Selecting Hybrids Wisely

Bob Nielsen
Purdue University
Email: rnielsen@purdue.edu
Web: www.kingcorn.org
Corn is a GMO!

First of all, let’s admit that…

Genetic modification of corn has been occurring for thousands of years.
- Center of origin = Mexico, central America
- Earliest plant breeders = women
- Genetic modification the old-fashioned way: Hard work!

Now, genetic modification is possible using fancier tools than ever before.
- Including the transfer of genes from other living species into corn.
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 no. 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 method that is easy or perfect 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**
Hybrids often respond differently to yield influencing factors.

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

35 hybrids in common, 1999-2000

Hybrids of interest to me!

#2 in 1999
#3 in 2000

#34 in 1999
#7 in 2000

If zero G x E

Purdue Univ. Hybrid Performance Trials, 1999-2000
Central locations
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/
Hybrid Selection Strategy:

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.
An illustration of identifying consistent performers:

Percent of maximum yield ...

Hybrid:Max Ratio = Indiv hybrid yld divided by max yld in trial

Higher G x E

Low G x E + higher performance

Low G x E, but also lower performance

Higher G x E

Purdue Corn Performance Trials, Central Zone, Medium Maturity Hybrids, 2001-2002 (28 hybrids in common both years)
You can be more selective…

Hybrid:Max Ratio = Indiv hybrid yld divided by max yld in trial

94% of max yld or greater:

Purdue Corn Performance Trials, Central Zone, Medium Maturity Hybrids, 2001-2002 (28 hybrids in common both years)
You can be more liberal...

Hybrid:Max Ratio = Indiv hybrid yld divided by max yld in trial

90 % of max yld or greater:

Purdue Corn Performance Trials, Central Zone, Medium Maturity Hybrids, 2001-2002 (28 hybrids in common both years)
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!
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.
Comparing Specialty Hybrids w/ Normal Hybrids:

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
Yield Comparisons of Top 5 non-Bt and Bt Hybrids
Purdue Corn Performance Trials, 1999

Average yield difference for Bt hybrids = -2.0%

Example of Best vs. Best Strategy:

<table>
<thead>
<tr>
<th>Region</th>
<th>Non-Bt</th>
<th>Bt</th>
</tr>
</thead>
<tbody>
<tr>
<td>North-Hi</td>
<td>153</td>
<td>149</td>
</tr>
<tr>
<td>Central-Hi</td>
<td>202</td>
<td>202</td>
</tr>
<tr>
<td>South-Hi</td>
<td>213</td>
<td>204</td>
</tr>
<tr>
<td>North</td>
<td>143</td>
<td>139</td>
</tr>
<tr>
<td>Central</td>
<td>191</td>
<td>192</td>
</tr>
<tr>
<td>South</td>
<td>200</td>
<td>194</td>
</tr>
</tbody>
</table>

Average yield difference for Bt hybrids = -2.0%
Yield Comparisons of Top 5 non-Bt and Bt Hybrids
Purdue Corn Performance Trials, 2000

Average yield difference for Bt hybrids = -7.1%

1/ South trial = Average of 3 hybrids only.
Yield Comparisons of Top 5 non-Bt and Bt Hybrids
Purdue Corn Performance Trials, 2002

Average yield difference for Bt hybrids = -5.1%

1/ Northern early maturity trial = Average of 4 hybrids only.
In Conclusion:

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.