Corn hybrid selection and use

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The focus of most seed companies
Corn silage: Major crop for dairy farmers, minor one for seed companies

- Less than 7% of U.S. corn acreage is harvested for silage. 2011: 91 million corn acres, 6.6% for silage. 2012: 96 million acres.

- Some of the 6-7% is planted for grain but harvested for silage because of drought, maturity problems, etc.

- Therefore, the true market for seed corn *planted for silage* is about 5%, limiting most seed companies’ interest in breeding silage-only hybrids. (Follow the money.)
Relationship between corn forage *in vitro* true digestibility and era of release for whole-plant and stover.
Conventional hybrids
Conventional hybrids

- Intended primarily for grain harvest. Usually only 5-8 % points difference in NDF-d between the top and bottom conventional hybrids in university silage trials.

- Some conventional hybrids have good digestibility, some do not. *Quality is primarily related to grain yield.*

- Rely on company and university trials to identify the best conventional hybrids. Much bigger % difference in yield than in fiber digestibility.
## 2010 Cornell University corn silage hybrid trials

<table>
<thead>
<tr>
<th>30-hr NDF-d</th>
<th>101-105 RM Cayuga</th>
<th>101-105 RM Livingston</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trial average</td>
<td>57</td>
<td>61</td>
</tr>
<tr>
<td>High</td>
<td>59</td>
<td>63</td>
</tr>
<tr>
<td>Low</td>
<td>53</td>
<td>58</td>
</tr>
<tr>
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</tr>
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<td>51</td>
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<td>47</td>
<td>45</td>
</tr>
<tr>
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Low NDF-d environment
2012 Cornell University corn silage hybrid trials

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High NDF-d environment
Leafy hybrids
Leafy corn silage in the field and in the cow

- University trials: No consistent yield, silage quality or milk production advantage.

- Some leafy hybrids have a slight advantage in "harvest window".

- Choose leafy hybrids based on how they do in university or other trials, not because of the leafy trait.
Why are leafy hybrids popular?

- Seed price and yield are similar to conventional hybrids.
- The extra leaves are at eye level, where farmers can see them.
- Leafy hybrids simply look great in the field.
- Leafies have sex appeal!
BMR corn is just different

• It looks different.

• It grows different.

• It tests different.

• Fiber fragility is different.

• It feeds different.

• Some say it even tastes different!
Brown midrib (BMR) hybrids

- Silage-only. Most BMR corn is sold by Mycogen Seeds, but Dupont-Pioneer and others have entered the market. A small but growing % of silage seed sales.

- A naturally-occurring mutation discovered in 1924. Incomplete lignin formation $\Rightarrow$ less lignin $\Rightarrow$ higher stalk digestibility.

- Much of the benefit is from *increased dry matter intake*; best with high corn silage diets and high-producing cows.
A new player in the BMR arena

- Dupont-Pioneer has one BMR hybrid, P1376XR, ~113 RM.

- BM-1 gene, while Mycogen and others use the BM-3 gene.

- Too early to gauge performance vs. BM-3 hybrids.
2011 Penn State trial results

- Mycogen F2F665 and Pioneer 1376XR were not significantly different in yield than the highest-yielding non-BMR hybrid in the trials.

- BMR yields differed greatly: Individual BMR hybrids varied from 59% to 94% of non-BMR yields.

- Hybrid selection is critical, and BMR hybrids are no exception.
2012 Penn State trial results

- Average of 2 sites: Pioneer 1376XR 17% lower yield, 3% higher milk/ton.

- Four Mycogen BMR hybrids averaged 17% lower yield, 2% lower milk/ton.

- Early season dry weather problems; low starch levels for Mycogen BMR hybrids.
2012 Cornell University corn silage hybrid trials

Average of three 91-95 RM trials, 4 replications each

<table>
<thead>
<tr>
<th>Hybrid</th>
<th>% DM</th>
<th>Yield, T/A@ 35% DM</th>
<th>30-hr NDF-d %</th>
<th>Starch %</th>
<th>Milk 2006 Lbs/ton</th>
<th>Milk 2006 Lbs/A</th>
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<tbody>
<tr>
<td>Trial ave.</td>
<td>38.0</td>
<td>19.9</td>
<td>63.1</td>
<td>36.3</td>
<td>3491</td>
<td>26517</td>
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<tr>
<td>BMR</td>
<td>35.7</td>
<td>18.2</td>
<td>69.9</td>
<td>33.5</td>
<td>3645</td>
<td>23233</td>
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It’s not all about NDF-d

2012 Cornell University 91-95 RM silage trial
One site, 4 replications

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<th>Milk 2006 lbs/A</th>
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<tr>
<td>Trial ave.</td>
<td>37.7</td>
<td>16.7</td>
<td>65.5</td>
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<td>20718</td>
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<tr>
<td>BMR</td>
<td>34.9</td>
<td>15.6</td>
<td>74.2</td>
<td>29.9</td>
<td>3543</td>
<td>19265</td>
</tr>
</tbody>
</table>

8.5” of rain 1 June through 31 August, including 1.7” in July
BMR hybrids do not like dry feet!
All BMR, all the time?

- A few high-producing herds—~30,000 herd average—have started growing all BMR corn silage.

- Primarily farms that irrigate or soils reliably well-supplied with moisture. BMR doesn’t like dry feet, and this more than any other factor may be the cause of lower yields.

- All-BMR ready for prime time? NO, not unless the corn is irrigated. Too much dry weather risk. Even then…
BMR and lodging problems
BMR and lodging problems

- Less lignin = *Potential* standability problems. We’ve had very few problems in the 8 years we’ve grown BMR corn at Miner Institute. Until mature, it bends but doesn’t break.

- **No** university data anywhere on standability of corn hybrids in silage trials—BMR or otherwise.

- Standability can be influenced by ear placement. Some Mycogen reps in California recommend moderately lower population because of long internodes and high ear placement due to rapid growth: 100°F + irrigation.
BMR vs. non-BMR corn silage
Average of 18 field and lactation trials
Leafy corn

BMR corn
Starch

Conventional vs. BMR

2012 World Ag Expo forage quality contest
30-hour NDF-d
Conventional vs. BMR

NDFd (30-hour)

- Conventional
- BMR

2012 World Ag Expo forage quality contest
Milk per ton
Conventional vs. BMR

Milk Per Ton (lb/ton)

Final Rank

2012 World Ag Expo forage quality contest
BMR hybrids in the feedbunk

- Positive milk responses even with cows milking over 100 lbs. Higher producing cows = greater milk response.

- Great feed for transition and fresh cows, pushes them to higher peak milk production.

- Relatively little benefit when fed to non-milking heifers and cows making less than 60-70 lbs.
BMR and transition cows

- Cornell Univ. research, conventional vs. BMR corn silage. 70 Holsteins paired for parity, production, etc. Diets included 47% CS pre-fresh, 41% CS post-fresh.

- Trial period: 3.5 weeks pre-fresh to 3.5 weeks post-fresh. Then all cows received conventional corn silage.

- BMR CS: +6% DMI pre-fresh, +11% DMI post-fresh.

- FCM production First 15 weeks post-fresh: BMR =106, conventional 99. (100 vs. 95 non-corrected)
BMR isn’t for all dairy farms

- Lower yield + higher seed cost makes BMR more expensive per ton of silage.

- Should be stored in a separate silo: Not cost-effective for non-milking heifers and low-producers.

- A good fit with herds large enough to have a silo for BMR corn silage. Silage bags are OK, especially (but not exclusively) for medium-size herds.

- Not good for most “one TMR” herds.
Mixing BMR and non-BMR hybrids in a field

- Delaware research suggests that you can mix BMR and non-BMR hybrids in a field.

- I don’t recommend this! Too many potential differences in yield, disease resistance, etc.

- Photo is fall 2012. BMR on the left of the picture. Northern Corn Leaf Blight.
Northern Corn Leaf Blight

• Note typical canoe-shaped lesions.

• Wide variability in hybrid resistance.

• Difficult to predict. Serious one year, not the next.
Over-the top fungicides for corn: A tough call

- University of Wisconsin: No consistent economic return from fungicide usage. Rely on genetic resistance via hybrid selection.

- University of Illinois: average of 7.6 bu/A response, 15-20 bu/A when the corn was under high disease pressure.

- Pioneer: On-farm trials over 5 years with 475 growers, average response 7.0 bu/A.

- Pennsylvania: Farmers there routinely spray BMR with fungicide, convinced it’s economical. (NCLB).
Conditions favoring fungicides

- Hybrids with poor disease resistance (Northern corn leaf blight). BMR reportedly has poor NLCB resistance.

- Fields with high residue—notill, strip till. (Corn silage leaves very little residue.)

- Extended warm, humid growing conditions.

- High plant populations—poor air circulation. Narrow rows? Perhaps, but no data.
Fungicide economics

- Fungicide + application cost = ~$30/acre.

- If corn silage is worth at least $40/ton, a 1 ton/acre response will more than pay for a fungicide application.

- 7 Bu/acre = about 1 ton corn silage.

- Very little data on fungicide use on corn silage.
Some notable “corn dogs”

<table>
<thead>
<tr>
<th>State university trial</th>
<th>Dog of the trial</th>
<th>Top-yielding hybrid</th>
<th>Trial average</th>
<th>Dog % of top hybrid</th>
<th>Dog % of trial average</th>
</tr>
</thead>
<tbody>
<tr>
<td>NY</td>
<td>13.0</td>
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<td>17.4</td>
<td>64</td>
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<tr>
<td>NY</td>
<td>16.6</td>
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<td>62</td>
<td>72</td>
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<tr>
<td>NY</td>
<td>14.8</td>
<td>21.5</td>
<td>25.3</td>
<td>58</td>
<td>69</td>
</tr>
<tr>
<td>Michigan</td>
<td>15.1</td>
<td>23.3</td>
<td>20.6</td>
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<tr>
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<td>Averages</td>
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Kernel texture

Flinty (hard)  Floury (soft)
Kernel texture in corn silage

- Lots of discussion about the impact of kernel texture in corn silage. Soft (floury) vs. hard (vitreous).

- Some recommend hybrids with soft kernel texture. Not a lot of floury kernel texture hybrids on the market. And anyway…

- …kernel texture appears to be of little importance in corn silage, especially when harvested at recommended DM levels of 32-35%. However, opinions differ!
Recent research data on kernel texture

- **University of Wisconsin:** Until whole plant DM is over 35%, there’s very little difference in starch digestibility due to kernel texture.

- Ruminal starch availability doesn’t start to decline until the kernel approaches black layer—a stage nobody recommends for silage harvest.

- **Ohio State University:** Regardless of kernel texture, starch digestibility is at least 96% in well-fermented corn silage and HMC. Vitreous hybrids may actually be better because of higher grain yield!
Corn hybrids for silage: Summary

- Don’t assume that the newest hybrids have better NDF-d; they probably don’t. Rely on trial data.

- Improvements in conventional hybrids have mostly been in the ear, not the stalk.

- Leafy hybrids are an option if they have high yield and acceptable digestibility.

- BMR: Not for all farms, not for all cows. Should be stored in a separate silo. Topnotch field and herd management a must. *BMR makes cows milk.*
Effect of maturity on corn silage dry matter digestibility

<table>
<thead>
<tr>
<th>Maturity Level</th>
<th>DM Digestibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>50</td>
<td>29% DM</td>
</tr>
<tr>
<td>55</td>
<td>34% DM</td>
</tr>
<tr>
<td>60</td>
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</tr>
<tr>
<td>70</td>
<td></td>
</tr>
<tr>
<td>75</td>
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</table>

God gives man all earth to dwell
But because man's heart is small
Ordains for each one spot
Shall prove beloved over all

Rudyard Kipling