Genetics for the Future Southeast Dairy Industry

Marjorie Faust
ABS Global, Inc.
DeForest, WI

Take-home messages
For genetics, the future began yesterday
- Global competitiveness requires overall economic efficiency
- Durability traits increasingly important for breeding tomorrow’s cow
- To account for array of durability traits, more sophisticated approaches needed
  - More data needed for traits with large environmental component
  - Balanced selection index

No. Herds with: <500 cows declining, >500 cows increasing

~50% of milk
Dairies in the Pampas in Argentina

Trends and forces shaping the SE dairy industry
- ~9.0 m dairy cows, stable national herd
- 95% of dairy cows are Holstein
- 7,730 herds, 10% of dairies, are >200 cows
- Nearly 50% of US milk production from western states, 6-7% from southeast
- Increasing low-cost global competition

A quick review of some of the genetic tools - PTAs
- Yield and Components
- Productive Life (PL)
- Somatic Cell Score (SCS)
- Daughter Pregnancy Rate (DPR)
- Daughter Calving Ease
- Linear traits and composites
- TPI, Net Merit – Includes many of the above PLUS ...
In genetics, the future began yesterday

Standardized changes in PTA's of the US Holstein Cow population

Genetic changes in Holstein Type traits expressed in standardized PTA units
Can we build a longer lasting cow?

"Milk production is great, but I need cows that last longer."

- If... 6 years from now dairies had more 5, 6 or 7 year-old cows in the herd would they consider that a good thing?
- What traits can we use to predict longevity...to build a longer lasting cow?
- Are these relationships the same today as yesterday?
- Do these traits have value for SE dairies?

We often use correlations to look at relationships

- Correlations range between +1 and -1
- +1 correlation
  - As one trait goes up, so does the other one
    - Example: Milk yield and protein yield (+.8)
- -1 correlation
  - As one trait goes up, the other goes down
    - Example: Milk yield and fat % (-.6)
- 0 correlation
  - No relationship between the 2 traits
    - Example: Milk yield and tail length

Relationships between traits and productive life

<table>
<thead>
<tr>
<th>Trait</th>
<th>1980</th>
<th>1982</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk (PTAM)</td>
<td>+.43</td>
<td>.08</td>
<td></td>
</tr>
<tr>
<td>Dairy Form (DF)</td>
<td>+.41</td>
<td>-.25</td>
<td></td>
</tr>
<tr>
<td>Stature (ST)</td>
<td>+.05</td>
<td>-.13</td>
<td></td>
</tr>
<tr>
<td>Body Depth (BD)</td>
<td>-.07</td>
<td>-.29</td>
<td></td>
</tr>
</tbody>
</table>

- Over time, we have changed the cow, her environment, and also how we define productive life.
OK. Pop Quiz Time

- Of the following 5 traits, which one has the strongest relationship (correlation) with Daughter Pregnancy Rate (DPR)?
  A. Body Depth
  B. Dairy Form
  C. Rump Angle
  D. Udder Depth
  E. Foot and Leg Composite

Correlation of DPR with:

- [Graph showing correlation values for different traits]

Pop Quiz #2

- Of the following 5 traits, which one has the strongest relationship (correlation) with Dau. Preg. Rate (DPR)?
  A. RTA Milk
  B. Productive Life (PL)
  C. Somatic Cell Score (SCS)
  D. Sire Calving Ease (% Difficult Births)
  E. Daughter Calving Ease (% Difficult Births)
Correlation of DPR with:

What about traits related to longevity?

Correlation of Body Traits with Productive Life

Using absolute values, these traits had high correlations with PL

That's fine for CA or WI, but what about the SE?

Comparison of sires for heat tolerance of daughters

<table>
<thead>
<tr>
<th>Trait</th>
<th>Heat tolerant difference</th>
<th>More heat tolerant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk (PTAM)</td>
<td>-11.24</td>
<td>Lower milk</td>
</tr>
<tr>
<td>Fat % (PTAF%)</td>
<td>-10.10</td>
<td>Fat heat</td>
</tr>
<tr>
<td>Protein % (PTAP%)</td>
<td>+0.06</td>
<td>Components</td>
</tr>
<tr>
<td>PTA Type (PTAT)</td>
<td>+0.57</td>
<td>More type</td>
</tr>
<tr>
<td>Dairy Form (DF)</td>
<td>-1.15</td>
<td>Less angular</td>
</tr>
<tr>
<td>Udder Composite (UDC)</td>
<td>+0.73</td>
<td>Better udders</td>
</tr>
<tr>
<td>Body Composite</td>
<td>+0.32</td>
<td></td>
</tr>
<tr>
<td>Productive Life (PL)</td>
<td>-0.50</td>
<td>Longer PL</td>
</tr>
<tr>
<td>Day of Pregnancy Rate (DPR)</td>
<td>+1.63</td>
<td>More/ Hi fertility</td>
</tr>
<tr>
<td>TPI</td>
<td>-96</td>
<td></td>
</tr>
</tbody>
</table>
Genetics for the Future SE Dairy Industry

- Excellent udders and feet and legs
- Medium size, less angular
- Commercial adaptability, group managed
- Efficient locomotion and trouble free handling
- Easy calving and efficient pregnancy machine
- Stays in the herd and allows the producer to decide when to sell or cull; the right to sell on their own terms at their price and not an involuntary cull
- Exceeds in all health, management, and utility traits
- Consistency, uniformity

The Complete Cow

How do we address such a long list of traits effectively?

Indexes allow for a more balanced approach to breeding

What is an Index?
Combination of several traits weighted by importance and summed into one value

Index examples:
- UDC (Udder Composite)
- PLC (Physical Composite)
- TPI (Type-Production Index) - Holsteins
- JPI (Jersey Production Index) - Jerseys
- PTI (Production Type Index) - Other breeds
- NMS (Net Milk Merit Dollars)
How are traits correlated to NMS and TPI?

<table>
<thead>
<tr>
<th>Trait</th>
<th>NMS</th>
<th>TPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk (PTAM)</td>
<td>.58</td>
<td>.60</td>
</tr>
<tr>
<td>Fat (PTAF)</td>
<td>.67</td>
<td>.67</td>
</tr>
<tr>
<td>PTA Type (PTXT)</td>
<td>??</td>
<td>.45</td>
</tr>
<tr>
<td>Udder Composite (LDC)</td>
<td>.22</td>
<td>.45</td>
</tr>
<tr>
<td>Feet &amp; Legs (PLC)</td>
<td>.16</td>
<td>.41</td>
</tr>
<tr>
<td>Dairy form (DF)</td>
<td>??</td>
<td>.15</td>
</tr>
<tr>
<td>Maternal CE</td>
<td>-.21</td>
<td>-.28</td>
</tr>
<tr>
<td>Daughter Pregnancy Rate</td>
<td>.15</td>
<td>.22</td>
</tr>
<tr>
<td>Somatic Cell Score</td>
<td>-.38</td>
<td>-.31</td>
</tr>
<tr>
<td>Productive Life</td>
<td>.38</td>
<td>.52</td>
</tr>
</tbody>
</table>

Use indices as a comprehensive starting point.

Confidence Ranges of 66% of bulls for NMS

It's all about using the right tools to get the job done!

- Sires of sons decisions – 43%
- Bull dam decisions – 33%
- Sires of cows decisions – 18%
- Dams of cows decisions – 6%
What do I gain from buying better sires?

<table>
<thead>
<tr>
<th>Trait</th>
<th>Top 50%</th>
<th>Bottom 50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein % (PTA%)</td>
<td>0.014</td>
<td>.009</td>
</tr>
<tr>
<td>Somatic Cell Score</td>
<td>2.94</td>
<td>3.0</td>
</tr>
<tr>
<td>Udder Composite (UC)</td>
<td>1.1</td>
<td>.63</td>
</tr>
<tr>
<td>Udder Depth (UD)</td>
<td>.70</td>
<td>.81</td>
</tr>
<tr>
<td>Udder Clift (UC)</td>
<td>1.1</td>
<td>.64</td>
</tr>
<tr>
<td>Feet &amp; Legs (FLC)</td>
<td>1.1</td>
<td>.55</td>
</tr>
<tr>
<td>Feet &amp; Leg Score (FLS)</td>
<td>1.1</td>
<td>.99</td>
</tr>
<tr>
<td>Dairy Form (DF)</td>
<td>.90</td>
<td>.66</td>
</tr>
<tr>
<td>Daughter Pregnancy Rate</td>
<td>-2</td>
<td>-3</td>
</tr>
<tr>
<td>Productive Life</td>
<td>.95</td>
<td>.68</td>
</tr>
</tbody>
</table>

Take-home messages

* For genetics, the future began yesterday
  
  - Global competitiveness requires overall economic efficiency
  - Durability traits increasingly important for breeding tomorrow’s cow
  - To account for array of durability traits, more sophisticated approaches needed
    - More data needed for traits with large environmental component
    - Balanced selection index

We like to think that...