Silage Hybrid testing at Penn State

- Began evaluations in mid 1990's
- Sabbatical leave at Miner Institute in 2000
- Revamped Penn State program in 2001
- Steady growth through the years
- Sabbatical in 2016 to visit other programs

Overall goals of our program

- Test hybrids
- Improve Characterization Methods
- Broaden Collaborations
- Develop Funding for Assessments
- Provide Roadmap for the Future

Penn State testing program

- Partner with Professional Dairy Managers of Pennsylvania
  - Provide input w/advisory team
  - Solicit hybrids
  - Develop initiatives
Laboratory Partner

- Provides insights into analytical issues and trends in the industry
- Help to work toward some consistency in evaluation and interpretation

Leadership Team

- Provides insights into analytical issues and trends in the industry
- Helps to work toward some consistency in evaluation and interpretation

Evaluation Program Principles

- Replicated, multiple environment evaluations
- Sort hybrids by DM within test
- Provide maturity subcategories at each location
- Conduct tests under typical crop conditions
- Conduct separate test for BMRs
- Report data to producers by November 1

2016 PDMP/PSU Silage Hybrid Evaluation Program

- Evaluated 163 hybrids
  - 88-94 d RM (4)
  - 95-103 d RM (20)
  - 98-111 d RM (40)
  - 104-111 RM/SC PA (33)
  - 111-115 d RM (36)
  - 116-120 d RM (16)
- Nine locations
  - Blair (2), Bradford (2), Cambria Centre, Franklin, Lancaster (2), and Chester Counties
- Three replications at each site
- Separate BMR evaluation at 3 locations (5)
Advisory Board Inputs

- Do hybrids vary in starch digestibility?
- Should we be evaluating fiber digestibility in more detail such as uNDF?
- Are there alternatives to Milk 2006?
Sabbatical II-2015/16

- Visited other silage testing programs across US
- Discussed current procedures and issues
- In NY, visited Miner and Cornell
- Cornell was rebooting their program

Collaboration with Cornell

- Strive for similar field and analytic procedures
- Work on incorporation of advanced fiber measurements
- Evaluate starch digestibility
- Develop alternative interpretation system
- Work with UVM and WNY Crop Mgmt Assn.

Fiber assessment

- uNDF 240 better describes indigestibility of the forage for use in cattle
- Improves prediction of energy from forages
- Helps improve predictions of intake and rumen function, microbial production etc.
- Can help explain performance issues with fiber digestibility in some cases
- NIRS prediction available from CVAS
Take home: Large range in uNDFs across all of our tests. 8 point diff @ NDFD 55
Smaller range within a test or location
Relationship between uNDF and NDFD varies depending on locations
Blue points in lower right are BMRs under drought stress in Juniata Co.
Fiber Conclusions

• Continue with the development of uNDF 240 as a routine measurement for silage assessment.
• Standardize our reporting as %NDF
• Change NDFD 24 hour to NDFD 30 at Penn State to be consistent with Cornell to facilitate comparisons.
• Add NDFD 120 and NDFD240 to reports

Starch Digestibility

• Hybrids with more floury endosperm are being marketed with the potential to improve starch digestibility
• How can differences be best assessed?
• How do differences interact with other factors such as particle size and time of ensiling?
Starch Digestibility Assessment Study

- Objective: characterize starch digestibility of hybrids over time.
- 6 hybrids
  - Check: TA 780, H5609
  - Test: HHG 7412, HHG 864, H5811, H5505
- 2 locations x 3 replicates x 5 time
- Time = 0, 60, 120, 180, 240d
- Grind: 4 and 1mm
- CVAS: 7h IVSD wet chemistry

Nutrient Characteristics of Corn Silage Over Time in Storage
(PDMP Data, 2013)

<table>
<thead>
<tr>
<th>Days</th>
<th>DM</th>
<th>Starch</th>
<th>IVSD7, 4mm</th>
<th>IVSD7, 1mm</th>
<th>SP%CP</th>
<th>NH3%CP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>35.5</td>
<td>32.3</td>
<td>53.5</td>
<td>73.1</td>
<td>28.1</td>
<td>13.0</td>
</tr>
<tr>
<td>60</td>
<td>35.0</td>
<td>32.4</td>
<td>65.7</td>
<td>84.8</td>
<td>47.6</td>
<td>10.1</td>
</tr>
<tr>
<td>120</td>
<td>35.4</td>
<td>32.0</td>
<td>65.8</td>
<td>84.5</td>
<td>48.4</td>
<td>10.1</td>
</tr>
<tr>
<td>180</td>
<td>36.0</td>
<td>32.2</td>
<td>68.5</td>
<td>85.2</td>
<td>50.0</td>
<td>10.3</td>
</tr>
<tr>
<td>240</td>
<td>36.1</td>
<td>32.1</td>
<td>69.3</td>
<td>85.8</td>
<td>51.1</td>
<td>10.2</td>
</tr>
</tbody>
</table>

Starch digestibility over ensiling time

In situ vs. In vitro

In situ vs. NIR

Starch digestibility by hybrid variety

In situ vs. In vitro

In situ vs. NIR
Starch Digestibility: Conclusions

- Tests are reasonably consistent at detecting large differences due to ensiling time.
- Less consistent detecting smaller hybrid differences.
- Hybrid differences most apparent at 0 and 30 hours.
- Current plan is to assess hybrids this fall with wet chem 7 h IVSD with a 1mm grind on 5 replicated studies.

Interpretation methods

- We have used Milk/ton based on the Milk 2006 spreadsheet developed by Univ of WI to interpret yield and quality data.
- Advisors express concern about value of fiber digestibility in Milk/ton ratings.
- New advances in understanding of forage quality.
- New laboratory analyses becoming available.
A model based approach for 2016 and beyond

• Predicting Milk Yield
  • Utilizing Cornell Net Carbohydrate and Protein System v. 6.5.5

• What is CNCPS?
  • Dynamic model used to balance feed rations for cattle
  • Under continuous development since 1980’s
  • First applied to on-farm use in the early 1990’s
  • Currently used as the basis for ration software programs
    that feed more than 40% of the cows in the US and
    many more cows worldwide.

Predicting Milk Yield
Utilizing Cornell Net Carbohydrate and Protein System v. 6.5.5 (NDS platform)

Base diet formulated for an ME & MP allowable milk yield of 100 lbs/day

• 2nd lactation, 110 DIM, 1585 BW, 3.80% milk fat, 3.20% milk true protein

• High Corn Silage Diet
  • 28 lbs DM from Corn Silage
  • 70% Forage in Ration
  • Target: 80 lbs Dry Matter Intake (DMI)

CNCP System Feed Library Values Used for base ration

• NDF digestibility values from 2 year average in Cumberland Valley Analytical Services database for:
  • Corn Silage, Alfalfa Haylage, Straw

Calculations

• Predicted ME Allowable Milk Yield for each hybrid
  • using same Dry Matter Intake (DMI) as the base ration
  • Library value for starch digestibility – decision for nutrition group due to uncertainty of green samples
  • Replaced Corn Silage (on dry matter basis) in base ration with each hybrid in the trial

• Calculate expected DMI – uNDF240 equivalent of the base ration
• Calculate uNDF240 intake on a DMI equivalent
Predicting Milk Yield
Utilizing Cornell Net Carbohydrate and Protein System v. 6.5.5 (NDS platform)

\textit{uNDF240 Adjustment}

Predicted ME Allowable Milk Yield, \textit{uNDF240} equivalent (lbs/day)

- Adjusted total ration DMI so the \textit{uNDF240} was equal to that in the base ration.
- Reflects how much the cow actually may be able to consume based on rumen fill.

\begin{table}[h]
\centering
\begin{tabular}{llllll}
\hline
Relative & Yield, & Predicted ME & \textit{uNDF240} & Adjusted & Predicted ME Allowable Milk \nMaturity & 35\% DM & Allowable Milk & \textit{uNDF240} & TMR DMI, & Allowable Milk \\
& tons/acre & Intake, & DMI Equivalent & DMI Equivalent & lbs/day & lbs/day & lbs/day & lbs/day & \\
\hline
 Aurora & & & & & & & & & \\
84-95 day & 15.3 & 31.4 & 107.2 & 5.3 & 66.4 & 121.6 \\
96-100 day & 17.5 & 32.4 & 107.7 & 5.2 & 67.3 & 124.2 \\
101-107 day & 19.8 & 34.5 & 107.6 & 5.5 & 63.7 & 116.3 \\
\hline
 Madrid & & & & & & & & & \\
84-95 day & 27.6 & 34.6 & 103.5 & 6.4 & 54.8 & 93.3 \\
96-100 day & 28.3 & 33.9 & 104.8 & 6.1 & 57.5 & 100.1 \\
101-107 day & 29.3 & 31.9 & 104.5 & 6.2 & 57.3 & 99.3 \\
\hline
\end{tabular}
\end{table}

Impact of \textit{uNDFD} on predicted milk
Interpretation: Conclusions

- Model based approach has merit and can incorporate more advanced measurements
- Need to do more validation of intake and milk differences with animal data
- Need a method to adapt to more of a spreadsheet format to facilitate data processing

BMR Study: NDFD

- High NDFD, Medium uNDF
- High NDFD, Low uNDF

Summary

- There is a need for some updating in our assessment of hybrids to reflect current issues in dairy nutrition
- Some development of approaches is necessary and underway
- Working together we hope to develop some consistency and better collaboration
- Testing programs can be more than just hybrid evaluation