Proceedings of the 53rd

FLORIDA DAIRY PRODUCTION CONFERENCE

Alto Straughn IFAS Extension Professional Development Center
Gainesville • Florida • April 20, 2017

Department of Animal Sciences
Institute of Food and Agricultural Sciences
University of Florida
Gainesville, Florida 32611
MISSION STATEMENT
The mission of the Florida Dairy Production Conference is to create a program which brings together some of the newest research, innovations, recommendations and ideas for improving the sustainability and profitability of the Florida dairy industry. The presented information provides practical take-home messages for dairy farmers and highlights emerging trends in the dairy industry. The conference strives to provide a friendly learning and sharing atmosphere with networking opportunities for our target audience of dairy owners and employees, allied dairy industry professionals, students and dairy educators.

PLANNING COMMITTEE
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Albert De Vries
Francisco Peñagaricano
José Santos
Mary Sowerby

Proceedings from past Florida Dairy Production Conferences are available at http://dairy.ifas.ufl.edu
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<tr>
<td>Micronutrients</td>
<td>Amanda Lacey</td>
<td><a href="mailto:amanda.lacey@micro.net">amanda.lacey@micro.net</a></td>
</tr>
<tr>
<td>Milk Specialties Global</td>
<td>Joseph Gulick</td>
<td><a href="mailto:jgulick@milspecialties.com">jgulick@milspecialties.com</a></td>
</tr>
<tr>
<td>ABS Global</td>
<td>Cheryl Johnson</td>
<td><a href="mailto:cheri.johnson@genusplc.com">cheri.johnson@genusplc.com</a></td>
</tr>
<tr>
<td>Betaseed</td>
<td>Cindy Supliski</td>
<td><a href="mailto:csuplinski@betaseed.com">csuplinski@betaseed.com</a></td>
</tr>
<tr>
<td>Boehringer-Ingelheim</td>
<td>Caroline Feagle</td>
<td><a href="mailto:caroline.feagle@boehringer-ingelheim.com">caroline.feagle@boehringer-ingelheim.com</a></td>
</tr>
<tr>
<td>Central Life Sciences</td>
<td>David Bennett</td>
<td><a href="mailto:dbennett@central.com">dbennett@central.com</a></td>
</tr>
<tr>
<td>Diamond V</td>
<td>John Gilliland</td>
<td><a href="mailto:jgilliland@diamondv.com">jgilliland@diamondv.com</a></td>
</tr>
<tr>
<td>Ecosyl Products Inc.</td>
<td>Laura St George</td>
<td><a href="mailto:ecosylproducts@live.com">ecosylproducts@live.com</a></td>
</tr>
<tr>
<td>Florida Dairy Farmers</td>
<td>Brian Chapman</td>
<td><a href="mailto:brianc@floridamilk.com">brianc@floridamilk.com</a></td>
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<td><a href="mailto:jake@dairydesign.com">jake@dairydesign.com</a></td>
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<td>Brian Winters</td>
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<td>Heath Graham</td>
<td><a href="mailto:heath.graham@zoetis.com">heath.graham@zoetis.com</a></td>
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Program

53rd Florida Dairy Production Conference

Thursday, April 20, 2017
Alto Straughn IFAS Extension Professional Development Center
Gainesville, Florida

9:00 AM  Welcome and opening remarks
          Thomas Obreza (Senior Associate Dean for Extension, University of Florida)

9:10     Alternative strategies for improving feed efficiency and sustainability
          Michael VandeHaar (Michigan State University)

9:50     Improving efficiency of microbial growth in order to reduce protein feed costs for cows
          Timothy Hackmann (University of Florida)

10:20    BREAK

10:50    Lessons from 30 years working with dairy producers
          Art Donovan (University of Florida)

11:30    Effects of prepartum acidogenic salts on calcium and energy metabolism in transition cows
          Corwin Nelson (University of Florida)

12:00 PM LUNCHEON

1:30     Genetic and non-genetic effects on embryo production technologies
          Peter Hansen (University of Florida)

2:15     Challenges, opportunities, and prospects of US dairy production
          Gordie Jones (Central Sands Dairy, Nekoosa, Wisconsin)

3:00     BREAK

3:30     The role of the modern dairy cow in improving the profitability of dairy production
          Greg Andersen (Seagull Bay Dairy, American Falls, Idaho)

4:00     Thinking outside the box: one Panhandle farm's quest for sustainability
          Meghan Austin (Cindale Farms, Marianna, Florida)

4:30     Producer panel
          Moderator: Albert De Vries

5:00     RECEPTION
Alternative strategies for improving feed efficiency and sustainability

Michael J. VandeHaar, Michigan State University

with help from:
  Kent Weigel and Louis Armentano, University of Wisconsin
  Rob Tempelman, Michigan State University
  Diane M. Spurlock, Iowa State University
  Roel Veerkamp, Wageningen UR, NL
  Charlie Staples, University of Florida

Funding was provided by Agriculture and Food Research Initiative Competitive Grant no. 2011-68004-30340 from the USDA National Institute of Food and Agriculture.

Outline and goals

Outline
1. Defining feed efficiency.
2. Breeding for optimal production and body size.
3. Using residual feed intake to further improve efficiency.

Goal: to spur the discussion about what kind of cow we want in the future
The modern dairy cow is a different beast!

- We have been altering cattle genetics for 9000 years.
- Most selection was made based on animal’s own phenotype.
- Population genetics (>1937) accelerated the progress.
- We made a lot of progress based on looks and a few numbers.
- Modern dairy cows are taller, thinner, and less muscular, and they have bigger udders.
- Today we have data. Lots of it.

Feed efficiency is a complex trait.

- Foods consumable by humans
- Foods not consumable by humans
- Non-food usable energy sources, fertilizers, and other chemicals
- Environmental pollutants

- Land
- Water
- Wastes
- Heat Energy
- Products that are not consumable by humans
- Human-consumable milk and beef

This is too complicated to use!
The basics of feed efficiency

Gross Energy of Feed → Net Energy of Feed → Energy captured as milk or body tissue

Energy lost as feces, gas, urine, and heat for metabolizing feed → Energy lost as heat for maintenance

Gross feed efficiency is the percentage of feed energy captured in milk and body tissues. To improve gross feed efficiency:
1. Increase the conversion of GE to NE
2. Increase milk production relative to maintenance.

Increased productivity in the past has resulted in increased efficiency

Our focus to increase milk yield has increased feed efficiency indirectly through the dilution of maintenance.

Gross feed efficiency < 10%

Gross feed efficiency ~ 20%

CO2/milk = 3.7

CO2/milk = 1.4
Efficiency increases from the “Dilution of Maintenance”

As cows eat more and produce more per day, a smaller percentage of the food they eat is used for maintenance and a greater percentage is converted to product.

The dilution of maintenance: past vs future

A cow at 4X has NE intake at 4X its NE for maintenance.

As productivity increases, gross efficiency increases but the incremental advantage diminishes. In addition, as cows eat more, they digest feed less efficiently, so this curve plateaus at ~5X.
High producing cows per unit BW are more efficient. The returns in efficiency from more milk are diminishing, but not as much as current NRC suggests!

Based on 5000 cows, Souza et al, unpublished

Optimal production per unit BW based on current data

GEff = -0.098 + 0.13 x MM - 0.0094 x MM^2

Is there an optimal milk production and body size?

Feb 15, 2010: Wisconsin cow Ever-Green-View My 1326-ET became the national milk production record holder, at 4 yr 5 mo. of age. She produced a 365-day record of 72,200 lbs of milk, with 2,790 lbs of fat and 2,140 lbs of protein.

If a cow produces this much, I don’t care if she weighs 2000 lb!
The dilution of maintenance: milk vs cow size

Whether we get more milk with the same BW or the same milk with a smaller BW, the cow is operating at a higher level and efficiency increases (but maybe not much).

Maintenance requirement – what is it?

- NRC 2001: 0.08 x Metabolic BW
- Birnie et al., 2000: 0.084 to 0.113 x MBW depending on BCS
- Moraes et al, 2015: 0.086 to 0.115 x MBW depending on decade
- Tempelman et al., 2015: 0.11 to 0.17 x MBW depending on research farm

Maintenance for lactating cows varies with level of milk, body weight, and body condition score.
**Holsteins are getting larger!**

- Of current proven AI bulls in 2007, 62% were >1SD for stature and 3% were <1SD. (Anderson, 2007)

- Because of the 2014 base change, current AI bulls look average for stature, but “average” for Holsteins jumped 0.8 stature points in the last 2 years!

- Larger, more angular cows have more health problems. (Hansen, 2000)

➤ Why select for cows that look like they can produce more milk when we can directly select for more milk?

---

**Jerseys vs Holsteins**

A comparison of the environmental impact of Jersey compared with Holstein milk for cheese production

J. L. Capper* and R. A. Cady†

<table>
<thead>
<tr>
<th></th>
<th>Jersey</th>
<th>Holstein</th>
<th>H/J</th>
</tr>
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<tbody>
<tr>
<td>Body Wt, lb</td>
<td>1000</td>
<td>1500</td>
<td>150%</td>
</tr>
<tr>
<td>Maint Reqt, Mcal/day</td>
<td>7.9</td>
<td>10.7</td>
<td>135%</td>
</tr>
<tr>
<td>Life Maint Reqt, Mcal/day</td>
<td>13</td>
<td>18</td>
<td>141%</td>
</tr>
<tr>
<td>Milk, lb/day</td>
<td>46</td>
<td>64</td>
<td>139%</td>
</tr>
<tr>
<td>Milk Energy, Mcal/day</td>
<td>18</td>
<td>22</td>
<td>119%</td>
</tr>
<tr>
<td>Life Cheese Yield, Mcal/day</td>
<td>28</td>
<td>33</td>
<td>118%</td>
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<tr>
<td>Life Multiple of Maintenance</td>
<td>3.2</td>
<td>2.8</td>
<td>89</td>
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*Feed intake was not measured.*
Jerseys vs Holsteins

Impact of milk yield, herd size, and feed efficiency on economic change between and within California dairies from 2006 through 2010. L. Rodriguez1, G. Bethard2, D. Tomlinson1, and M. McGilliard3,1Zinpro Corporation, Elk Grove, CA, 2G & R Consulting, Blacksburg, VA, 3Virginia Tech, Blacksburg.

- Feed efficiency and profitability were similar for top Jersey and Holstein herds.

- Published data is lacking to decide if feed efficiency is actually different between the breeds.

- Holsteins better produce almost twice as much milk more protein and fat, or they will be less efficient than Jerseys! Both breeds should focus on production per unit BW.

Genetic (upper right) and non-genetic (lower left) correlations and heritabilities (diagonal) for efficiency traits on 5700 Holsteins.
Lu et al., 2015

<table>
<thead>
<tr>
<th></th>
<th>MilkE</th>
<th>MBW</th>
<th>DMI</th>
<th>Gross Eff.</th>
<th>IOFC</th>
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<tr>
<td>MilkE</td>
<td>0.37 ±0.03</td>
<td>0.06 ±0.06</td>
<td>0.66 ±0.04</td>
<td>0.66 ±0.08</td>
<td>0.97 ±0.01</td>
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<tr>
<td>MBW</td>
<td>0.22 ±0.04</td>
<td>0.51 ±0.03</td>
<td>0.45 ±0.05</td>
<td>-0.28 ±0.06</td>
<td>0.02 ±0.07</td>
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<td>DMI</td>
<td>0.56 ±0.02</td>
<td>0.37 ±0.03</td>
<td>0.38 ±0.03</td>
<td>-0.11 ±0.04</td>
<td>0.54 ±0.06</td>
</tr>
<tr>
<td>Gross Eff.</td>
<td>0.39 ±0.02</td>
<td>-0.03 ±0.01</td>
<td>-0.19 ±0.02</td>
<td>0.13 ±0.00</td>
<td>0.70 ±0.05</td>
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<tr>
<td>IOFC</td>
<td>0.85 ±0.01</td>
<td>0.17 ±0.04</td>
<td>0.34 ±0.03</td>
<td>0.77 ±0.01</td>
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Selection against body size will enhance feed efficiency but not milk income per cow. Selection for milk increases both.
Summary for body size and efficiency

Liu et al., 2015. Body weight.
• For 5700 Holsteins, body weight was not genetically correlated with milk energy per day. The genetic correlation of body weight with gross feed efficiency was -0.3.

Manzanilla-Pech et al., 2015. Stature.
• For 1900 US Holsteins, stature was not genetically correlated with milk energy/day. The genetic correlation of stature with gross feed efficiency was -0.7 and with residual feed intake was +0.4.

➢ Selecting for bigger, taller cows does not increase milk.
➢ Selecting for bigger, taller cows decreases feed efficiency.

Other considerations in the size debate

• Milk solids yield (income per cow) is more important than size.
• Feed efficiency and profitability must be considered on a whole-farm basis.
• Smaller cows need less space so could have more cows per farm.
• Management time per cow is about the same.
• Bigger cows and their bull calves have more salvage value.
• Smaller cows might have fewer health problems.
• Smaller cows might handle heat stress better.
• Bigger cows might need less digestible diets (large herbivores can digest fiber better than small ones).
The basics of feed efficiency

Gross Energy of Feed → Net Energy of Feed → Energy captured as milk or body tissue

Energy lost as feces, gas, urine, and heat for metabolizing feed

To improve efficiency:
1. Increase the conversion of GE to NE
2. Increase milk production relative to maintenance.

Residual feed intake (RFI) = “unjustified” feed intake

Observed DMI = μ + b₁*MilkEnergy + b₂*BW⁷⁵ + b₃*ΔBodyEnergy + cohort + RFI

Efficient cows have negative RFI

The heritability of RFI is 0.17, based on 4900 Holsteins from North America and Europe. (Tempelman et al., 2015)
RFI is a repeatable trait

- Diet: high starch vs high fiber
- Climate conditions
- Lactation number
- Lactation stage
- Heifer vs cow

Selecting genotypes today that are more efficient should provide more efficient cows in the future, even if they are on higher fiber diets in a hotter climate.

Traditional breeding values are based on daughter performance, but feed efficiency data are not available. Perhaps genomics can help.

2 sets of 30 chromosomes, with 3 billion base pairs per set
Selection for RFI based on Single Nucleotide Polymorphisms (SNP)

- Genomics enables us to select for new traits and make decisions earlier on old ones.
- The SNP itself may have no biological effect, but it is linked to the DNA around it. If allele T is associated with a desirable trait, we can select for T and against C.
- Each single SNP may not have much effect, but additive effects of 1000s of SNP might.

Preliminary genomic analysis for traits related to feed efficiency (2900 cows)

The mean and estimates of genetic variance (VarG), proportion of phenotypic variance accounted for by SNP (Mh²), and Pi, such that 1-Pi represents the proportion of SNP fitted in the genome wide association analyses.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Mean</th>
<th>VarG</th>
<th>Mh²</th>
<th>Pi</th>
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<td>22</td>
<td>1.5</td>
<td>0.26</td>
<td>0.93</td>
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<td>Milk energy output, Mcal/d</td>
<td>27</td>
<td>3.3</td>
<td>0.22</td>
<td>0.91</td>
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<tr>
<td>Metabolic BW</td>
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<td>23</td>
<td>0.38</td>
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<td>BW change, kg/d</td>
<td>0.39</td>
<td>0.17</td>
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<td>0.98</td>
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<td>Residual feed intake, kg DM/d</td>
<td>0</td>
<td>0.27</td>
<td>0.14</td>
<td>0.91</td>
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</table>

Spurlock et al., 2014;
Results were similar with 4900 cows. Lu et al., 2017; Hardie et al., submitted
Animals could be selected for specific SNP or for the summation of 1000s of SNP.

Reference populations require continual updating.

**Preliminary genomic results of efficiency traits for North American bulls.** (Yao et al., 2016)

- Breeding values for 16,000 Holstein AI bulls in North America were predicted from a reference population of 3,500 cows.
- 57,000 SNP markers per animal were analyzed.
- Heritabilities were similar to what we previously reported.
- A “Feed_Saved” trait was calculated based on RFI and BW. Selection for this trait looks promising.
- Feed saved/yr = -(RFI + 2.1 lb per extra lb BW
- Reliability of EBV for RFI = 0.29

BV ranged from -2200 to +2200 lb/lactation.
**Genomic selection for RFI can work**

- Genomic Breeding Values for RFI were developed in growing heifers. Cows that were identified as being more efficient based on these GEBV did in fact need less feed to make milk. *(Davis et al., 2014)*

- Australia is now using genomic breeding values for RFI in combination with breeding values for smaller BW per unit milk in a “Feed Saved” index.

- Netherlands is now using Genomic Breeding Values for DMI.

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**Net Merit (NM$) – Selection Index**

<table>
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<tr>
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<th>1971</th>
<th>2010</th>
<th>2014</th>
<th>2019?</th>
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<td>Milk Yield</td>
<td>52</td>
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<td>-1</td>
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<td>Fat Yield</td>
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<td>19</td>
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<td>15</td>
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<td>Protein Yield</td>
<td>16</td>
<td>20</td>
<td>13</td>
<td></td>
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<tr>
<td>Productive Life</td>
<td>22</td>
<td>19</td>
<td>18</td>
<td></td>
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<tr>
<td>Somatic Cell Score</td>
<td>-10</td>
<td>-7</td>
<td>-8</td>
<td></td>
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<tr>
<td>Udder Composite</td>
<td>7</td>
<td>8</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Feet/legs Composite</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td></td>
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<tr>
<td>Body Size Composite</td>
<td>-6</td>
<td>-5</td>
<td>-5</td>
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<td>Daughter Pregnancy Rate</td>
<td>11</td>
<td>7</td>
<td>9</td>
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<tr>
<td>Cow Conception Rate</td>
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<td>Heifer Conception Rate</td>
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<td>Calving Ability</td>
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<td>Unjustified Feed Intake</td>
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<td>-18</td>
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Summary on selection for efficiency

• To increase total feed efficiency and profitability, we want cows that eat and produce at a higher multiple of maintenance.

• We need to stop breeding for large cows just because they look nice. Instead we should breed for cows that produce more milk solids per unit of BW.

• In the near future, we will select directly for feed efficiency, using genomic breeding values for RFI in combination with breeding values for smaller BW per unit milk in a “Feed Saved” index.

Managing for greater feed efficiency

Ad lib TMR feeding has helped increase milk production but decreased the focus on individual cow needs.

Feeding cows to meet their potential without overfeeding is key.

Grouping cows by feed needs improves feed efficiency and profitability, but grouping requires more work for management.

The farm team must work together and strategize:

How can we promote production and efficiency of feed use?
Should milk/feed be a goal in feeding?

- Each nutrient class also alters feed intake and partitioning between body stores and milk, and thus efficiency.
- These effects cannot be modeled. We must assess what is happening on the farm!
- Diets that increase feed efficiency may not increase profits!

Optimal feeding through a lactation cycle

<table>
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<th>GOALS</th>
<th>Maximal milk</th>
<th>Successful breeding</th>
<th>Optimal condition</th>
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<tr>
<td>Optimal health</td>
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</table>

- Intake limited mostly by gut distention
- Intake limited by metabolic controls
- Minimum fiber/high starch
- Low starch
- Digestible fiber
- High CP and RUP
- Low CP and RUP
- Expensive supplements
- Cheap feeds

Body weight

Milk yield

DM intake

Days in milk
**Nutritional grouping**

In a survey of 400 farms, Contreras-Govea et al. (2015) found the 2 major constraints to nutritional grouping were:

- “It makes things too complicated”
- “Low diets decrease milk yield”

Dairy feeding goals:

- develop diets that meet needs for fresh, peak, and maintenance groups using published data
- use supplements, metabolic modifiers, feed additives, and cheap feeds to improve efficiency within groups
- make rules based on milk and BCS for moving cows and design systems to track cows
- develop protocols for feeding an extra diet
- consider computer feeders for high cows within a group
- track cow responses and make decisions based on them

**Maintenance diets**

- Several studies show this works! *(Oba and Allen, 1998; Ipharraguerre et al., 2002; Voelker and Allen, 2003; Bradford and Allen, 2004; Boerman et al., 2015)*

- Use high quality forages (digestible fiber) as the base.
- Drop the starch to 10-20%.
- Use slowly fermenting starch sources (ground dry corn).
- Include high fiber byproduct feeds at 20-30%.
- Consider fat if the price is right
- Drop %CP 2 units to increase N efficiency and save money.
- Drop out expensive ingredients that are most effective for the high group.
- Pay attention to prices! The goal is to increase income over feed costs in the short run and health in the long run!
Take-home points.

Point 1: Efficient cows produce a lot of milk for their size!
Point 2: Efficient cows efficiently convert feed to net energy.

What can we do?
• Breed for milk and moderate reductions in cow size.

• Feed and manage for high production over the lactation (one diet cannot do this).

• Consider selecting for low RFI or “Feed Saved” when it becomes available.

We want more than just efficiency

Our goal is a cow that efficiently converts feed to milk
– has high GE to NE (low RFI) because of greater digestibility, greater % of DE to NE, or lower maintenance
– efficiently captures (partitions) lifetime NE to product because she operates at a high multiple of maintenance
– is profitable (high production dilutes out farm fixed costs)
– has minimal negative environmental impacts

AND
• is healthy and thrives through the transition period
• yields products of high quality and salability
• is fertile and produces high-value offspring
• is adaptable to different climates and diets
• can use human-inedible foods, pasture, and cheap feeds
• can digest feeds better
• requires less protein and phosphorus per unit of milk
• has a good disposition and looks happy to the general public
NOTES
Improving efficiency of microbial growth in order to reduce protein feed costs for cows

Timothy J. Hackmann
Department of Animal Sciences

The unseen importance
The unseen importance

- Microbial protein
  - >50% animal requirements

53rd Florida Dairy Production Conference
Gainesville, FL, April 20, 2017
Inefficiency

- Microbes use only $\frac{1}{3}$ to $\frac{2}{3}$ cellular energy (ATP) for protein synthesis (growth)

<table>
<thead>
<tr>
<th>System</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>g microbial DM (mol ATP)$^{-1}$</td>
<td>% theoretical maximum</td>
</tr>
<tr>
<td>Mixed microbes, in vivo</td>
<td>11 to 21</td>
</tr>
<tr>
<td>Mixed bacteria, in vitro</td>
<td>8 to 17</td>
</tr>
<tr>
<td>Pure cultures, in vitro</td>
<td>10 to 25</td>
</tr>
</tbody>
</table>
Economic impact

- Potential for increased efficiency
  - 150 to 300% if all energy used for growth
- If efficiency by only $\uparrow 5%$
  - $\uparrow 0.17$ lb microbial crude protein/cow/d
  - $\downarrow 0.034$/cow/d
- $\downarrow 0.034$/cow/d
  - $\downarrow 1.5$ million/yr for Florida
  - $\downarrow 115$ million/yr for US

Inefficiency

- Microbes use only $1/3$ to $2/3$ cellular energy (ATP) for protein synthesis (growth)

Where is the rest going?
Inefficiency—cellular view

- Energy (ATP)
- Energy spilling
- Growth (protein)
- Maintenance
- Reserve carbohydrate

Energy sinks

- Maintenance
  - Cost of living
  - Net product is heat

Maintenance of ion gradients
Energy sinks

- Reserve CHO
  - Up to 50% cell mass
  - May seem economical, but storage inefficient

- Energy spilling
  - Burning energy for the sake of burning energy

Williams & Coleman. 1992. The rumen protozoa

Problem

- Energy sinks
  - Seldom studied in mixed microbes from rumen
  - Relative importance not quantified

Previous work

- Mixed rumen microbes waste excess energy through
  - Reserve carbohydrate
  - Spilling

Unanswered question

- How do individual groups waste excess energy?

![Protozoa](image1)
![Bacteria](image2)

Objective

- Quantify how protozoa vs. bacteria waste excess energy
  - In vitro experiment
  - Energy provided in form of carbohydrate (glucose)

Carbohydrate excess
Hypothesis

- Compared to bacteria, protozoa
  - Waste more energy via storing reserve carbohydrate
  - Waste less energy via spilling

Methods

Rumen fluid (1 of 2 cows)
- Filter or centrifuge

Protozoa or bacteria
- Dose glucose (5 mM)

Energy use (heat production) by calorimetry
Chemical analysis
- Glucose
- Reserve carbohydrate
- Others

Reserve carbohydrate, spilling, maintenance
Methods

Separation of protozoa

Methods

Calorimeter

Gas analyzer
Results

Hypothesis

- Compared to bacteria, protozoa
  - Waste more energy via synthesizing reserve carbohydrate
  - Waste less energy via spilling
Results

Measurement of energy sinks in protozoa

Results

Measurement of energy sinks in bacteria
Hypothesis

- Compared to bacteria, protozoa
  - Waste more energy via synthesizing reserve carbohydrate
  - Waste less energy via spilling

Other questions

- How do protozoa otherwise compare to bacteria in using glucose?
  - Rate of fermentation?
  - Fermentation products?
Results

<table>
<thead>
<tr>
<th>Rate (μmol g protein⁻¹ min⁻¹)</th>
<th>Glucose consumption</th>
<th>Glucose fermentation</th>
<th>Lactate formation</th>
<th>Acetate formation</th>
<th>Propionate formation</th>
<th>Butyrate formation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

= Protozoa
= Bacteria
Summary

- Compared to bacteria, protozoa
  - Waste more energy via reserve carbohydrate
  - Waste less energy via energy spilling
  - Produce more lactate
  - Produce less propionate
- Data can improve microbial efficiency and reduce feed protein

Bridging the gap

- Laboratory experiments
- Feeding less protein
- Improved ration formulation software

Gainesville, FL, April 20, 2017
Bridging the gap

- Ration formulation software
  - Good start to predicting microbial protein
  - Still needs improvement
    - Current experiments provide key data

Cornell model (CNCPS v. 6.5)

Inefficiency—cellular view

Feed

- Growth (protein)
- Energy (ATP)
- Energy spilling
- Maintenance
- Reserve carbohydrate
Summary

- Microbes waste up to 2/3 energy (ATP)
- Both protozoa and bacteria waste energy, but differently
  - Protozoa → Reserve carbohydrate
  - Bacteria → Energy spilling
- Measuring waste first step towards reduction
- Long-term goals
  - Improved diet formulation software
  - More microbial protein
  - Less feed protein

Acknowledgements

- People

- Funding
  - SOUTEAST MILK
    - #F002995
  - USDA
    - #FLA-ANS-005307 & #FLA-ANS-005304
  - CAPES
Lessons from 30 Years Working with Dairy Producers in Florida

Art Donovan, DVM, MSc, DiplABVP

Overview

• Background Exposure
• Heros and Mentors
• Evolution of the Dairy Industry & Lessons Learned
• Science and Pseudoscience
• Acknowledgements
Background Exposures

• Milking cows in high school & early college years

Background Exposures

• Nova Scotia Agricultural College
Background Exposures

• Ontario Veterinary College – Guelph, Ontario

Heros and Mentors

• Heros

Dad & Mom

Patti
Heros and Mentors

• Mentors
  – Bob Curtis
  – The Kens!
    – Ken Leslie
    – Ken Braun

My Philosophy - Dairy Veterinarian

• Stop Look Listen

  – “More things are missed for not looking than for not knowing!”

Drs Francis Fox & Ken Braun
The ‘Germ Theory of Disease’

- Many diseases are caused by microorganisms.
- Organized the science of diseases
  - Disease causation
  - Vaccinology
  - Sanitation
  - Pasteurization
  - Epidemiology

Do I subscribe to the ‘Germ Theory of Disease’?

- It depends!
- On the organism / disease
Lessons Learned

• Florida Dairy Industry 1980 - now

<table>
<thead>
<tr>
<th>Year</th>
<th># Herds</th>
<th># Cows</th>
<th>RHA Milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>456</td>
<td>187,000</td>
<td>10,845</td>
</tr>
<tr>
<td>1990</td>
<td>300</td>
<td>180,000</td>
<td>14,044</td>
</tr>
<tr>
<td>2000</td>
<td>217</td>
<td>157,000</td>
<td>15,688</td>
</tr>
<tr>
<td>2010</td>
<td>140</td>
<td>114,000</td>
<td>16,324</td>
</tr>
<tr>
<td>2015</td>
<td>127</td>
<td>123,000</td>
<td>19,374</td>
</tr>
<tr>
<td>2017</td>
<td>122</td>
<td>121,000</td>
<td>19,638</td>
</tr>
</tbody>
</table>
Evolution of Dairies in Florida 1980-2017

• Diseases

• Facilities

• Feeding

Evolution of ‘Diseases’ in Florida 1980-2017

• Brucellosis
• IBR
• Heel warts
• Otitis media (‘Ear infections’)
• Bloody gut
• Mastitis
Evolution of ‘Diseases’ in Florida 1980-2017

• Brucellosis
  – 1980 - The scourge of the cattle industries in Florida
  – Test-and-Slaughter
  – Enter Dr. Paul Nicoletti
    – First-rate scientist
    – Ex-USDA employee
    – Rallied stakeholders
    – Stood up to politicians
    – Stubborn as hell!
    – Wouldn’t take ‘No’ for an answer

“This is a controllable infectious disease propagated by politicians!”

• IBR
  – Lots of ‘shipped in’ replacement heifers
  – Lots of respiratory disease, abortions
  – In steps Dr. Ken Braun
    – Vaccinatable disease
    – Solidified replacement rearing programs → ↓ in imported animals
    – Nutrition, nutrition, nutrition!
Evolution of ‘Diseases’ in Florida 1980-2017

• Heel warts – mid to late 1980s
  – Severe acute foot rot that did not respond to traditional antibiotic therapy
  – Treats tried
    – Cautery – Yes, we applied a hot dehorning iron in these lesions!
    – Topical antibiotics – varying success (due to environmental conditions?)
    – Topical formalin gel
  – Enter Dr. Jan Shearer
    – Hoof spraying with tetracycline
    – Formaldehyde foot baths
    – Any foot baths

• Otitis media (‘Ear infections’)
  – “What da heck is this!”
  – Early observations – trauma? ‘Hit by milk truck’
  – Parasites (ticks / mites)
Evolution of ‘Diseases’ in Florida 1980-2017

• Otitis media (‘Ear infections’)
  – Gina Temple, Jack Gaskins, Mary Brown
  – Caused by *Mycoplasma bovis*
  – Transmission – Predominantly through milk
  – Early clinical signs – Fever, head-shaking, ear-scratching
  – Treatment – Anything but the penicillins/cephalosporins and sulfas
  – Prevention – Avoid milk exposure, ventilation, nutrition, sanitation

• Bloody gut
  – 1998 – ‘Dead cow syndrome’
  – Crash in milk followed by death

• Bloody gut
  – Followed 10 cows through a slaughter facility
  – Lung abscesses, hardware disease?
  – Lung abscesses, pneumonia
    – Resulting from bacterial escape from the small intestine after an episode of BG
Evolution of ‘Diseases’ in Florida 1980-2017

- **Bloody gut**
  - Earlier detection
  - Surgical treatment
  - Medical treatment
  - Cause
  - Prevention

Evolution of ‘Diseases’ in Florida 1980-2017

- **Mastitis**
  - 1980s – I’d go to meetings and get laughed at by other veterinarians
  - Milk quality was keeping milk ‘legal’
Evolution of ‘Diseases’ in Florida 1980-2017

- **Mastitis**
  - 1980s – I’d go to meetings and get laughed at by other veterinarians
  - Milk quality was keeping milk ‘legal’
  - Milker schools, Parlor Checks (milking machine function), Cultures

  Time spent in parlor vs time spent in barns/pasture

  5-6 min 2-3x/d vs ‘the rest of the day’

“**We’ve got to move out of 1940s level of management.”**

- **Mastitis**
  - Dave Bray and his ‘colorful’ farm analyses

  “The germs that cause mastitis now are the same as the ones causing mastitis in the 1940s!”

  “We’ve got to move out of 1940s level of management.”
Evolution of ‘Diseases’ in Florida 1980-2017

• **Mastitis**
  – Facilities were the 1st major step forward
  – How to manage those facilities
Evolution of ‘Diseases’ in Florida 1980-2017

• **Mastitis**
  – Facilities were the 1st major step forward
  – How to manage those facilities
  – Where are we now?

![Mastitis Image](image1)

Evolution of ‘Diseases’ in Florida 1980-2017

• **Mastitis**
  – Facilities were the 1st major step forward
  – How to manage those facilities
  – Where are we now?

![Mastitis Image](image2)
Evolution of Facilities in Florida 1980-2017

- Heat stress
- Cow housing
- Calf housing
- Maternity housing

This might be big!

  - This might be big!
Evolution of Facilities in Florida 1980-2017

- Heat stress / Cow Housing

Evolution of Facilities in Florida 1980-2017

- Heat stress / Cow Housing / Cow Comfort
Evolution of Facilities in Florida 1980-2017

- Heat stress / Cow Housing / Cow Comfort

Evolution of Facilities in Florida 1980-2017

Welfare Assessments

<table>
<thead>
<tr>
<th>Animal weight (lbs)</th>
<th>Freestall width (lbs)</th>
<th>Freestall length (lbs)</th>
<th>Neck roll height (lbs)</th>
<th>Curb to rail nose and brisket height (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,200-1,500</td>
<td>42-48</td>
<td>6’-6”</td>
<td>44-46</td>
<td>66</td>
</tr>
<tr>
<td>1,500-1,800</td>
<td>48-52</td>
<td>7’-6”</td>
<td>46-48</td>
<td>66</td>
</tr>
<tr>
<td>over 1,800</td>
<td>52-58</td>
<td>8’-6”</td>
<td>48-50</td>
<td>71</td>
</tr>
</tbody>
</table>

* An additional 12” to 18” in stall length (compared to side-lunge stalls) is required to allow the cow to thrust her head forward during the tangle process.

* Above top of curb or top of mattress (NDSU wolf 3000, 2008).
Evolution of Facilities in Florida 1980-2017

- Heat stress
- Cow housing
- Calf housing
Evolution of Facilities in Florida 1980-2017

• Calf housing
Evolution of Facilities in Florida 1980-2017

• Calf housing
Evolution of Facilities in Florida 1980-2017

- Calf housing

![Graph showing pre-wean calf mort (%)]

Evolution of Facilities in Florida 1980-2017

- Calf housing

![Graph showing pre-wean calf mort (%)]
Evolution of Facilities in Florida 1980-2017

- Calf housing

Pre-wean Calf Mort (%)

Group Feeding / Housing

- Sanitation
Group Feeding / Housing

- **SANITATION**
  - You’ve got to *do* ’em & *cross* ’em in group housing systems

Evolution of Facilities in Florida 1980-2017

- Heat stress
- Cow housing
- Calf housing
- **Maternity housing**
Evolution of Facilities in Florida 1980-2017

- Heat stress
- Cow housing
- Calf housing
- Maternity housing

Moore et al., 2005
28-33% reduction in colostrum quality by delayed harvest of colostrum
Evolution of Facilities in Florida 1980-2017

• Maternity housing
Evolution of Facilities in Florida 1980-2017

• Maternity housing

[Graph showing stillborn rate (%)]

Evolution of Facilities in Florida 1980-2017

• Maternity housing

Evolution of Feeding in Florida 1980-2017

• ‘One shot’ cottonseed hull based diet
• ‘One shot’ with supplemental hay
Evolution of Feeding in Florida 1980-2017

- ‘One shot’ cottonseed hull based diet
- ‘One shot’ with supplemental hay
- Partial TMR
- TMR

Forage production
End Result 1980-2017

- Herd milk production >28,000 lb/cow/lct
- SCC <200,000 year round
- Clinical mastitis rate <2 cases/100 cows/mo
- Pregnancy Rates >22%
- Cull Rates <30%
- Calf Mortality Rates <3%

Why Not Reproduction?

- Change is slow
- I am slower!
Cryptosporidium aka ‘Crypto’

- Diarrheal disease of young calves
- Every calf in Florida gets infected with crypto
- Every calf in Florida becomes diseased
- “What can you do about it?”

‘Crypto’

- Antibiotics – Halofuginone, Amikacin, Paramamycin
- Antiparasiticides – Deccox, Bovatec
- Activated charcoal & wood vinegar – ‘First Choice’
- Herbals – Essential oils of oregano
- Aloe vera juice – “Cures everything!”
- Vaccine – Promises, Promises
- Disinfectants - ammonium hydroxide, hydrogen peroxide, chlorine dioxide, 10% formol saline, and 5% ammonia
‘Crypto’

“What can you do about it?”

• Maximize sanitation
• Supply >>>100% of energy and protein requirements for maintenance and growth
• High quality feed ingredients! Milk works pretty good!
• Keep ’em hydrated
• Kaolin-pectin, bismusol, probiotics
Thank you!!
Effects of Prepartum Acidogenic Salts on Calcium and Energy Metabolism in Transition Cows


Florida Dairy Production Conference
Gainesville, April 20, 2017

Consequences of Hypocalcemia

Risk of metritis increases with decreased post-partum calcium

Feeding Acidogenic Salts Prepartum Increases Postpartum Calcium

Santos, J.E.P, 2016, Proceedings Florida Ruminant Nutrition Symposium

Feeding Acidogenic Salts to Reduces Prepartum Intake

Charbonneau et al. (2006) J. Dairy Sci. 89:537-548
**Hypothesis**

Reducing the negative DCAD from -70 to -180 mEq/kg and extending the duration of feeding from 21 to 42 days will not affect performance and metabolism in dairy cows.

**Objective**

Evaluate the effects of two levels of negative DCAD, -70 vs. -180 mEq/kg, and two durations of feeding, 21 vs. 42 days, on performance and metabolism in parous Holstein cows.

**Cows and Treatments**

- 114 parous Holstein cows at 233 d of gestation were enrolled in the experiment.
- Randomized complete block design with a 2 x 2 factorial arrangement of treatments:
  - 2 durations of feeding (21 vs. 42 d)
  - 2 levels of negative DCAD (-70 vs. -180 mEq/kg)
Measurements

- Acid-base status and urine pH
- Concentrations of minerals and metabolites in blood
- Colostrum yield and composition
- Prepartum DM intake and lactation performance
- Daily body weight and weekly body condition
Data Analyses

- Continuous data were analyzed by ANOVA with mixed models using SAS
- First 21 d of the dry period: positive DCAD vs. -70 vs. -180
  - Fixed effects: treatment, day, and treatment x day
  - Random effect: block, cow (treatment)
  - Orthogonal comparisons: Positive vs. Negative DCAD and -70 vs. -180 mEq/kg
- Day -21 to +42: 2 levels of DCAD (-70 vs. -180) and the two durations of feeding (21 vs. 42)
  - Fixed effects: DCAD, duration, DCAD x duration, day, DCAD x day, duration x day, DCAD x duration x day
  - Random effects: block, cow (DCAD x Duration)

Diet Composition

<table>
<thead>
<tr>
<th>Ingredient (% DM)</th>
<th>Positive DCAD</th>
<th>-70 mEq/kg</th>
<th>-180 mEq/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn silage</td>
<td>34.2</td>
<td>34.2</td>
<td>34.2</td>
</tr>
<tr>
<td>Triticale silage</td>
<td>20.4</td>
<td>20.4</td>
<td>20.4</td>
</tr>
<tr>
<td>Bermuda hay</td>
<td>6.7</td>
<td>6.7</td>
<td>6.7</td>
</tr>
<tr>
<td>Straw</td>
<td>13.8</td>
<td>13.8</td>
<td>13.8</td>
</tr>
<tr>
<td>Citrus pulp</td>
<td>7.7</td>
<td>7.1</td>
<td>6.7</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>13.1</td>
<td>8.5</td>
<td>5.8</td>
</tr>
<tr>
<td>Prepartum mineral</td>
<td>4.2</td>
<td>4.2</td>
<td>4.2</td>
</tr>
<tr>
<td>Bio-Chlor*</td>
<td>0</td>
<td>5.2</td>
<td>8.3</td>
</tr>
</tbody>
</table>

* Contains: condensed corn fermentation solubles, processed grain by-products, condensed extracted glutamic acid fermentation product and magnesium chloride hexahydrate
### Diet Composition

<table>
<thead>
<tr>
<th>Item, DM basis</th>
<th>Diet</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive DCAD</td>
<td>-70 mEq/kg</td>
<td>-180 mEq/kg</td>
</tr>
<tr>
<td>CP, %</td>
<td>14.9 ± 0.8</td>
<td>14.7 ± 0.4</td>
<td>14.6 ± 0.6</td>
</tr>
<tr>
<td>ADF, %</td>
<td>29.4 ± 1.4</td>
<td>28.9 ± 1.2</td>
<td>29.1 ± 1.1</td>
</tr>
<tr>
<td>NDF, %</td>
<td>43.1 ± 1.7</td>
<td>43.7 ± 1.5</td>
<td>43.8 ± 1.5</td>
</tr>
<tr>
<td>Forage NDF, %</td>
<td>39.3 ± 1.7</td>
<td>39.3 ± 1.7</td>
<td>39.3 ± 1.7</td>
</tr>
<tr>
<td>Nonfiber CHO, %</td>
<td>31.7 ± 1.3</td>
<td>31.1 ± 1.6</td>
<td>31.1 ± 1.9</td>
</tr>
<tr>
<td>Starch, %</td>
<td>12.3 ± 0.4</td>
<td>12.6 ± 0.5</td>
<td>12.9 ± 0.6</td>
</tr>
<tr>
<td>Fat, %</td>
<td>2.8 ± 0.2</td>
<td>2.8 ± 0.1</td>
<td>2.8 ± 0.1</td>
</tr>
<tr>
<td>Ca, %</td>
<td>0.67 ± 0.07</td>
<td>0.64 ± 0.05</td>
<td>0.62 ± 0.05</td>
</tr>
<tr>
<td>P, %</td>
<td>0.33 ± 0.01</td>
<td>0.33 ± 0.02</td>
<td>0.33 ± 0.03</td>
</tr>
<tr>
<td>Mg, %</td>
<td>0.44 ± 0.06</td>
<td>0.47 ± 0.06</td>
<td>0.48 ± 0.03</td>
</tr>
<tr>
<td>K, %</td>
<td>1.54 ± 0.10</td>
<td>1.49 ± 0.09</td>
<td>1.46 ± 0.09</td>
</tr>
<tr>
<td>S, %</td>
<td>0.29 ± 0.03</td>
<td>0.40 ± 0.03</td>
<td>0.47 ± 0.03</td>
</tr>
<tr>
<td>Na, %</td>
<td>0.08 ± 0.03</td>
<td>0.11 ± 0.03</td>
<td>0.13 ± 0.04</td>
</tr>
<tr>
<td>Cl, %</td>
<td>0.50 ± 0.07</td>
<td>0.86 ± 0.07</td>
<td>1.11 ± 0.03</td>
</tr>
<tr>
<td>DCAD, mEq/kg</td>
<td>+109 ± 35</td>
<td>-66 ± 17</td>
<td>-176 ± 20</td>
</tr>
</tbody>
</table>

### Urine pH

- Short -70
- Long -70
- Short -180
- Long -180

**Before diet change**
- DCAD: $P < 0.01$
- Duration: $P < 0.01$
- Interaction: $P < 0.01$

**After diet change**
- DCAD: $P < 0.01$
- Duration: $P = 0.40$
- Interaction: $P = 0.35$

Day relative to calving
Serum Calcium

- Short -70
- Long -70
- Short -180
- Long -180

Calcium, mM vs. Day Relative to Calving

Prepartum
DCAD: P = 0.36
Duration: P = 0.16
Interaction: P = 0.76

Postpartum
DCAD: P = 0.61
Duration: P = 0.53
Interaction: P = 0.56

Serum Phosphorous

- Short -70
- Long -70
- Short -180
- Long -180

Phosphorus, mM vs. Day Relative to Calving

Prepartum
DCAD: P = 0.99
Duration: P = 0.84
Interaction: P = 0.03

Postpartum
DCAD: P = 0.53
Duration: P = 0.73
Interaction: P = 0.81
Serum Non-Esterified Fatty Acids (NEFA)

- Short-70  - Long-70  - Short-180  - Long-180

Day Relative to Calving

Prepartum
DCAD: $P = 0.64$
Duration: $P = 0.29$
Interaction: $P = 0.06$

Postpartum
DCAD: $P = 0.65$
Duration: $P = 0.30$
Interaction: $P = 0.97$

Ionized Calcium and Measures of Acid-Base Status

<table>
<thead>
<tr>
<th>Item</th>
<th>Treatment</th>
<th>SEM</th>
<th>Dur</th>
<th>DCAD</th>
<th>Inter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pH</td>
<td>Short</td>
<td>0.007</td>
<td>0.80</td>
<td>&lt; 0.01</td>
<td>0.58</td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>0.007</td>
<td>0.80</td>
<td>&lt; 0.01</td>
<td>0.58</td>
</tr>
<tr>
<td>Blood $PCO_2$, mm Hg</td>
<td>Short</td>
<td>0.75</td>
<td>0.50</td>
<td>0.12</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>0.75</td>
<td>0.50</td>
<td>0.12</td>
<td>0.14</td>
</tr>
<tr>
<td>Blood $HCO_3^-$, mM</td>
<td>Short</td>
<td>0.5</td>
<td>0.49</td>
<td>&lt; 0.01</td>
<td>0.13</td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>0.5</td>
<td>0.49</td>
<td>&lt; 0.01</td>
<td>0.13</td>
</tr>
<tr>
<td>Base excess, mM</td>
<td>Short</td>
<td>0.63</td>
<td>0.75</td>
<td>&lt; 0.01</td>
<td>0.21</td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>0.63</td>
<td>0.75</td>
<td>&lt; 0.01</td>
<td>0.21</td>
</tr>
<tr>
<td>Blood $iCa$, mM</td>
<td>Short</td>
<td>0.01</td>
<td>0.44</td>
<td>&lt; 0.01</td>
<td>0.93</td>
</tr>
<tr>
<td></td>
<td>Long</td>
<td>0.01</td>
<td>0.44</td>
<td>&lt; 0.01</td>
<td>0.93</td>
</tr>
</tbody>
</table>
### Postpartum Performance: Colostrum Yield and Components

<table>
<thead>
<tr>
<th>Item</th>
<th>Short -70</th>
<th>Short -180</th>
<th>Long -70</th>
<th>Long -180</th>
<th>SEM</th>
<th>Dur</th>
<th>DCAD</th>
<th>Inter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colostrum, kg/d</td>
<td>4.56</td>
<td>4.43</td>
<td>4.26</td>
<td>0.42</td>
<td>0.45</td>
<td>0.14</td>
<td>0.29</td>
<td></td>
</tr>
<tr>
<td>Fat yield, %</td>
<td>4.31</td>
<td>4.46</td>
<td>4.63</td>
<td>0.40</td>
<td>0.85</td>
<td>0.33</td>
<td>0.58</td>
<td></td>
</tr>
<tr>
<td>Protein yield, %</td>
<td>11.77</td>
<td>12.57</td>
<td>12.57</td>
<td>0.44</td>
<td>0.38</td>
<td>0.34</td>
<td>0.34</td>
<td></td>
</tr>
<tr>
<td>Lactose yield, %</td>
<td>3.62</td>
<td>3.55</td>
<td>3.51</td>
<td>0.08</td>
<td>0.68</td>
<td>0.33</td>
<td>0.66</td>
<td></td>
</tr>
<tr>
<td>SNF yield, %</td>
<td>16.66</td>
<td>17.45</td>
<td>17.37</td>
<td>0.44</td>
<td>0.37</td>
<td>0.47</td>
<td>0.37</td>
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</tr>
<tr>
<td>SCC yield, %</td>
<td>6.05</td>
<td>6.74</td>
<td>6.51</td>
<td>0.27</td>
<td>0.31</td>
<td>0.49</td>
<td>0.12</td>
<td></td>
</tr>
<tr>
<td>Colostrum NE, Mcal/kg</td>
<td>1.21</td>
<td>1.26</td>
<td>1.28</td>
<td>0.04</td>
<td>0.77</td>
<td>0.22</td>
<td>0.36</td>
<td></td>
</tr>
</tbody>
</table>

### Postpartum Performance: Milk Yield and Components

<table>
<thead>
<tr>
<th>Item</th>
<th>Short -70</th>
<th>Short -180</th>
<th>Long -70</th>
<th>Long -180</th>
<th>SEM</th>
<th>Dur</th>
<th>DCAD</th>
<th>Inter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk, kg/d</td>
<td>43.1</td>
<td>39.1</td>
<td>41.1</td>
<td>1.1</td>
<td>0.04</td>
<td>0.79</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>3.5 FCM, kg/d</td>
<td>46.7</td>
<td>43.9</td>
<td>45.8</td>
<td>1.3</td>
<td>0.23</td>
<td>0.63</td>
<td>0.31</td>
<td></td>
</tr>
<tr>
<td>ECM, kg/d</td>
<td>45.2</td>
<td>42.4</td>
<td>44.3</td>
<td>1.2</td>
<td>0.21</td>
<td>0.62</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Fat yield, kg/d</td>
<td>1.73</td>
<td>1.66</td>
<td>1.73</td>
<td>0.06</td>
<td>0.52</td>
<td>0.57</td>
<td>0.51</td>
<td></td>
</tr>
<tr>
<td>Protein yield, kg/d</td>
<td>1.27</td>
<td>1.18</td>
<td>1.24</td>
<td>0.04</td>
<td>0.18</td>
<td>0.64</td>
<td>0.30</td>
<td></td>
</tr>
<tr>
<td>Lactose yield, kg/d</td>
<td>2.00</td>
<td>1.82</td>
<td>1.91</td>
<td>0.06</td>
<td>0.05</td>
<td>0.78</td>
<td>0.19</td>
<td></td>
</tr>
<tr>
<td>SNF yield, Kg/d</td>
<td>3.64</td>
<td>3.34</td>
<td>3.50</td>
<td>0.10</td>
<td>0.08</td>
<td>0.72</td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td>Milk NE, Mcal/kg</td>
<td>0.731</td>
<td>0.757</td>
<td>0.753</td>
<td>0.009</td>
<td>0.10</td>
<td>0.50</td>
<td>0.26</td>
<td></td>
</tr>
</tbody>
</table>
### Body Weight

- **Prepartum**
  - DCAD: $P = 0.78$
  - Duration: $P = 0.50$
  - Interaction: $P = 0.01$

- **Postpartum**
  - DCAD: $P = 0.61$
  - Duration: $P = 0.62$
  - Interaction: $P = 0.16$

### Dry Matter Intake

- **Before diet change**
  - DCAD: $P = 0.02$
  - Duration: $P = 0.02$
  - Interaction: $P = 0.36$

- **After diet change**
  - DCAD: $P < 0.01$
  - Duration: $P = 0.45$
  - Interaction: $P = 0.29$
Conclusions

- Feeding a negative DCAD reduced DMI by 1 kg/d in the first 21 d of the dry period
- Reducing the level of negative DCAD from -70 to -180 mEq/kg in the last 21 d of gestation:
  - Reduced DMI by 1.8 kg/d
  - Induced a more exacerbated metabolic acidosis prepartum
  - Increased the concentration of iCa in blood prepartum

Conclusions

- Extending the duration of negative DCAD had minor impacts on blood iCa and measures of acid-base status postpartum.
- Extending the duration of negative DCAD feeding decreased the milk yield 2.4kg/d, and lactose yield when fed for a longer time.
- Concentrations of minerals or metabolites were not significantly affected by level or duration of DCAD.
- Data suggest that extended feeding of negative DCAD is not detrimental to performance when fed at -180 mEq/kg
Thank You!

**Graduate Students:**
- Camilo Lopera Higuita
- Roney Zimpel
- William Ortiz
- Francisco Lopez
- Achilles Vieira-Neto
- Bolivar Faria
- Maria Lucia Gambarini

**Funding:**
- Southeast Milk Checkoff
- Arm and Hammer Animal Nutrition
Genetic and non-genetic effects on embryo production technologies

PJ Hansen
Dept. of Animal Sciences, University of Florida

Survey of 17 states
79.5% of US dairies
82.5% of US cows
n. Operation average percentage of cattle pregnancies conceived during the previous 12 months by breeding method, and by herd size:

<table>
<thead>
<tr>
<th>Breeding Method</th>
<th>Small (Fewer than 100)</th>
<th>Medium (100-499)</th>
<th>Large (500 or More)</th>
<th>All Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural service (bull-bred)</td>
<td>29.1 (3.3)</td>
<td>22.0 (2.8)</td>
<td>19.7 (4.0)</td>
<td>26.8 (2.4)</td>
</tr>
<tr>
<td>AI (after detected estrus or timed)</td>
<td>70.3 (3.2)</td>
<td>77.0 (2.8)</td>
<td>79.9 (3.9)</td>
<td>72.5 (2.4)</td>
</tr>
<tr>
<td>Embryo transfer (superovulated or in vitro embryo)</td>
<td>0.6 (0.2)</td>
<td>1.0 (0.4)</td>
<td>0.4 (0.2)</td>
<td>0.7 (0.2)</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

EMBRYO TRANSFER CAN TEACH US ABOUT FERTILITY GENETICS AND IMPORTANCE OF MATERNAL ENVIRONMENT

Enhance genetic selection for embryo transfer
Enhance genetic selection for fertility in general

How does life in the uterus affect adult life?
DO CSF2-TREATED CALVES HAVE A DIFFERENT POSTNATAL PHENOTYPE?

ET calves sired by bulls for both treatments
ET-Control (n=5)
ET-CSF2 (n=10)

Day 5-7 CSF2 or vehicle
Day 7 ET to recipient cows

Body weight
Withers height

13 mo of age

Age (mo)
0 1 2 3 4 5 6 7 8 9 10 11 12 13

Body weight (kg)
0 100 200 300 400

Age x treatment, P<0.001

Control vs CSF2, P < 0.05

Body weight (lb)
0 250 500 750
EMBRYO TRANSFER CAN TEACH US ABOUT FERTILITY GENETICS AND IMPORTANCE OF MATERNAL ENVIRONMENT

PART 1
GENETIC ASPECTS OF EMBRYO TRANSFER RESULTS

Enhance genetic selection for embryo transfer
Enhance genetic selection for fertility in general

How does life in the uterus affect adult life?
Evaluation of genetic components in traits related to superovulation, in vitro fertilization, and embryo transfer in Holstein cattle


J. Dairy Sci. 100:2877–2891
https://doi.org/10.3168/jds.2016-11907

Department of Animal Sciences, University of Florida, Gainesville 32611
†Department of Animal Science, Faculty of Veterinary Medicine, Uludag University, Bursa, 16059 Turkey
‡Animal Genomics and Improvement Laboratory, Agricultural Research Service, USDA, Beltsville, MD 20705-2350
### Heritabilities for Embryo Yield and Pregnancy Success After Transfer

<table>
<thead>
<tr>
<th>Trait</th>
<th>Heritability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Superovulation (n=926)</strong></td>
<td></td>
</tr>
<tr>
<td>Total structures recovered</td>
<td>0.32</td>
</tr>
<tr>
<td>Total no. good embryos</td>
<td>0.21</td>
</tr>
<tr>
<td><strong>In Vitro Fertilization (n=628)</strong></td>
<td></td>
</tr>
<tr>
<td>Total structures recovered</td>
<td>0.15</td>
</tr>
<tr>
<td>No. of cleaved embryos</td>
<td>0.12</td>
</tr>
<tr>
<td>No. of high quality embryos</td>
<td>0.01</td>
</tr>
<tr>
<td>Proportion of embryos high quality</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Embryos Transferred (n=12,089)</strong></td>
<td></td>
</tr>
<tr>
<td>Pregnancy success, recipient</td>
<td>0.03</td>
</tr>
<tr>
<td>Pregnancy success, embryo</td>
<td>0.02</td>
</tr>
</tbody>
</table>

### Genetic Markers for Total No. of Structures and Good Embryos Could Be Identified

![Figure 2](image-url) Proportion of SNP variance explained by 10-SNP windows associated with total structures recovered in the superovulation data set with Anscombe transformation. Color version available online.
**Take-Home Messages**

- There is a significant genetic component to number of structures and embryos recovered from both superovulation and IVF procedures
  - could be used to identify and select for donors that do well in embryo transfer programs
  - those genes controlling embryo yield are probably not related to fertility to AI (since they probably control follicle number)

- There was low heritability for embryo quality and embryo survival on both the recipient and embryo side
  - just like AI, most of the variation in whether a cow gets pregnant to AI depends on environment and not genetics

  ---DOES NOT MEAN THAT GENETICS ARE NOT IMPORTANT---

---

**Holstein cow population**

<table>
<thead>
<tr>
<th>Location</th>
<th># Dairies</th>
<th>High DPR</th>
<th>Low DPR</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florida</td>
<td>6</td>
<td>677</td>
<td>137</td>
<td>814</td>
</tr>
<tr>
<td>California</td>
<td>5</td>
<td>394</td>
<td>1129</td>
<td>1523</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>1071</td>
<td>1266</td>
<td>2337</td>
</tr>
</tbody>
</table>

- **Genetic information (PTA values)**
  - Daughter pregnancy rate (DPR)
  - Heifer conception rate (HCR)
  - Cow conception rate (CCR)

- **Phenotypic information (Farm data)**
  - Pregnancy rate at first service
  - Services per conception
  - Days open
### Differences in fertility between high and low DPR groups

<table>
<thead>
<tr>
<th>Trait</th>
<th>N</th>
<th>LSMEANS (%) (SEM)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>High DPR</td>
<td>Low DPR</td>
</tr>
<tr>
<td>Preg. rate first service (Lact1)</td>
<td>2213</td>
<td>53.1 (1.69)</td>
<td>28.6 (2.32)</td>
</tr>
<tr>
<td>Preg. rate first service (Lact2)</td>
<td>1969</td>
<td>43.9 (1.77)</td>
<td>23.0 (2.38)</td>
</tr>
<tr>
<td>Preg. rate first service (Lact3)</td>
<td>1321</td>
<td>41.0 (1.88)</td>
<td>25.0 (2.53)</td>
</tr>
<tr>
<td>Services /conception (Lact1)</td>
<td>2213</td>
<td>1.93 (0.06)</td>
<td>3.26 (0.07)</td>
</tr>
<tr>
<td>Services /conception (Lact2)</td>
<td>1969</td>
<td>2.09 (0.07)</td>
<td>3.30 (0.07)</td>
</tr>
<tr>
<td>Services /conception (Lact3)</td>
<td>1321</td>
<td>2.20 (0.08)</td>
<td>3.20 (0.10)</td>
</tr>
<tr>
<td>Days open (Lact 1)</td>
<td>2213</td>
<td>98 (2.59)</td>
<td>163 (2.94)</td>
</tr>
<tr>
<td>Days open (Lact 2)</td>
<td>1969</td>
<td>112 (2.80)</td>
<td>167 (3.13)</td>
</tr>
<tr>
<td>Days open (Lact 3)</td>
<td>1321</td>
<td>110 (3.24)</td>
<td>158 (3.81)</td>
</tr>
</tbody>
</table>

### Daughter Pregnancy Rate

\[
PR = \frac{\text{Number of cows that became pregnant during a given 21-day period}}{\text{Number of cows that were eligible for breeding}}
\]

**National average for PR ~16%**

**DPR = PR of a bull’s daughters**

\[
PR (DPR) = \frac{21}{(\text{days open} - \text{voluntary waiting period} + 11)}
\]

A 1% increase in DPR = ~ -4 days open

1% PR = 400 lb milk

Welcome Super Petrone-ET
(Dec 2016)
+ 639 milk
+6.9 (-28 days open)
Enhance genetic selection for embryo transfer
Enhance genetic selection for fertility in general

How does life in the uterus affect adult life?

PART 2 – EFFECTS OF ENVIRONMENT DURING EARLY PREGNANCY ON POSTNATAL FUNCTION

-- 249 SUPEROVULATION CALVES
-- 345 CALVES BORN BY IVF-CONV-SEMEN
-- 658 CALVES FROM IVF-REVERSE SORTED SEMEN
REVERSE-SORTING
SEX SORTING OF FROZEN-THAWED SEMEN

<table>
<thead>
<tr>
<th></th>
<th>AI</th>
<th>IVF-conv</th>
<th>IVF-sexed</th>
<th>Superov.</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genomic PTA for milk (lb)</td>
<td>447±12a</td>
<td>638±37b</td>
<td>625±26b</td>
<td>516±40ab</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Genomic PTA for fat (lb)</td>
<td>19.6±0.4a</td>
<td>32.6±1.5b</td>
<td>31.5±1.1b</td>
<td>32.1±1.5b</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Genomic PTA for protein (lb)</td>
<td>16.1±0.2a</td>
<td>24.4±0.9b</td>
<td>23.3±0.7b</td>
<td>21.1±0.9b</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Dam PTA for milk (lb)</td>
<td>152±13a</td>
<td>477±73b</td>
<td>401±61b</td>
<td>45±66ab</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Sire PTA for milk (lb)</td>
<td>727±14a</td>
<td>762±41a</td>
<td>1015±29b</td>
<td>807±46a</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Net merit dollars ($)</td>
<td>321±3a</td>
<td>456±9b</td>
<td>464±6b</td>
<td>420±10c</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Genomic PTA for DPR</td>
<td>1.9±0.03a</td>
<td>2.0±0.09a</td>
<td>2.4±0.06b</td>
<td>2.1±0.1ab</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

Genetic Merit

Gainesville, FL, April 20, 2017
### Adult Performance – First Lactation

<table>
<thead>
<tr>
<th>Endpoints</th>
<th>AI</th>
<th>IVF-conv</th>
<th>IVF-sexed</th>
<th>Superov.</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reproduction traits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age at first calving (months)</td>
<td>23.5±0.1</td>
<td>23.8±0.3</td>
<td>23.2±0.2</td>
<td>23.3±0.3</td>
<td>0.4520</td>
</tr>
<tr>
<td>Days open, first lactation (d)</td>
<td>100.0±2.1</td>
<td>108.3±5.5</td>
<td>102.7±3.9</td>
<td>87.5±7.6</td>
<td>0.1479</td>
</tr>
<tr>
<td><strong>Production traits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected actual milk yield, 305 (lb)</td>
<td>24283±68^[a]</td>
<td>24081±220[^ab]</td>
<td>23577±167^[b]</td>
<td>23960±328[^ab]</td>
<td>0.0014</td>
</tr>
<tr>
<td>Projected actual fat yield, 305 (lb)</td>
<td>854±3^[a]</td>
<td>848±9[^ab]</td>
<td>829±7[^b]</td>
<td>846±13[^ab]</td>
<td>0.0072</td>
</tr>
<tr>
<td>Projected actual protein yield, 305 (lb)</td>
<td>736±2^[a]</td>
<td>740±7^[a]</td>
<td>720±6[^b]</td>
<td>729±11[^ab]</td>
<td>0.0318</td>
</tr>
</tbody>
</table>

### Potential Mechanisms

**Damage to sperm during sex-sorting (?)**
- DNA labeling (chromatin staining)
- Exposure to a laser beam
- Positive or negative charge on membrane
- Intensive manipulation

**Paternal contribution upon fertilization**
- **Dogma:** only genomic DNA
- **Reality:** much more!

**Delayed fertilization?**
- Aged oocyte → ↓ Fertility

**miRNA** → **mRNA** → **siRNA** → **Sperm-borne proteins**
Effect of Dam Parity on Offspring Phenotype

<table>
<thead>
<tr>
<th>Endpoints</th>
<th>Dam parity</th>
<th>P-value</th>
<th>Dam parity by technique interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nulliparous (parity = 0)</td>
<td>Parous (parity ≥1)</td>
<td></td>
</tr>
<tr>
<td>Reproduction traits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age at first calving (mo)</td>
<td>23.3 ± 0.2</td>
<td>23.6 ± 0.2</td>
<td>0.29</td>
</tr>
<tr>
<td>Days open, first lactation</td>
<td>96.0 ± 4.2</td>
<td>103.3 ± 3.2</td>
<td>0.15</td>
</tr>
<tr>
<td>Production traits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected actual milk yield, 305 d (lb)</td>
<td>2367 ± 154</td>
<td>2427 ± 136</td>
<td>0.0019</td>
</tr>
<tr>
<td>Projected actual fat yield, 305 d (lb)</td>
<td>829 ± 6</td>
<td>860 ± 5</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Projected actual protein yield, 305 d (lb)</td>
<td>721 ± 5</td>
<td>742 ± 4</td>
<td>0.0007</td>
</tr>
</tbody>
</table>

Conclusions

- Procedures used for IVP with reverse-sorted semen have consequences that extend to adult life
- IVP-sexed offspring are characterized by:
  - Reduction in milk, fat, and protein production
- The consequences of IVP-conv and MOET were minimal for postnatal function
- Dam parity while carrying a calf causes alterations in fetal programming
  - Performance of offspring from nulliparous heifers was inferior than those born from parous cows (parity ≥1)
### Developmental Programming Occurs in Cattle

<table>
<thead>
<tr>
<th>Maternal Environment</th>
<th>Type of cattle</th>
<th>Treatment</th>
<th>Altered Adult Phenotype</th>
<th>Reference</th>
</tr>
</thead>
</table>

**first AI calf in the U.S.A.**
February 1939
Schomp Farm, Stanton, NJ

---

53rd Florida Dairy Production Conference
Gainesville, FL, April 20, 2017
I'm An Artificial Calf

Ralph A. Porterfield

I'm a little heifer, I'm an artificial calf,
Some people think it's funny, but go ahead and laugh.
When I grow up to be a cow and join the milking herd
I'll bet I'll be a big success — perhaps the latest word.

You seldom find a little calf as beautiful as me,
If I could be your pin-up girl I'd be happy as can be,
Now I'll tell you my ambition which is not to fly or sail
But to always be on duty and to put 'er in the pail.

I want to be a glamour girl and take in every fair,
I want to win blue ribbons, at least to win my share.
In just another year or two I'll have symmetry and style
And to this I'm looking forward for I think it well worth while.

When people come to see me they tell me I have type,
And off they go just feeling fine without a single gripe.
It's always nice to please them for I'm sure that they can see
That artificial breeding is worth its modest fee.

Think it over, brother, for I know I'll pay my way
By eatin' and producin' and consumin' lots of hay.
Enroll your little herd of cows and be the last to laugh
'Cause you'll never go astray with an artificial calf.
Challenges, Opportunities, & Prospects of US Dairy Production

Gordie Jones DVM

53rd Florida Dairy Production Conference
April 20th 2017

Dr. Gordie Jones

• 15 years Dairy Practice
• 10 years Dairy Nutrition / Facility /Cow Comfort consulting
• 3 years Monsanto (BST) consulting
• 6 years designed & managed Fair Oaks Dairy Farms (20,000 cows)
• 5 years building and managing my dairy farm!
• Consulting again
Remember we are here because we love cows!
“Pleistocene Mega fauna”

– Born during the last Ice Age

The First Farmers

• Were in Mesopotamia
• Modern day Iraq
• Large headed grains
• Wheat, Barley, Triticale
• A stick in the sand
• A little water and we were farmers!
The First Farmers

• Our First fences
• Were to keep the wild cows out!!
• She opened the gate
• And we now had a cow!

Only 11 species were able to be domesticated.

• Our Cow is the star!
• She Provided POWER, Protein, & Fertilizer
• She truly is the foundation of civilization.
• The foster mother of the human race
• All of the domesticated animals are “herd” species - looking for a leader
• Except the Cat!!
Covenant;
To care for, and keep

The Star of the show!
Guns, Germs & Steel

Jarred Diamond

Vaccine

- First vaccine....
- Small Pox
- Cow Pox
- Latin  Vacca = Cow
- Vaccinate
Cow-inate!!!!

Trends in the Dairy Industry over the last 25 years can be best described by the term: **CHANGE**

PM Fricke, Ph.D.
Most Dairy Farmers will double herd size 4 times.

- Pretty easy when 25 cows
- Become 50-100-200 cows
- But as we get to 200 cows
- Becomes 400-800-1,600 cows
- Now we are at 1,600 becoming 3,200 cows
- 3,200 cows and now dairymen are just
- Building more 3,000 milk cow dairies

Dairy Sectors (who’s dairying?)

- Sunset dairies
  - Small dairies that will shut down when the current owner retires or leaves for economic, age, or lifestyle reasons
- Niche dairies
  - Production for a specific market or with a specialized system (organic, grazing, Amish, etc.)
- Lifestyle dairies
  - Operate with considerable off farm income for personal lifestyle reasons
- Large dairies
  - This is the principal sector in terms of current and future milk production in the United States and quickly across the world.
  - Large is a semi-load of milk at least every other day (400 cows)
Four Major Forces Shaping US Dairing

- **Industrialization / consolidation of production**
  - The dairy industry is in a phase of rapid structural change
  - Large dairy production technology has irreversibly dominated the industry

- **Globalization of markets**
  - No beef moves to Japan from North America

- **Food safety issues**
  - BSE, E. coli 0157, organic markets, fear based food marketing, No GMO’s

- **Consumerism**
  - Low fat, Low carb, “Happy cows” Natural,

Challenges & Opportunities
Dairy Farming

- Run as a business, is a Great Way of Life
- Run as a Way of Life, is a poor Business

Water

- Climate Change
- Current Demands NOT sustainable
- Opportunity
- Midwest
Water, The Midwest is favored

Welfare

• Tail Docking? Gone
• Polled Cows
• No overcrowding
• All cows must go outside for part of day
Hormones

- Hormones Gone
- No OvSync, Co Sync, Double Whatever Sync

Genetics
Future Farms
Experts' projections of milk yield in 2067

- **Actual**
- Linear (Actual)
- Expon. (Actual)

---

Soils
Crops
Silo/bales
Lagoon
Natural areas
Barns
Milking center
Personnel
Equipment
Commodities
Robots
Air
Waterways
Roads
Vehicles

All breeds are included in these averages.

- Mix of genes in future?
- On-farm solids separation?
- Climate change?

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual</th>
<th>Linear (Actual)</th>
<th>Expon. (Actual)</th>
<th>Forecasters Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2067</td>
<td>71,944</td>
<td>36,453</td>
<td>36,453</td>
<td>3.8 million Dairy Cows</td>
</tr>
</tbody>
</table>

53rd Florida Dairy Production Conference
Gainesville, FL, April 20, 2017
Expert's forecast of milk yield in USA

USDA Agricultural Statistics Quick Survey Data

Dairy lateral integration in the future

- Enhances labor efficiency
- Common protocols
- Driverless feed vehicles
- Identical robotics and barns
- Staff veterinarians
Which farms will survive?
Carrying capacity of USA agriculture is greatest with dairy!

Dairy Companies & Consultants

- Everyone wants to “Value Add” to my business
- First I do not care “what” you know
- Until I know that you care!
- And I need you to have “ownership”
- What ever solutions you have for my problems
- You need to have a belief that they work
- And that they fit my dairy or problem.

Cow Comfort is Universal

- Cow Comfort is independent of size
Freestall Pen
Head to Tail
3 things a Cow Should Do!

• Stand to MILK
• Stand to EAT & DRINK
• LAY DOWN

“Milk is the Absence of stress!!!”
Questions? Thoughts?

Dr. Gordie Jones
Partner
Central Sands Dairy, LLC.

gordon.a.jones@att.net
The role of the modern dairy cow in improving the profitability of dairy production

GREG ANDERSEN
SEAGULL BAY DAIRY, INC. AMERICAN FALLS, IDAHO

Seagull Bay Dairy: American Falls, Idaho
Andersen Dairy: Declo, Idaho

One Herd on Two Sites
300 Holsteins 2,000 Crossbreds
Some Elite Holsteins (Sell 50 bulls annually to AI)

Seagull Bay Dairy
• 600 milk cow (Fresh – 90 days)
• 160 close up cows/springers
• Baby calves up to 180 days

Andersen Dairy
• 1500 milk cows
• Far off dry cows
• Heifers 7 months and older
Seagull-Bay Supersire 7H11351
Ammon-Peachey Shauna “Global Cow”

How we used to do it
Corrective Matings based on “type” evaluations

Evaluation
- Classification by breed organizations
- Mating programs by AI companies

Results?
- Great improvement in Mammary System
- More attractive cows
- Taller cows
- TPI index gives heavy weight to PTAT
- TPI has been widely used as a selection tool for sires

Downside?
- Tall cows score higher
- Economic traits not necessarily correlated to Type traits

Dairy Shows Champions—“Incredible- but not always practical”
What do dairy producers want?

Moderate Size
Healthy Cows
Athletic
High Components
Calving Ability
Fertility
Hardiness
High Production
Udder Health

Health and Wellness
Direct Selection > Indirect Selection

Health Traits in US: 1990’s
Included in TPI and NM formulas
Daughter Pregnancy Rate etc.
Calving Ease
Somatic Cell Score
Productive Life
Livability *New*

Wellness Traits in US: 2015
Not yet included in TPI and NM
Zoetis, ABS, Genex, etc...
Metabolic Disease Resistance
Mastitis Resistance
Lameness
Metritis
Ketosis
DA
“Type is not the limiting factor...”
Lloyd Holtermann – Rosylane Holsteins WI

| 1000 Holsteins Watertown, Wisconsin | 1.68 Feed Efficiency in 2016 |
| All Holsteins | 0 Milk Fever |
| Does not Classify | 0 Ketosis |
| Type not used in selection criteria | 36 Preg Rate |
| Health is main component of Feed Efficiency | 4% DOA |
| PL and Protein main traits for selection | |

What does the “modern cow” look like?
Will color matter? Performance only?

Points to consider

- How is your milk check calculated?
- Management & Nutrition First
- Use a selection index
- Custom indexes are highly encouraged based on your own breeding needs
- Focus on 4-5 key traits and avoid high negatives
- Gender-sorted semen technology is improving
- Consider choosing which cows and heifer will provide replacements
- Every pregnancy has a purpose
- Semen purchases are an investment and not an expense
- Use the best sires for your plan from any breed you are using
- Holstein Herds that have selected for PL and DPR have very good fertility and longevity
- Body condition is very important to cow health and fertility
- Modern dairy cows can achieve high production and maintain body condition
- Hybrid vigor is real
Interim results from Procross study

Comparison of Montbeliarde × Holstein and Viking Red × Holstein crossbreds with pure Holstein cows during first lactation in 8 commercial dairies in Minnesota

https://www.ansci.umn.edu/sites/ansci.umn.edu/files/procross_final_f1_first_lactation-lb.pdf

Amy Hazel, Brad Heins, and Les Hansen
University of Minnesota – Jan 2016

Table 1. Production (actual and not mature equivalent) during the first 305 days of first lactation for M-H and V-H crossbreds compared to pure Holstein cows.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Holstein</th>
<th>Montbeliarde × Holstein</th>
<th>Viking Red × Holstein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cows</td>
<td>978</td>
<td>513</td>
<td>540</td>
</tr>
<tr>
<td>Age at calving (months)</td>
<td>23.9</td>
<td>23.8</td>
<td>23.7</td>
</tr>
<tr>
<td>Milk (lb)</td>
<td>24,185</td>
<td>24,150</td>
<td>23,259**</td>
</tr>
<tr>
<td>Fat (lb)</td>
<td>900</td>
<td>900</td>
<td>910</td>
</tr>
<tr>
<td>% Fat</td>
<td>3.74</td>
<td>3.83</td>
<td>3.83**</td>
</tr>
<tr>
<td>Protein (lb)</td>
<td>733</td>
<td>759**</td>
<td>740</td>
</tr>
<tr>
<td>% Protein</td>
<td>3.05</td>
<td>3.14**</td>
<td>3.15**</td>
</tr>
<tr>
<td>Fat + Protein (lb)</td>
<td>1,653</td>
<td>1,678*</td>
<td>1,651</td>
</tr>
<tr>
<td>Somatic cell score</td>
<td>2.1</td>
<td>2.2</td>
<td>2.1</td>
</tr>
</tbody>
</table>

* Significant difference (P < 0.05) from pure Holstein.
** Significant difference (P < 0.01) from pure Holstein.

Table 2. Fertility during first lactation for M-H and V-H crossbred cows compared to pure Holstein cows.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Holstein</th>
<th>Montbeliarde × Holstein</th>
<th>Viking Red × Holstein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days to first breeding</td>
<td>970</td>
<td>71</td>
<td>507 49*</td>
</tr>
<tr>
<td>First service conception rate (%)</td>
<td>948</td>
<td>38</td>
<td>499 43</td>
</tr>
<tr>
<td>Overall conception rate (%)</td>
<td>950</td>
<td>38</td>
<td>499 46*</td>
</tr>
<tr>
<td>Time to first pregnancy (%)</td>
<td>559</td>
<td>2.30</td>
<td>356 2.07**</td>
</tr>
<tr>
<td>Days open</td>
<td>901</td>
<td>125</td>
<td>440 11.1**</td>
</tr>
</tbody>
</table>

n = Number of cows.
* Tendency for significant difference (P < 0.10) from pure Holstein.
* Significant difference (P < 0.05) from pure Holstein.
** Significant difference (P < 0.01) from pure Holstein.
More results

Table 2. Twinning rate, gestation length, calving difficulty score (1-5 scale), and stillbirth rate during first lactation for M-11 and V-11 crosses and compared to pure Holstein cows.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Holstein (BO service sire)</th>
<th>Montbeliarde (VR service sire)</th>
<th>Viking Red (MO service sire)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nº of cows</td>
<td>971</td>
<td>496</td>
<td>308</td>
</tr>
<tr>
<td>Twinning rate (%)</td>
<td>1.0</td>
<td>0.6</td>
<td>0.8</td>
</tr>
<tr>
<td>Gestation length (days)</td>
<td>270</td>
<td>270**</td>
<td>280**</td>
</tr>
<tr>
<td>Calving difficulty-All (%)</td>
<td>1.6</td>
<td>1.6</td>
<td>1.3</td>
</tr>
<tr>
<td>Calving difficulty-Females</td>
<td>1.4</td>
<td>1.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Calving difficulty-Males</td>
<td>1.6</td>
<td>1.7</td>
<td>2.3**</td>
</tr>
<tr>
<td>Stillbirth rate-All (%)</td>
<td>2.0</td>
<td>9**</td>
<td>5**</td>
</tr>
<tr>
<td>Stillbirth rate-Females (%)</td>
<td>6</td>
<td>2*</td>
<td>3</td>
</tr>
<tr>
<td>Stillbirth rate-Males (%)</td>
<td>11</td>
<td>7</td>
<td>8</td>
</tr>
</tbody>
</table>

1 Significance difference (P < 0.05) from pure Holsteins.
2 Significant difference (P < 0.01) from pure Holsteins.

Table 3. Survival during first lactation for M-11 and V-11 crosses and compared to pure Holstein cows.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Holstein (BO service sire)</th>
<th>Montbeliarde (VR service sire)</th>
<th>Viking Red (MO service sire)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival to 0 DIM (%)</td>
<td>1033</td>
<td>968</td>
<td>1033</td>
</tr>
<tr>
<td>Survival to 14 months (%)</td>
<td>1021</td>
<td>63</td>
<td>352</td>
</tr>
<tr>
<td>Survival to 17 months (%)</td>
<td>1021</td>
<td>76</td>
<td>351</td>
</tr>
</tbody>
</table>

* Tenancy for significant difference (P < 0.05) from pure Holsteins.
** Significant difference (P < 0.01) from pure Holsteins.

Holsteins improving in profitable traits
Changes in genetic selection differentials and generation intervals in US Holstein dairy cattle as a result of genomic selection 2016
http://www.pnas.org/content/113/28/E3995.full.pdf
Adriana García-Ruiz, b, John B. Cole, Paul M. VanRaden, George R. Wiggans, Felipe J. Ruiz-López, and Curtis P. Van Tassel

Protein Yield increasing and DPR increasing

Milk yield increasing SCS decreasing

Concluding thoughts

There is an impressive pool of sires from various dairy breeds

Holsteins have the largest pool

Disciplined selection within the Holstein breed has worked very well for many herds

Genomic selection has increased the rate of genetic advancement

Choose specifically and intensely for traits of most economic importance to your business

Consider selecting for Wellness Traits

“WinStar breeding will be primarily focused on high total merit index breed improvement. Cows with innate ability for high production coupled with adequate fitness and wellness traits are proven to outperform their peers of lesser genetic merit. Improved performance will lead to increased profit potential in well managed herds of all sizes.”
Thinking Outside the Box: One Panhandle Farm’s Quest for Sustainability

Meghan E. Austin, DVM

People that make this work...
Jackson County

- Marianna, FL
- #1 county for row crop production
- Currently 3 dairies in county
- Population: 49,746
- Close proximity to Tallahassee & Gulf Coast
Cindale Farms: The beginning

- Parents (Dale & Cindy Eade) have been in the dairy business for 37 years
- Parents are ‘first-generation’ farmers

  1994 ‘A New Beginning’
  - Parents were minority owners in large dairy operation until 1994
  - Leased small facility in Cottondale
  - Initially all work done by family

The beginning

- 1996
  - Moved to leased farm in Marianna
  - Grew herd & increased labor force

- 2003
  - Purchased land and built current facility
  - 467 acres of pasture, hardwood forest, timber & wetlands
The last 7 years

- Brad and I returned in late 2009
  - Spent many good years at UF

- Reinvigoration/fresh ideas
  - Focus more on grazing
  - Change genetic base of herd
  - Seasonal calving
  - Assist with goals of becoming more involved with local community

- Management transition
  - 2009-2014: management responsibilities shared w/Dale & Cindy
  - August 2014: management responsibilities transitioned to Brad & I
Farm Basics

- 467 acres
  - Hybrid rotational grazing operation
  - 75 acres under center pivot
- 550+ cattle
  - 300 milk cows (Jersey & Jersey-holstein crosses)
  - 250 youngstock
Main barn
  o Double 12 parallel rapid exit parlor
  o Break room, storage, milk room & working facility

Feed/cooling barn
  o External feed alleys

Six bay commodity barn

Two stage waste water management system
  o Partitioned concrete lined solid separator
  o Effluent lagoon
Cindale Farms

![Image of dairy farm]

Cindale Farms

![Image of milking equipment]
Hybrid grazer

- Feed a TMR
- Able to rotationally graze the majority of the year to offset some purchased forage inputs
- Purchase additional forages
Cindale Farms

- 75 acres under center pivot surrounding barns
  - Managed intensive rotational grazing
  - Perennial & annual pastures
  - Conservation tillage employed across farm
  - External fencing high tensile electric, cross fenced with polywire
  - Paddock sizes are varied depending upon forage availability
Cindale Farms
Reproduction

- Utilize both A.I. and natural service
  - A.I. on natural heats for month of January
  - Bulls in February-March

- Seasonal
  - Main breeding season from January 1st to April 1st (calves kept)
  - Second season July 1st to Sept 1st (all calves sold)
Cindale Farms

ο Calf raising
  o Seasonal (End of Sept-beginning January)
  o Housed in groups on grass paddocks based on age
  o Start in a ‘training pen’
    • Tattooed and paste dehorned
    • 2-3 days
  o Constant access acidified milk
    • Receive 1.5-2 gallons milk/day
    • Acidify to pH 4.2-4.8
  o Wean at 8 weeks
    • Gradual weaning beginning at 6 weeks
Cindale Farms

A vision for the future

- Enhancing sustainability
  - Ability to support additional family units
  - Optimizing land use while enhancing environment
  - Establishing connection to local consumers/economy

- Diversification
  - Preferred over linear expansion of dairy
  - Fit our goals/ideas for the future

The birth of a new business: ‘ Thinking outside the box’
Southern Craft Creamery

The beginning

- 2010-2011
  - Early brainstorming began

- 2012
  - Lauren began perfecting our ‘base’ recipe
  - Marketing ideas came to fruition
  - Construction

- 2013
  - First sales began in February

The last 4 years

- 2013
  - Establishing a viable market
    - Building relationships
    - Wholesale to independent grocers & chef-owned restaurants
  - Selected as Overall Winner for Garden & Gun magazine’s ‘Fourth Annual Made in the South Awards’
  - Shipping headaches

GARDEN & GUN
The last 4 years

2014
- Expand market
- Expand production facility (twice)
- Management transition
- Recognized by the Florida Cabinet
- Jackson County Agricultural Innovators
- Featured in Food & Wine’s blog
  - Top 7 holiday ice creams

2015-2016
- Continued to expand market while maintaining quality
- Purposeful slow growth
- Featured in Southern Living Magazine
  - 2015 Food Award Winner
  - 2016 Food Award Winner
Southern Craft Creamery

What's in store for 2017...
- Doubling production capacity
- Continued expansion of market
- Expansion into retail

Southern Craft Creamery

Creamery basics
- Handcrafted, artisanal ice cream
- Small batch
- Non-homogenized
- Local sourced ingredients from producers
- Sales in over 38 locations
Southern Craft Creamery

Southern Craft Creamery
Cindale Farms & Southern Craft Creamery

A vision for the future

- Cindale Farms
  - Continued diversification
  - Enhanced utilization of fresh, local milk

- Southern Craft Creamery
  - Continued market expansion while staying true to vision
  - Product diversification
  - Venture into retail

- Enhancing sustainability
  - Continue to support additional family units
  - Optimize land use while enhancing/preserving environment
  - Enhancing connection to local consumers/economy
Looking back to when we were looking ahead

- Six years ago our family had a serious conversation about our future
- Agreed that ‘small farms’ would be obsolete in 10 years
  - This seems to have been fast-forwarded
- Our vision had to fit our goals and desires as both a family unit and profitable business enterprise

We must all challenge ourselves to think ‘outside the box’ if we want to continue to dairy

- We are obviously all very good at producing high volumes of milk, but if we continue to do so in the face of decreasing demand, where will the majority of us be in 20, 10 or even 5 years?
Dairy Industry: Opportunities & Challenges

- We don’t farm like we did 30 years ago, so why do we continue to sell milk the same way?
  - "The art of life is a constant readjustment to our surroundings." – Kakuzo Okakura
  - "The price of doing the same old thing is far higher than the price of change." – Bill Clinton
  - "Adapt or perish, now as ever, is nature’s inexorable imperative." – H.G. Wells

- We have to be innovative and continue to challenge the ‘norm’ on the dairy aisle and on the dairy farm
  - Beginning to see progress in this area...need more
  - Opportunity for farms of all sizes

- We need to get out of our ‘comfort’ zone

- How do we accomplish?
  - By thinking ‘outside the box’
  - By having meaningful, open, transparent conversations with consumers
Dairy Industry: Opportunities & Challenges

- Today’s consumer (for the most part) wants to know where their food comes from, how it is produced & why ‘we’ do what ‘we’ do.
  - Let’s use this to our advantage!

Don’t be afraid to try something new...
PRODUCER PANEL
Improving calving rates in dairy cows by infusion of seminal proteins at AI

John J. Bromfield, Laila Ibrahim, Peter J. Hansen and Cliff Lamb
Department of Animal Sciences, University of Florida

Seminal plasma is the cell free fluid that transports sperm cells into the female reproductive tract at insemination. However, during AI seminal plasma is either removed or significantly diluted to facilitate an increased number of insemination from a single ejaculate, one ejaculate is enough to provide for 300 breedings. Previous work in our laboratory has shown the benefits of uterine seminal plasma exposure in promoting healthy pregnancy outcomes by increasing embryo development and changing the maternal immune system during early pregnancy. We hypothesize that exposure of uterine tissues to seminal plasma at the time of AI in cows promotes cellular changes that increase pregnancy success. In addition, we aim to identify the active proteins in seminal plasma that induce these changes and supplement them back into semen for AI.

Using an explant model of isolated endometrium (the lining of the uterus) we have demonstrated that seminal plasma does indeed drive acute changes in the expression of key molecules important in early embryo development. We observed significant time and dose dependent increases in the expression of CSF2, PTGS and IFNε in response to seminal plasma (15-, 5- and 10-fold, respectively). Upregulation of these molecules in the uterus at the time of AI may help establish healthy embryonic development, and subsequently improve pregnancy outcomes.

Investigations in women, pigs and mice suggest that the seminal plasma protein TGFβ is integral in initiating the changes in uterine protein expression that may assist in embryo development. As such we profiled semen for TGFβ content in 33 bulls. Interestingly we identified two isoforms of TGFβ in bovine seminal plasma. Seminal plasma TGFβ-1 was measured at very high concentrations with an average concentration of 7108 ±1553 pg/ml (range of 156 - 33,311 pg/ml). Seminal plasma TGFβ-2 was measured at an average concentration of 6067 ± 1157 pg/ml (range of 0 - 27,358 pg/ml). The wide variation of both TGFβ isoforms between bulls may be a source of variable pregnancy rates observed in bulls at different locations or different times of year. It has been suggested that diet, environment and stress can all modulate TGFβ expression in biological fluids.

The preliminary studies discussed here are the first to describe the presence of TGFβ in bull semen and the role in which it can modulate the uterine environment at the time of insemination to potentially improve embryo quality. We have recently completed an experiment where we have infused seminal plasma into cows at the time of AI to identify specific changes in the uterus in a whole animal model. The fact that seminal plasma proteins are lacking, or significantly diluted during AI provides a unique opportunity to improve AI pregnancy success.
Improving efficiency of microbial growth in order to reduce protein feed costs for cows

César R. V. Teixeira, Rogério de Paula Lana, Junyi Tao, and Timothy J. Hackmann
Departamento de Zootecnia, Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brazil; Department of Animal Sciences, University of Florida, Gainesville, Florida, USA

Objectives: The majority of protein metabolized by the cow comes from microbes growing in the rumen, but microbes use as little as 1/3 cellular energy (ATP) on growth. If we could elucidate why microbes grow so wastefully, we could increase microbial protein supply to the cow and decrease need for expensive feed protein. We know that microbes waste energy on storing energy inefficiently (synthesizing reserve carbohydrate) and burning off excess energy as heat (energy spilling), but we do not know the relative importance of these energy sinks. The objective of this study was to compare how protozoa and bacteria, two major microbial groups in the rumen, waste energy on reserve carbohydrate synthesis vs. energy spilling when given excess energy (glucose).

Methods: Rumen fluid was collected from one of two cows, and bacteria and protozoa were prepared by filtration and centrifugation. Microbial groups were resuspended in nitrogen-free buffer (to limit growth), transferred to anaerobic flasks, and then given a large dose of glucose (5 mM). Glucose, reserve carbohydrate, and total heat production were monitored after dosing glucose. Energy spilling was calculated as heat not accounted by synthesis of reserve carbohydrate or endogenous metabolism (heat production prior to dosing glucose). Experiments were repeated six times per microbial group.

Results: Protozoa consumed glucose rapidly (within 50 min) and synthesized large amounts of reserve carbohydrate, with over half of glucose carbon (53%) being directed towards this carbohydrate. They did not spill energy, as all heat production (104%) was accounted by reserve carbohydrate and endogenous metabolism. Bacteria, by contrast, consumed glucose more slowly (¼ the rate of protozoa). They synthesized only half as much reserve carbohydrate as protozoa. Instead, bacteria spilled large amounts of energy, with spilling accounting for >50% of heat production once glucose was exhausted.

Conclusions: Both protozoa and bacteria can waste energy from excess glucose, with protozoa doing so by synthesizing reserve carbohydrate and bacteria largely by spilling energy.

Implications: These results could guide feeding strategies that decrease energy waste by microbes, increase microbial protein supply, and decrease feed protein. Specifically, results could improve prediction of microbial protein supply by diet formulation software, which in turn would guide those strategies. Diet formulation software, such as the Cornell Net Carbohydrate and Protein System (CNCPS), predicts microbial protein supply but imperfectly, owing to poor representation for how microbes waste energy on reserve carbohydrate and energy spilling. Our results will improve this representation, improve prediction of microbial protein supply, enable software to formulate diets that maximize microbial protein, and reduce expensive feed protein.
GENETIC AND NON-GENETIC EFFECTS ON MATERNAL ABILITY TO SUPPORT EMBRYONIC SURVIVAL AND MODIFY SUBSEQUENT PERFORMANCE OF THE OFFSPRING

Peter J. Hansen, Serdal Dikmen, Raluca Mateescu, and John B. Cole

Dept. of Animal Sciences, University of Florida (PJH, RM), Uludag University Faculty of Veterinary Medicine, Bursa, Turkey (SD), and USDA Animal Improvement Laboratory, Beltsville MD (JC)

Objectives
We analyzed a unique dataset of embryo transfer recipients and their calves from a local dairy in north Florida to achieve two goals:

1) Identify genetic markers for ability of cows to produce embryos, of cows to become pregnant after embryo transfer, and of the embryos to establish pregnancy after transfer to recipients
2) Determine whether embryo transfer and parity have effects on the offspring that affect its subsequent production when it becomes an adult.

Genetic markers for embryo transfer. Reproductive technologies such as superovulation and embryo transfer allow superior females to produce many more offspring than in traditional breeding programs. In addition to high cost, these technologies are also associated with variable animal response. Heritability of number of structures recovered and number of good embryos for superovulation were moderate (0.27 and 0.15, respectively). Values for number of good embryos from in vitro fertilization (IVF) were 0.21. Thus, there is genetic variation in embryo production in both systems. In contrast, the heritability of recipient (0.03) and embryo (0.02) pregnancy success after transfer were low. A genome wide association study was performed to identify regions of the genome associated with embryo production traits. Several regions were identified including several similar to regions previously associated with other fertility traits. These regions might be useful in increasing accuracy of genetic selection for reproduction.

Postnatal function as affected by embryo technology and maternal parity during gestation. This study tested the hypothesis that postnatal function of cattle is influenced by the environment experienced by the developing embryo and fetus during gestation. Accordingly, we evaluated survival, growth, and production traits of offspring derived by IVF, multiple ovulation and embryo transfer (MOET), and artificial insemination (AI). IVF calves were born heavier and had an altered growth trajectory compared to AI calves, in addition to having higher mortality rates during the first six months of age. Traits of MOET offspring were intermediate and not different from AI or IVF. Moreover, the altered phenotype of IVF offspring extended to adult milk production. Cows derived by IVF produced less milk and fat in their first lactation compared with dairy cows derived by AI. Additionally, females born to heifers had a distinct postnatal phenotype compared with offspring from cows. In conclusion, we provide evidence that the microenvironment of the embryo and fetus can affect development in ways that have an impact on adult performance. Some benefits of IVF in livestock for genetic improvement could be offset in certain circumstances by adverse programming events.
Promoting testing and surveillance for bovine viral diarrhea virus in Florida and Georgia Dairy herds using bulk tank milk samples

Jones AL¹, MRS Ilha¹, Roy Berghaus² and E Rollin². UGA College of Veterinary Medicine

¹Tifton Veterinary Diagnostic Laboratory, Tifton, GA; ²Food Animal Health Management Program, Athens, GA

Funding to support this research was provided through the Florida Milk Checkoff program, May 1, 2015

Disease caused by bovine viral diarrhea virus (BVD) produces significant economic loss to the dairy industry. Studies have shown a BVD outbreak in a lactating herd can cost $35 to $410 per lactating cow depending on the severity of the disease. Diseases observed in infected herds include: reproductive failure (failure to conceive, embryonic loss, abortion, congenital defects and stillborn or weak, unthrifty calves) and respiratory disease and diarrhea in young calves. The effect of BVD infection on the developing fetus varies depending on the stage of pregnancy. Exposure of the fetus to the non-cytopathic BVD biotype prior to 125 days of gestation can result in the development of a persistently infected (PI) calf. PI calves shed large numbers of the virus throughout their lifetime and continually expose other cattle to the virus. Management practices to control the disease include vaccination of all members of the herd, biosecurity procedures to prevent introduction, bio-containment to interrupt the spread of the virus and laboratory testing of samples for the presence of the virus in a herd, with the final goal of identifying and removing PI animals from the herd.

A polymerase chain reaction (PCR) assay to detect BVD antigen has been validated for use in bulk milk samples (Idexx VetMAX™ Gold BVDv Detection Kit). This test has been shown to be highly sensitive and can consistently detect a single PI cow in a group of up to 800 lactating dairy cows. Samples from each truckload of milk from 39 dairies in GA and 39 in FL delivered to Southeast Milk, Inc. laboratories in Belleview or Okeechobee, FL were collected by SMI employees and shipped to the TVDIL for testing over a 6 month period. Somatic cells were collected from the milk samples and BVD RNA was extracted.

The cumulative incidence of BVD 38.4% [14/39 (35.9%) farms in FL and 16/39 (41%) farms in GA had at least one positive test during the 6 month period]. A follow up survey asking dairy owners or managers about their management practices was sent to all the dairies tested. Twenty one surveys were returned (13 from BVD negative herds and 8 from positive herds). Surveys included questions about replacement management or source, vaccination practices, degree of veterinary involvement and owner knowledge about BVD. Responses from positive and negative dairies were compared using Fisher’s Exact statistical test. Overall, 95% of farmers had some knowledge about BVD. Management activities such as purchasing or raising replacement heifers, vaccination programs and vaccines used, BVD testing, etc. were not significantly different between farms with a positive or negative BVD test. However, negative BVD farms were more likely to have consulted a veterinarian on a weekly or monthly basis than BVD positive farms (81.8% vs 14.3% respectively; P=0.033).

These results indicate a whole herd BVD testing plan may be warranted in some herds. BVD is likely causing health and reproductive problems.
Evaluating new sensor technologies and breeding lines for mitigating forage yield decline
Cheryl Mackowiak and Ann Blount: NFREC, Quincy Florida

Field and crop surveying (sensor-based) technologies are being developed to better assess crop health from plant- to field-scale. The Veris® on-the-go sensor technology provides a platform to collect real-time soil electrical conductivity (EC), pH, and organic matter measurements comprised of hundreds or more samples per acre (significantly greater than is typically performed with grid sampling). Additionally, spectral imaging sensors can detect canopy visible and near visible radiation to calculate a Normalized Difference Vegetation Index (NDVI for estimating crop productivity) or thermal radiation, used to detect crop development and stress. Canopy sensors can be used on the ground or via drones. The NDVI can also be calculated from satellite imagery. The potential production benefits derived from these technologies have yet to be realized or demonstrated across many commodities or production systems. We soil mapped sections of fields at three different dairies across Florida. The question was: Can we use soil mapping and other data collections, such as canopy sensing via hand-held or aerial methods, to aid in forecasting crop productivity in cool-season forages?

Our project began in late fall, 2015, with cool-season forage plantings at three Florida dairies. We tested commercial varieties and experimental lines of triticale, oat, wheat, rye and ryegrass. We included N calibration test strips (56 kg N ha⁻¹ in a 6 m wide band across the forage types), used for the canopy sensing. Additionally, a quinine-based, bird-repellent seed treatment (Avipel, Arkion Life Sciences, LLC., New Castle, DE), was demonstrated. Bird damage, particularly on central and southern Florida dairy operations, remains a serious problem to silage seed plantings.

The Veris MSP3 EC mapping helped forecast crop response, where greater relative yields tended to correspond to higher EC values. It is interesting to note that the lowest EC values also coincided well with lighter colored areas depicted in online Google Earth maps. These lighter colored swaths were likely derived from spatial variability in pivot emitter performance over time. Soil pH helped to identify where alkalinity was increasing. The soil organic matter was not as well understood, as it tended to be greater in areas with greater EC, but not always.

Aerial thermal imagery coincided with the NDVI results in that cooler temps were found with forages that were less mature or having greater coverage and growth. Cooler canopy temperatures were likely due to increased canopy transpiration. However, high transpiration rates might also be a sign that a plant is less water efficient and therefore one might consider thermal imagery as a useful field screening tool in drought tolerance research and breeding. A combination of imaging and mapping tools, along with strategic sampling, can be used towards developing productivity indices, but much further research and testing is required in this area.

Our on-dairy mapping and surveying efforts coincided with the testing of different cool-season grass forages over the past few years. Recent releases include rust resistant forage oat varieties, “Legend 567” and “FL 0720” that is under commercial production contract (available Fall, 2017). We are anticipating the release of a new forage triticale, FL08128 for cool-season silage production and excellent disease resistance. The on-farm testing has served also as sentinel plots to indicate new disease or insect outbreaks, like sorghum and oat aphids, crown rust on oat, and gray leaf spot on ryegrass.
Title: A High Manure Uptake Bermudagrass/Stargrass for Dairy Production

Authors: P.R. Munoz, J. Dubeux, and L. Sollenberger

Agronomy Department - IFAS - University of Florida

Objectives

In the process of developing new forage cultivars, selection is carried out under recommended or reduced fertilizer rates to produce nutrient efficient cultivars. However, in dairy operations, each cow generates significant amounts of manure every day that must be used or disposed. Usually dairy producers apply this manure in bermudagrass and stargrass pastures. This takes advantage of manure as a fertilizer but is also a way to dispose of this large amount of “waste.” The amount applied is restricted by the Nutrient Management Plan (NMP) to the amount of nutrients, especially nitrogen, removed by the pasture. The objective of this work was to develop a new variety of bermudagrass aimed at the problem of nutrient uptake, thus the new variety should not only yield well, but also be able to remove more nutrients than the current varieties. With this new variety the dairy producer could increase the manure applications per acre per year in their NMP.

Methods

Starting in early summer 2014, we established a large collection of 287 bermudagrass and stargrass lines in three Florida sites: Ona, Citra, and Marianna. This collection was evaluated for yield, diseases, pest and nitrogen content. We calculated the amount of nitrogen needed for unit of biomass produced and selected the four with the higher nutrient uptake per unit of mass and three with the lowest, with the addition of two controls (Florida 44 and Tifton 85). A greenhouse experiment with increased levels of nutrients was established. Once the response of the selections was confirmed we established a field experiment, summer 2015, under four nutrient fertilization rates: 1/2X, 1X, 2X, and 6X, where X=recommended fertilization for hay production of bermudagrass. Yield was evaluated six times during in 2016, the first year of evaluation.

Results and Implications

Out of the seven selections six produced more biomass than the controls. Response to nutrient fertilization was observed in four of the selections, with higher biomass production usually achieved when fertilized with 2X. Three of the selections showed good efficiency potential with production of a similar amount of biomass with1/2X as with higher nutrient rates. One selection performed the best under low and high nutrient fertilization rates, reaching over 22,000 lb/acre during the season. As a reference, the control Tifton 85 produced an average of 15,000 lb/acre and did not respond significantly to nitrogen fertilization. These experimental lines will be established at three Florida sites during 2017, evaluated under low and high nutrient fertilization for two years to collect the data needed for release to Florida producers as cultivars. Additionally, one or two collaborators would be needed to evaluate their performance under manure applications. With this procedure we expect to have an improved cultivar for Florida dairy producers in the near future.
Effects of dietary 25-hydroxyvitamin D on activation of antimicrobial defenses of dairy cattle

Michael B. Poindexter*1, Mercedes Kweh1, Marcos Zenobi1, Roney Zimpel1, Francisco R. Lopes1, Y. Jiang1, Pietro Celi2, Scot N. Williams2, Jose E.P. Santos1, Corwin D. Nelson1; Department of Animal Science, University of Florida, Gainesville, FL, USA1, DSM Nutritional Products, Columbia, MD, USA2

Previous research funded by the Milk Check-Off showed that intramammary administration of the active vitamin D metabolite, 1,25-dihydroxyvitamin D3, enhanced expression of antimicrobial genes in immune cells of the udder. Objectives in this experiment were to determine the effects of feeding supplemental 25-hydroxyvitamin D3, the precursor to 1,25-dihydroxyvitamin D3, compared with conventional vitamin D3 on concentrations of 25-hydroxyvitamin D and minerals in serum, mammary immunity, and mastitis resistance in dairy cows. Sixty Holstein cows (multiparous, pregnant, lactating, SCC < 165,000/mL) were blocked by milk yield and, within each block, randomly assigned to receive a daily dietary supplement containing 1 mg vitamin D3 (1mgD, equivalent to 40,000 IU), 3 mg vitamin D3 (3mgD), 1 mg 25-hydroxyvitamin D3 (1mg25D), or 3 mg 25-hydroxyvitamin D3 (3mg25D) for 28 days (n = 15/group). Blood and milk were sampled at 0, 7, 14, and 21 d for measurement of vitamin D metabolites, minerals, and energy metabolites in serum. At 21 d, cows fed 1mgD and 3mg25D received an intramammary *Streptococcus uberis* challenge. Data were analyzed by analysis of variance. Significance was declared at \( P < 0.05 \). The cows fed the 1mg25D and 3mg25D treatments had greater concentrations of 25-hydroxyvitamin D in serum at 7, 14 and 21 d compared with cows fed 1mgD and 3mgD treatments (62 ± 7, 66 ± 8 ng/mL, 135 ± 15, and 232 ± 26 ng/mL for 1mgD, 3mgD, 1mg25D, and 3mg25D, respectively, at 21 d). The 3mg25D cows had greater concentrations of calcium and phosphorous at 21 d compared with other treatments (Ca = 2.38, 2.4, 2.37, 2.48 ± 0.02 mM; \( P = 1.69, 1.87, 1.88 \) and 2.10 ± 0.08 mM for 1mgD, 3mgD, 1mg25D and 3mg25D, respectively). Milk yield, dry matter intake, bodyweight, and energy metabolites (NEFA, BHBA, glucose) did not differ between treatments. Expression of inducible nitric oxide synthase and beta-defensin 7 antimicrobial protein genes in milk somatic cells sampled from 0 to 21 d was positively correlated with concentrations of 25-hydroxyvitamin D in serum. For the mastitis challenge, the 3mg25D cows had less severe mastitis at 60 and 72 h after challenge with *Streptococcus uberis* compared with 1mgD cows. The 3mg25D cows also had slightly lower \( (P = 0.06) \) rectal temperature compared with 1mgD cows during the challenge period (38.9 vs. 39.1 °C). Inducible nitric oxide synthase gene expression, when adjusted for vitamin D 1\( \alpha \)-hydroxylase gene expression, was greater in 3mg25D cows compared with 1mgD cows during mastitis. In conclusion, feeding 25-hydroxyvitmain D3 increased serum 25-hydroxyvitamin D more effectively than supplemental vitamin D3, resulting in increased serum calcium and phosphorous concentrations and less severe mastitis in lactating dairy cows.
Effect of Level of Dietary Cation-Anion Difference and Duration of Prepartum Feeding on Calcium and Energy Metabolism in Transition Cows

C. Lopera and J.E.P. Santos
Department of Animal Sciences, University of Florida

The objectives were to evaluate the effects of two levels of negative dietary cation anion difference (DCAD), -70 vs. -180 mEq/kg, and two durations of feeding, 21 vs. 42 days, on performance and metabolism in parous Holstein cows. One-hundred and fourteen (n = 114) Holstein cows at 230 d of gestation were randomly assigned to one of four treatments with two levels of negative DCAD (-70 vs. -180 mEq/kg) and two durations (Dur) of feeding the negative DCAD, short (S; 21 days) or long (L; 42 days). Cows in S received a diet for the first 21 days of dry period that was similar in nutrient content to the negative DCAD diets, but had a positive DCAD of +110 mEq/kg. Therefore, during the first 21 d of the experiment, cows were fed one of three DCAD diets, +110, -70, or -180 mEq/kg, whereas during the last 21 d of gestation they were fed either -70 or -180 mEq/kg. Measurements included intake of dry matter, yields of milk and milk components, body weight, body condition, and blood samples analyzed for minerals, metabolites and measures of acid-base status. Reducing the level of negative DCAD induced a more exacerbated compensated metabolic acidosis that increased concentrations of ionized calcium (iCa) during the prepartum period (1.26 vs. 1.29 ± 0.01 mM). Prepartum dry matter intake decreased (P=0.02) approximately 1.2 kg/d in the first 21 days of the dry period in L compared with S. Also, reducing the level of negative DCAD reduced (P<0.01) dry matter intake approximately 1 kg/d in the last 21 days of gestation. Yield and composition of colostrum was not influenced by treatments (means of 4.2 kg, 4.60% fat, and 12.4% true protein). Extending the period of feeding the negative DCAD, particularly the -70 mEq/kg, reduced milk yield in the first 42 DIM (Table 1); however, yields of 3.5% fat-corrected milk (FCM), energy-corrected milk (ECM), fat and true protein were unaffected by treatments.

Table 1. Effect of level of DCAD and duration of feeding on lactation performance in Holstein cows

<table>
<thead>
<tr>
<th>Item</th>
<th>Treatment</th>
<th>-70 mEq/kg</th>
<th>-180 mEq/kg</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Short</td>
<td>Long</td>
<td>Short</td>
</tr>
<tr>
<td>Milk, kg/d</td>
<td></td>
<td>43.1a</td>
<td>39.1b</td>
<td>41.7</td>
</tr>
<tr>
<td>3.5% FCM, kg/d</td>
<td></td>
<td>46.7</td>
<td>43.9</td>
<td>46.0</td>
</tr>
<tr>
<td>ECM, kg/d</td>
<td></td>
<td>45.2</td>
<td>42.4</td>
<td>44.5</td>
</tr>
<tr>
<td>Yield, kg/d</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fat</td>
<td></td>
<td>1.73</td>
<td>1.66</td>
<td>1.73</td>
</tr>
<tr>
<td>Protein</td>
<td></td>
<td>1.27</td>
<td>1.18</td>
<td>1.25</td>
</tr>
<tr>
<td>Lactose</td>
<td></td>
<td>2.00a</td>
<td>1.82b</td>
<td>1.94</td>
</tr>
<tr>
<td>Solids not fat</td>
<td></td>
<td>3.64A</td>
<td>3.34B</td>
<td>3.55</td>
</tr>
<tr>
<td>Net energy, Mcal/kg</td>
<td></td>
<td>0.731A</td>
<td>0.757h</td>
<td>0.748</td>
</tr>
</tbody>
</table>

a,b Values with different superscripts differed (P ≤ 0.05); A,B Values with different superscripts

Initial results suggest that reducing the negative DCAD from -70 to -180 and extending the period of feeding from 21 to 42 days had minor effects on cows during the postpartum period. In fact, yields of 3.5% FCM, ECM and milk components were unaffected by treatment.
Title: Jiggs Bermudagrass and Mulato II Brachiariagrass: Are They Viable Options for Use on North Florida/South Georgia Dairies?

Authors: Lynn Sollenberger (Agronomy Dept.), Joe Vendramini (Range Cattle REC), Marta Kohmann (Agronomy Dept.), Leonardo Moreno (Agronomy Dept.), and Jose Dubeux (North Florida REC)

Abstract:

Productive and high quality forages are critical to the success of dairy operations, but the combination of high yield and excellent quality has been difficult to find among warm-season perennial grasses adapted to the Gulf Coast region. Mulato II brachiariagrass and Jiggs bermudagrass have characteristics that make them attractive to dairy enterprises, but additional research station and on-farm evaluation is needed before they can be recommended to producers. Jiggs bermudagrass establishes rapidly, has fine stems for rapid wilting/drying, is persistent under frequent defoliation, and tolerates poorly drained soils. Mulato II is a productive grass with high nutritive value, but persistence in cooler climates is not documented. For both grasses, it is important to know if they provide advantages over currently used hybrid bermudagrasses in North Florida/South Georgia, environments that are cooler than where they have been most widely tested and used.

The objective of this project was to assess the potential of Jiggs and Mulato II for use as warm-season forages on dairies by measuring yield, persistence, and nutritive value in research station experiments and on-farm demonstrations carried out at three dairies. At each dairy, Jiggs and Tifton 85 bermudagrasses and Mulato II brachiariagrass were planted in side-by-side 0.5-acre strips between July 24 and August 6, 2014. Establishment was monitored during the 2014 growing season. On-station, one experiment compared Jiggs and Tifton 85 bermudagrasses, harvested every 28 days during summer at two stubble heights (3 and 6 inches) and fertilized at three levels of K2O (0, 20, and 40 lb/acre/harvest). The second experiment compared Jiggs and Mulato II harvested every 28 days and fertilized at two nitrogen rates.

The on-farm demonstrations showed that under producer conditions Jiggs bermudagrass consistently established easier and faster than Tifton 85 or Mulato II. Through two years, on-station experiments showed no evidence that Jiggs is less cold tolerant than Tifton 85 in North Florida, but Jiggs forage is less digestible than Tifton 85 and Mulato II. Mulato II stands survived the first winter after planting with virtually no stand loss and produced higher yields than Tifton 85 in the year after planting due to strong late-season production. However, an average to slightly colder than average second winter killed most of the Mulato II stand indicating that it will not function as a long-lived perennial in North Florida. Based on these studies, we conclude that Jiggs provides rapid establishment and earlier spring growth than most bermudagrasses. Additionally, it has persisted under frequent cutting in North Florida for at least two years, but its forage is less digestible than Tifton 85. Mulato II is not well suited to systems requiring a long-lived perennial, but because it is a seeded forage, it may have some potential as a high digestibility, short rotation forage crop. It could be seeded in spring of one year and produce high yields of high quality forage that growing season and the next.
Inoculant Effects on Mycotoxins, Fermentation Characteristics, and Nutritive Value of Bermudagrass Silage – Year 2

Joe Vendramini¹, Lynn Sollenberger², and Jose C. Dubeux Jr.³

¹ Range Cattle Research and Education Center, Ona, FL
² Agronomy Department, Gainesville, FL
³ North Florida Research and Education Center, Marianna, FL

Year Funded: 2015

The objective of this research project was to evaluate the effects of commercial silage inoculants on mycotoxins, fermentation characteristics, and nutritive value of bermudagrass silage. The data is referent to the second year of this research project. The experimental area was located at the Range Cattle Research and Education Center, Ona, FL. A Jiggs bermudagrass hayfiled was subdivided in 36 plots of 10 x 10 ft each plot. The plots were staged on September 15 2015 at 3 inches stubble height and fertilized with 80 lbs N/ac. The harvest occurred on October 15 2015 with target regrowth interval of 4 weeks. Treatments were 7 commercial inoculants and control (untreated treatment) in a randomized complete block design with 6 replicates. The inoculants tested were B500, Biotal Plus II, Early Sile Advance, Promote HQ, Promote VS-3, AS, and XC. The mini-silos (PVC pipes with rubber caps with capacity of 2 lb of green forage) were filled immediately after harvest with the target 20-30% forage dry mater concentration. The inoculants were applied with a hand sprayer before ensiling. The silos were opened on February 19 2015. There were no effects ($P > 0.05$) of the inoculants on silage nutritive value. The mean values of nutritive value measurements were: DM = 25%, DM recovery = 91%, CP = 12.1%, NDF = 68.1%, ADF = 39.7%, IVTD = 49%, and NDFD = 25%. In addition, there were no effects ($P > 0.05$) of inoculant on fermentation characteristics. The mean values for the fermentation characteristics were: pH = 5.0, Lactic acid = 2.0%, Acetic acid = 1.4%, Propionic acid = 0.5%, Butyric acid = 0.3%, and Ammonia = 19.3% CP. Aerobic stability (120 h) and mold and yeast counts pre- and post-aerobic stability measurements were similar among treatments. In addition, there was no presence of aflatoxin (< 5 ppb), zearalenone (< 500 ppb) and T2 (< 500 ppb) on the silage in any of the treatments tested. Commercial inoculants were not effective to improve nutritive value, fermentation characteristics, and aerobic stability of Jiggs bermudagrass silage. The results differed from the first year of the research trial (2014) despite of similar forage characteristics in 2014 and 2015. There is a need to develop management practices to make the use of inoculants in warm-season grass silage more consistent and predictable.