as great as 7 to 15 bushels per acre.
The good news ...

- Adjustments and repairs to planters coupled with proper operation can easily prevent these losses from occurring.
  - Offseason care of planter
  - Servicing or replacing worn parts
  - Making planter adjustments and operating the planter as soil & weather conditions dictate

For more information, see my article on the Web:
Variable Inputs:

Fertilizer & lime ...

- Publication E-2567
  - THE source for fertilizer recommendations for Indiana, Michigan, and Ohio
  - Available from your local county Extension office

Also on the Web at:
http://www.agcom.purdue.edu/AgCom/Pubs/AY/AY-9-32.pdf
Nitrogen application rates

- Use reasonable N rates
  - Based on realistic yield goal
    - Five-year running average probably okay
    - Not 20 bushels more than that!
  - Aim for about 1 lb of applied N per bushel if in corn/soy rotation
    - Or about 1.2 lbs x goal if corn/corn
These N rates are accurate ...

- When all the applied nitrogen is used by the plant,
- But we know that some of the nitrogen we apply to a field is lost to the environment ...

**In other words:**

Nitrogen use efficiency varies from year to year and field to field.
Nitrogen use efficiency

- Nitrogen use efficiency is the balance between that used by plants vs. that lost to the environment.
  - Nitrogen use efficiency is greatest when all other stresses are minimal.
    - Therefore, manage all aspects of the crop to the best of your ability to minimize stress to the crop throughout the season.
  - Recognize there is no single universal way to apply nitrogen fertilizer for maximum crop use efficiency.
How do we lose nitrogen?

- Leaching of nitrate N
  - esp. coarse-textured soils
- Denitrification of nitrate N
  - Microbial action in saturated, poorly drained, low oxygen soils
- Surface volatilization of ammonia gas
  - Microbial action on surface-applied urea-containing fertilizers that have not been incorporated

How to minimize N loss potential?

First, understand the mechanisms.
Leaching of nitrate-N

- Risk is greatest on sandier soils
- Nitrate-containing fertilizers are at risk as soon as they are applied
  - Ammonium nitrate, UAN solutions
- Urea quickly converts to nitrate
  - Typically less than 2 weeks in spring
- Anhydrous slowest to convert to nitrate
Denitrification of nitrate-N

- Nitrate $\rightarrow$ N gas
  - Driven by soil microbes
  - Occurs in saturated soils, especially when soil temperatures are 50°F or greater
- Poorly drained, heavy soils are most at risk from denitrification
- Relative risk of N sources same as for leaching potential
Volatilization of ammonia-N

- Urea → ammonia → volatilize
  - Driven by urease enzymes in plant residue
- Susceptible forms of N fertilizer
  - Urea or N solutions surface-applied without incorporation, esp. hi-residue systems
- Risk of loss greatest with
  - Warm, sunny days after application
  - Soil pH greater than 6.5
Also consider decomposition

- Surface-applied N is used by microbes for the decomposition of plant residue.
  - Especially meaningful for no-till systems
  - Consequently, lengthens time before the N is available to this year’s crop

- “Tie-up” of nitrogen by decomposition in corn/corn rotation may also account for part of the “N credit” of a corn/soy rotation.
Alternate forms of N fertilizer

- Anhydrous ammonia
- UAN solutions
- Urea
- Ammonium sulfate
- Ammonium nitrate
- Manures
- Sewage sludge
Anhydrous Ammonia (82% N)

- Slowest to convert to nitrate
  - Consequently, slowest to denitrify or leach
- Must be injected
  - Consequently, no loss to volatilization
  - Can result in erosion on steep slopes
UAN Solutions (28 – 32% N)

- Nitrate portion subject to immediate denitrification and leaching
- Urea portion subject to volatilization
- Applying in concentrated band on surface preferred over broadcast
- Injecting UAN most desirable application method
Urea (46% N)

- Subject to surface volatilization
  - Applying in concentrated band on surface preferred over broadcast
  - Incorporating urea most desirable
- Converts quickly (2 weeks) to nitrate
  - Thereafter subject to denitrification and leaching
Ammonium Sulfate (21% N)

- Little to no surface volatilization
- Ammonium converts quickly to nitrate
  - Subject to denitrification and leaching
- Good source of sulphur, if needed
- BUT, is also the most acidifying form of N fertilizer
Ammonium Nitrate (34% N)

- Little to no surface volatilization
- Nitrate portion subject to immediate denitrification and leaching
- Ammonium converts quickly to nitrate
  - Subject to denitrification and leaching
Pre-Plant Weed ‘n Feed N

- Common practice, but remember that surface-applied UAN is susceptible to significant N loss due to volatilization and tie up by trash
  - Urease inhibitor offers some protection from N volatilization
- Bottom Line: Potentially an inefficient method of applying fertilizer N
Preplant N or sidedress N?

- Sidedressed N is more efficient in the long run than preplant N applications.
  - Less time available prior to crop N uptake for N loss to occur due to leaching or denitrification
    - Esp. important for coarse textured soils (leaching) and poorly drained soils (denitrification)
  - Consequently, sidedress N application rates can be lowered up to 10 percent
Managing manure apps’s

- Folks tell me that I don’t know crap about manure, so...

- Check out Purdue’s Manure Management Planner software
  - A Windows-based computer program used to create manure management plans for crop and animal feeding operations

Download Ver. 0.14 from the Web at: http://www.agry.purdue.edu/mmp/
P & K fertilizer philosophy:

Feed & buildup levels

Recommended rates intended to feed crop & buildup soil levels toward the critical soil test level.

Soils testing less than critical level cannot provide the necessary nutrients to sustain crop growth.
P & K fertilizer philosophy:

**Maintenance levels**

<table>
<thead>
<tr>
<th>Soil test level</th>
<th>Critical level</th>
<th>Maintenance rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Recommended rates intended to simply replace what crop removes. No yield response to applied fertilizer is expected at these soil test levels.</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>Soils testing at or above critical level can provide all the necessary nutrients to sustain crop growth.</td>
<td></td>
</tr>
</tbody>
</table>
P & K fertilizer philosophy:

**Drawdown levels**

Soils testing above maintenance limit simply contain excessive nutrients relative to plant growth.

Recommended rates decrease with increase in soil test levels, until eventually zero amounts are called for.

- **Maintenance limit**
- **Drawdown rates**

**Soil test level**

- Low
- High
Summary

P & K fertilizer philosophy:

Soil test level

Recommended rate

Critical level

Maintenance limit

Buildup

Maintenance

Drawdown

Low

High

Soil test level
### Critical soil test levels for corn and soybean.

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>Ppm</th>
<th>Lbs/ac</th>
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<tbody>
<tr>
<td>K at CEC</td>
<td>5</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>88</td>
<td>175</td>
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<td></td>
<td></td>
<td>150</td>
<td>300</td>
</tr>
</tbody>
</table>

Variable rate P & K ...

- Where within-field variability for soil P or K levels ranges above and below the critical levels, variable rate application may be profitable.

- If within-field variability exists, but all above critical level, then VR application will be of little use.
Starter fertilizer ...

- Success with starter fertilizer means
  - Maximizing the probability of getting a response and
  - Maximizing the potential size of the response if it occurs

- Aim for biggest bang for the fertilizer dollar
Starter fert. decisions ...

- High soil P & K + warm seedbed

- Probability of yield response to starter is low and
- Size of expected response is low, so ...
- Little yield risk if decision to forego the use of starter
Starter fert. decisions ...

- High soil P & K, but cold, crappy conditions for germination and seedling growth

- Probability of yield response to starter P & K is low but
- Probability of yield response to starter N is high, so
- Use starter N and aim for no less than 20 lbs N per acre
Starter fert. decisions ...

- Low soil P + cold, crappy conditions for germination and seedling growth

- Probability of yield response to starter P and N is high, so
- Apply N-P mix but still aim for no less than 20 lbs starter N per acre
2 x 2 versus “popup” ...

- Salt content of N and K fertilizers can injure seed or seedling if rates are too high.
  - Rates of “popup” starter fertilizers limited by this risk to not much more than 5 to 8 lbs per acre of actual N + K
  - Higher allowable (safe) rates with 2 by 2 equals greater opportunity for yield response.
Lime application ...

- Can be a profit-maker
  - Especially when pH levels are less than 6.0
- One of few opportunities for intensive soil sampling and variable rate technology to return profit to farmer
  - Identify and apply lime to particularly low pH areas of field, no application to areas of field with acceptable pH levels.
Soil pH variability ...

Example of pH variability in a 30 acre field in Tippecanoe Co.
Secondary & micro-nutrients

- Profit margin for the dealer is more certain than for most Indiana farmers
  - MOST Indiana crop land can supply adequate levels of secondary or micronutrients.
  - Use both soil test AND plant tissue analysis to develop recommendations
    - Because most soil tests correlate poorly to response in the field
- Ditto for “root enhancers”
Weed control ...

- Healthy crops compete well with weeds.
  - i.e., Use solid agronomic practices
  - Aim for uniform stands of vigorously growing plants

- Common sense = Timely weed control
  - Follow weed size suggestions on label.

“Big weeds were once small!”
--T. Jordan, Purdue Univ.
Weed control ...

- An overall good weed reference Web site:
  
  **Iowa State Univ. Weed Science Online**: http://www.weeds.iastate.edu/

- Choose cost-effective chemicals
  - Often is a wide range of costs among chemicals that are rated fairly equal in effectiveness
  - The **WeedSOFT®** software program is a new tool.
WeedSOFT®

- A biology- and economics-based weed management decision support tool for crop managers.
- Partner states include:
  - Nebraska (project coordinator)
  - Indiana, Illinois, Missouri, Michigan, Kansas, Wisconsin
WeedSOFT® Modules

Available in Indiana version

Bioeconomic Decision

Weed Identification

Groundwater Risk Assessment

Groundwater Vulnerability
Indiana WeedSOFT®

- Available in 2003 on CD-Rom
  - Initial price $195
  - Yearly updates will be ~ $35
- Demo CD available for $10
  - Designed to give user a feel for how the software operates and not designed to be a decision aid
    - Fewer weed options & herbicide treatments
- WeedSOFT® website for info and ordering:
  - http://weedsoft.unl.edu
Insecticide use...

- Soil insecticides (WCR) - 1st yr corn
  - NW Indiana, NE Illinois: Probably YES
  - Elsewhere (SW Indiana?): Maybe, IF:
    - Your experience includes frequent problem with wireworm, seedcorn maggot, white grub, etc.
    - Monitoring of WCR beetles in last year’s soybean fields exceeded threshold levels
      - Five or more beetles trapped per day

Monitoring and Decision Rules for Western Corn Rootworm Beetles in Soybean:
http://www.entm.purdue.edu/entomology/ext/targets/e-series/EseriesPDF/E-218.htm
Insecticide use...

- Soil insecticides (BCW, FAW, etc.)
  - Is not a good IPM practice for such critters that arrive by air from winter hideaways to the south of Indiana.

- Insecticide seed trtmts (Gaucho, etc.)
  - Do you need soil insecticide for CRW?
  - Do you frequently suffer from wireworm, seedcorn maggot, etc.?
Perfect hybrids do not exist!

- Else there wouldn’t be so many hybrids for sale in the marketplace
- Corn’s genetic yield potential is great!
  - Physiological est’s as high as 600 bu/ac
  - Francis Childs, IA, 500+ bu/ac
- Harvested yield is influenced by many factors
  - Disease, insects, weeds, fertility, your management, soils, weather
  - Genetics interacts with most of these factors
How to choose hybrids wisely?

- Commercial advertising?
  - Radio, TV, magazines, newspapers
- Sales literature?
- Sales pitches from seed dealer?
- Testimonials?
- Comparative yield performance data
  - My personal favorite
Yield performance data

- Many possible sources:
  - Seed company summaries
  - Yield contest summaries
  - County test plots
  - Your test plots
  - University trials
Seed company summaries

- Number of test locations can be quite large *(a strong advantage)*
- Comparisons with competitor hybrids often limited in number *(no surprise)*
- Tend to favor their hybrids over competitors *(no surprise)*
- Are probably the best information source for that particular company’s hybrids *(makes sense)*
- Side-by-side comparisons commonly used technique *(has limitations)*
Yield contest summaries

- Farmers “win” with a particular hybrid and set of management practices.
- Such contests are not meant for comparative hybrid performance.
  - How often a hybrid is associated with winning contest yields can be influenced by how actively the seed company promotes the hybrid among contestants.
County test plots

- The number of test locations is usually limited to a small number within the county.
- Hybrid entries are often chosen by local sales reps.
- Hybrid entries are often not repeated more than one year.
- Number of companies represented can range from few to many.
Your test plots

- Number of test locations = 1
- Number of hybrid entries often limited
- Hybrids entered into test are some combination of your choices and seed rep’s recommendations
- Perception of value to testing on YOUR soils using YOUR management practices
University trials

- No vested interest in which hybrids win
- No. of locations typically fewer than those in seed co. trials, but more than county trials.
- No. of companies in trial is typically quite large
  - No. of hybrids per company per zone usually small
  - Hybrids entered into trials are usually the choice of the seed company
- Multi-year hybrid data are usually available

Purdue Variety Trials:
http://www.agry.purdue.edu/ext/variety.htm
Bottom line?

- There is no single perfect method for selecting corn hybrids that will perform consistently well in your farming operation.

- Choosing hybrids wisely requires a lot of searching for yield data and a lot of homework “massaging” the data to make sense out of it.
Dumb hybrid decision-making

- Simply because it’s cheap.
- Simply because it’s new.
- Simply because it’s biotech.
- Simply because it’s the one the company has the most bags of in the warehouse.
- Simply because it’s genetically different from the other one you bought.
- Simply because you trust the seed rep.
Smart hybrid decision-making

- Look for hybrids that yield consistently well across a diverse set of conditions, especially weather and disease.
  - That is to say, you are looking for hybrids with high yield and low G x E.
What is G x E ????

**Genotype by Environment**

- Describes the common fact that hybrids (genotypes) often respond (or interact) differently to different environments
  - Soils,
  - Diseases,
  - Insects,
  - Fertility,

- and especially **weather**
G x E illustrated...

Hybrids often respond differently to yield influencing factors.

Four hypothetical hybrids

Which hybrid would you want?
Another G x E example ...

Purdue Univ. Hybrid Performance Trials, 1999-2000
Central locations

35 hybrids in common, 1999-2000

Hybrids of interest to me!

If zero G x E

#2 in 1999
#33 in 2000

#34 in 1999
#7 in 2000
Identifying G x E ...

- Identifying high yielding hybrids with low G x E requires data, data and more data from many environments summarized in a way that is easy to interpret.
  - Do not place HIGH priority on hybrid performance on your farm.
  - Performance in 1 environment does not predict the future accurately.
Locations vs. years ...

- You and I don’t have time to test hybrids for 10 years to determine their stability to weather patterns.
  - Multiple locations can be substituted for multiple years to achieve the same goal.
  - Multiple test locations will also increase the diversity of pest situations encountered by the hybrids in the trial.
So, you see ...

- Seed companies benefit greatly from all of those on-farm hybrid trials that you all participate in.
  - Hundreds of test plots per year.
  - Hundreds of weather patterns per year.
  - Hundreds of disease situations per year.
- If you concentrate primarily on your farm’s results, you miss out on these benefits!
Your challenge ...

- Obtain hybrid performance data from multiple test locations.
  - Esp. datasets with large groups of hybrids in common across multiple locations
  - Emphasize locations within your latitude or hybrid ‘adaptation zone’, but don’t be hesitant to use data outside of your ‘zone’.
Think outside the box...

e.g., If in central Indiana, okay to use nearest central OH or IL data. If in northern Indiana, okay to use southern MI data.

Links to other university variety testing programs can be found at:

**North Central Crop Evaluation Committee:**
http://www.ksu.edu/kscpt/nccec/
Identify consistent performers

- Several selection criteria to consider...
  - Consistently within the upper group of hybrids as determined by a trial’s L.S.D. value.
  - Consistently within 5 to 10% of the maximum yield in a trial.
  - Consistently greater than 5% above the average yield of a trial.

The latter two are also options for trials where statistical analyses are not conducted.
After identifying hybrids...

- Eliminate hybrids with weaknesses for specific traits important to your farming operation.
  - e.g., gray leaf spot tolerance, root & stalk strength, emergence vigor, etc.
  - Info about hybrid characteristics can be found on many seed company Web sites.

Links to Seed Company Web Sites:
http://www.agry.purdue.edu/links/national/commercial-ag.htm
Avoid ...

- Single location-Single year trials
  
  - Not enough data to predict stability of hybrid performance across a range of growing conditions.
  
  - This is why you should not place a lot of faith in the ability of your own on-farm testing to predict a hybrid’s yielding ability in the future.
Avoid ...

- Side-by-side comparisons, unless they are between pairs of hybrids you’ve already identified as being top yielders.

  - In other words, just because my hybrid outyields your hybrid in 12,089 side-by-side comparisons across 10 states, does not mean that either hybrid is the best performer in the marketplace!
Avoid …

- Hybrids without documented comparative yield performance data over multiple locations
  - Don’t buy on advertising or price alone!
- “Percent wins against the competition”
  - The “competition” is often a “bunch” of unidentified hybrids that could be “dogs” for all you know.
  - What you need to know is the “percent wins” against the BEST of the competition!
Transgenic crop issues

- The “GMO” debate continues.
- Recognize that current transgenic crops are not critical for the agronomic success of most Indiana corn/soy operations.
- Impact on farmer is determined by the stance taken by the grain buyer.
  - Farmer’s choice to grow or not ultimately depends on his/her perception of the market uncertainties for sale of the crop.
Specialty grains?

- Producing specialty-trait grains will not guarantee increased profits.
  - A survey by Indiana Prairie Farmer magazine (Feb. 2000) indicated 1 out of 4 specialty grain producers reported above average profitability.
- Capturing premiums most likely for those who identify the opportunity early
  - Challenge is knowing when to move on to the next specialty grain opportunity
Specialty grains require ...

- Market or contract (for cash grain)
- Yielding ability competitive with “normals” or an exceptional market premium
- Good grain handling skills on your part
  - Grain quality is usually very important to buyer
- Often, ability & willingness to
  - harvest on demand or on schedule of buyer
  - store grain on-farm in an identity-preserved fashion
  - deliver grain on demand or on schedule of buyer
Specialty Grains Information

- Illinois Specialty Farm Products:
  - http://web.aces.uiuc.edu/value/

- Specialty Corns for Value-Added Grain Production:
  - http://www.ag.ohio-state.edu/~hocorn/
Specialty Trait Hybrids…

- Often more complex to evaluate than normal hybrids. You need to know...
  - Performance compared to other hybrids with similar trait, if others exist.
  - Grain yield, output trait “yield” or quality, and other important characteristics.
  - Finding comparative data in public or private trial reports may be difficult.
Specialty Trait Hybrids:

Also should determine...

- Performance compared to the best “normal” hybrids in the marketplace.
  - Yield & other important characteristics relative to economics of adopting specialty trait versus “normal” no. 2 yellow dent hybrids.
  - Comparison to “normal” version of same hybrid not as important.
  - Finding comparative data in public or private trial reports may be difficult.
Comparison to “normals”

- Compare the best specialty hybrids in a trial with the best normal hybrids.
  - University trials work well for this, assuming that companies enter the best hybrids of these traits in the trials.
  - This strategy is useful for comparing...
    - Bt vs. non-Bt hybrids
    - RR vs. non-RR hybrids
    - Waxy vs. normal starch hybrids
Wise hybrid selection...

- Requires a lot of research & homework.
- Can be challenging because multiple location performance data are often difficult to obtain.
- Can be challenging because performance data often require further analysis & scrutiny.
- Can improve net profits due to higher and more consistent hybrid yields on your farm.

In Conclusion:
Corn plant density

- Optimum plant density is generally equal to that which results in about 95% capture of available sunlight.
  - Beyond that degree of crop canopy development, little additional sunlight is captured and little additional grain dry matter is produced.
Seeding rate issues ... 

- Hybrid
  - Crop canopy
  - Stalk health
  - Ear “flex”
- Stand establishment conditions
  - Wet & cold versus dry & warm
  - Pests & diseases
- Soil factors
  - Water holding capacity & drainage
- Yield level probably best predictor of optimum seeding rate...
Corn seeding rates

Plants or seeds per acre

<table>
<thead>
<tr>
<th>Yield level (bu/ac)</th>
<th>Plants or seeds per acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;125</td>
<td>30,000</td>
</tr>
<tr>
<td>100-125</td>
<td>25,000</td>
</tr>
<tr>
<td>&lt; 100</td>
<td>20,000</td>
</tr>
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</table>

Source: Industry & univ. research
Variable rate seeding...

- Requires spatial yield variability that
  - Is consistent over years.
    - Not always the situation
  - Includes marginal soils that consistently yield less than 100 to 125 bushels per acre
    - If yield variability is all greater than 125 bu, then VR seeding offers little advantage
- Effect on yield will be negligible, but
  - Opportunity for lower seed cost in marginal soils
Stalk rots & lodging in corn

- Several fungi often involved
  - All are part of the complex of microorganisms in the soil that decompose dead plant material.
  - Survive from one season to the next in
    - The soil, or
    - Infested corn plant residues

Image Source: RLNielsen
Entry into the corn plant

- Fungal spores blown into base of leaf sheath germinate and grow directly into the stalk tissue
- Fungal spores enter directly through wounds (hail, ECB, mechanical injury)
- Infect root system directly, causing root rot, later stalk rot

Image Source: RLNielsen
A disease of ‘old age’

- Fungi typically don’t infect corn at early stages of development.
  - Yet, fungi are present in soil and plant residues 12 months out of the year.
- Rather, develop at mid-to late grain fill stages
  - Early August to early September
Why ‘old age’ disease?

- Young, healthy roots and stalks are fairly resistant to fungal infection.
- Susceptibility to rots increases as ...
  - Cell maintenance & repair diminishes due to lack of carbohydrate replenishment
  - Carbohydrates remobilize from stalk tissue to fulfill demands of developing ear
  - The incidence of both increases during the course of grain fill
Photosynthetic stresses

- Any plant stress occurring any time during the season can affect the photosynthetic productivity of the plant ‘factory’ during the important grain fill period.
  - Especially stresses that occur during grain fill...
What kind of plant stresses?

- Hail damage
- Excessively dry soils
- Excessively wet soils
- Periods of cloudy weather
- European or SW Corn Borer
- Leaf diseases
  - Gray leaf spot, anthracnose, NCLB
- High yield potential itself
Minimizing risk of stalk rots

- Hybrid selection
  - ‘Stay-green’ trait infers less cannibalization
  - Stalk strength characteristics
  - Disease tolerance, esp. leaf diseases
  - Bt trait where ECB or SWCB are prevalent
  - Stress tolerance in general
  - Avoid excessively high populations
Minimizing risk of stalk rots

- Minimize risk of stress
  - Always use best agronomic practices
  - Avoid/alleviate soil compaction
  - Avoid nutrient deficiencies
  - Attend church regularly!
- Avoid continuous corn rotation
  - Residue conducive for inoculum development
- Use tillage where appropriate
  - Esp. helps avoid diplodia and anthracnose

Image Source: RL Nielsen
Late-season scouting

- Beginning in early August, scout fields or areas within fields that are likely to be at high risk for stalk rots
  - Susceptible hybrids
  - Severe drought or soggy soil stress
  - Severe nutrient deficiency
  - Severe hail damage
  - Severe insect or leaf disease infestations
  - Exceptionally high yields
Late-season scouting

- Pinch or slice lower stalks for evidence of disintegrating stalk tissue
- Dig up plants and inspect roots for health and integrity
- Schedule high risk fields for early harvest
- Continue scouting during harvest
  - Stalk health condition can change rapidly
    - Gibberella stalk rot exploded during 2001 October rainy period
Stay on top of things ...

- University pest & crop newsletters
  - Purdue, Ohio State, Kentucky, Illinois, Michigan State, Ontario

- Printed versions or free on the Web at:
  - http://www.kingcorn.org/cale
Stay on top of things ...

- Identify & diagnose problems early!
  - Early detection & diagnosis may allow you to correct the problem this year
    - Get help from county CES educators, campus specialists, crop consultants, industry agronomists
  - Avoid post-mortems at harvest-time
    - Often impossible to accurately diagnose causes of crop problems late in the season