DCHA
DAIRY CALF & HEIFER ASSOCIATION
ANNUAL CONFERENCE

MOVING FORWARD

APRIL 11-13, 2016
MADISON, WIS.

RESOURCE GUIDE
EVERY BASE COUNTS

With the Purina® AMPLI-CALF® Program.

The simple 3-step program features unique, complementary ingredients that support optimal growth rates and healthy transitions during a calf’s first 6 months. Research proves the Purina® AMPLI-CALF® Program can increase first lactation milk production by as much as 2,740 pounds.

Learn how you can score greater profit potential at everybasecounts.com
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Tweet it, post it and tag it with #DCHA2016. One lucky social media follower will be randomly chosen to win a complimentary 2017 conference registration!

#DCHA2016

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DAIRY CALF AND HEIFER ASSOCIATION 2016 ANNUAL CONFERENCE
CHOOSE A HEALTHIER, MORE PROFITABLE HERD

YOUR HEIFER CALVES ARE YOUR LEGACY. PREDICT HOW HEALTHY THEY WILL BE AS COWS BY PROACTIVELY TESTING THEM WITH CLARIFIDE® PLUS.

CLARIFIDE® Plus provides unique genomic predictions for mastitis, lameness, metritis, retained placenta, displaced abomasum and ketosis. And with a powerful new economic index—the Dairy Wellness Profit Index™ (DWP$™)—producers have the unprecedented ability to choose and plan for a healthier and more profitable herd.

To learn how CLARIFIDE Plus can help make your life easier by selecting heifers to help build a healthier herd, contact your Zoetis representative or visit clarifideplus.com.

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WELCOME!

Welcome to this year’s Dairy Calf and Heifer Association Conference! Themed “Moving Forward,” this conference will offer unmatched networking opportunities and highlight the latest practices, technology and research in the calf and heifer industry. We hope you enjoy the conference!

REGISTRATION

MONDAY, APRIL 11
9:00 am – 6:00 pm

TUESDAY, APRIL 12
6:00 am – 5:00 pm

WEDNESDAY, APRIL 13
6:30 am – 3:00 pm

TRADE SHOW

The conference trade show will kick off with a reception Monday evening and remain open throughout the entire conference. Listed below are the specific trade show activities and breaks.

MONDAY, APRIL 11
6:30 – 7:30 pm: Advocating Agriculture through Social Media & Trade Show Reception

TUESDAY, APRIL 12
7:15 – 8:00 am: Breakfast & Welcome
10:30 – 11:00 am: Break
12:15 – 1:00 pm: Lunch
3:30 – 4:00 pm: Break
5:00 – 6:30 pm: Mixer

Receive complimentary drink tickets from exhibitors!

WEDNESDAY, APRIL 13
7:00 – 7:45 am: Breakfast
10:00 – 10:30 am: Break
11:30 am – 12:15 pm: Lunch
Within the first 45 days of life, calves are programmed to become an asset or a resource drain. First Defense® reduces death and infection associated with *E. coli* and coronavirus.

*One bolus delivers Immediate Immunity.*

**LIKE IMMEDIATE IMMUNITY**
2016 CONFERENCE SPEAKERS

TREVOR DE VRIES
University of Guelph

BERNIE ERVEN
Ohio State University

STAN ERWINE
Dairy Management Inc.

DANIELLE MZYK
North Carolina State University

TAMILEE NENNICH
Famo Feeds

TOM OELBERG
Diamond V

THERESA OLLIVETT
UW School of Veterinary Medicine

MIKE OVERTON
Elanco

GREG PETERSON
Peterson Farm Brothers

KEITH POULSEN
Wisconsin Veterinary Diagnostic Lab

DAVE SJEKLOCHA
Cattle Empire

DON SOCKETT
Wisconsin Veterinary Diagnostic Lab

SANDY STOKES GOFF
Stagecoach Consulting Services

MIKE VAN AMBURGH
Cornell University

PAUL VITALE
Vital Communications, Inc.

RAY WILLIAMS
Williams Dairy Heifer Raising
NOTHING IS MORE PRECIOUS THAN LIFE, AND THAT’S THE PHILOSOPHY THAT DRIVES PHILEO.

As global population continues to increase, the world faces a growing demand for food and greater sustainability challenges. Working at the crossroads of nutrition and health, we are committed to delivering future evidence-based solutions that enhance ruminant health and performance. In each and every country, or team’s progress is led by the most advanced scientific outcomes as well as the field input of experience farmers.

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Rick Kreykes
Regional Sales Manager Ruminants
Mobile: 1-936-371-0315
r.kreykes@phileo.lesaffre.com

North American Headquarters
7475 West Main Street
Milwaukee, WI 53214, USA
Ph: 1-877-677-7000
info@phileo.lesaffre.com
# Schedule at a Glance

## Monday, April 11
- **9:00 am – 6:00 pm**: Registration Open  
  Registration Desk
- **11:00 am**: Boxed Lunch & Bus Loading  
  Lobby
- **11:00 am – 6:00 pm**: Farm Tours  
  Rosy-Lane Holsteins & Nehls Bros. Farm
- **6:30 – 7:30 pm**: Advocating Agriculture through Social Media & Reception  
  Trade Show

## Tuesday, April 12
- **7:15 – 8:00 am**: Breakfast & Welcome  
  Trade Show
- **8:15 – 10:30 am**: Classroom Sessions  
  Geneva/Mendota
- **10:30 – 11:00 am**: Break  
  Trade Show
- **11:15 am – 12:00 pm**: Classroom Sessions  
  Geneva/Mendota
- **12:15 – 1:00 pm**: Lunch  
  Trade Show
- **1:15 – 1:45 pm**: Annual Business Meeting  
  Geneva/Mendota
- **1:45 – 3:30 pm**: Classroom Sessions  
  Geneva/Mendota, Salon ABC, Salon DE, Salon FGH
- **3:30 – 4:00 pm**: Break  
  Trade Show
- **4:15 – 5:00 pm**: Classroom Sessions  
  Salon DE, Salon FGH
- **5:00 – 6:30 pm**: Mixer  
  Trade Show

## Wednesday, April 13
- **7:00 – 7:45 am**: Breakfast  
  Trade Show
- **8:00 – 10:00 am**: Classroom Sessions  
  Geneva/Mendota, Salon ABC, Salon DE, Salon FGH
- **10:00 – 10:30 am**: Break  
  Trade Show
- **10:45 – 11:30 am**: Classroom Sessions  
  Salon ABC, Salon DE, Salon FGH
- **11:30 am – 12:15 pm**: Lunch  
  Trade Show
- **12:30 – 3:00 pm**: Classroom Sessions  
  Geneva/Mendota, Salon ABC, Salon DE, Salon FGH
- **3:00 – 6:00 pm**: Post-Conference Tour & Lab Demonstrations  
  Wisconsin Veterinary Diagnostic Lab
## Exhibitor and Booth Location

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**Thank you to our exhibitors**

**2017 DCHA Annual Conference**

April 11-13, 2017

Madison, Wis.
Naturally inconsistent levels of fat and protein in waste milk can leave critical gaps in calf nutrient needs. Additionally, supply can fluctuate, causing saleable milk to be used instead of supporting farm income.

LAND O LAKES® Pasteurized Milk Balancer® helps improve the performance of pasteurized milk to deliver consistent levels of nutrients and milk supply—while delivering vitamins, minerals, fly control and feed technologies—to help feed calves to a higher plane of nutrition.

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WE CARE FOR CALVES

**MONDAY, APRIL 11**

**REGISTRATION DESK OPEN**
9:00 am – 6:00 pm
*Sponsored by* Newport Laboratories and Merial

**BOXED LUNCH & BUS LOADING**
11:00 am
Meet in lobby at 11 am to begin loading buses; farm tour registration required for tour.

**FARM TOURS & DEMONSTRATIONS**
Meet in conference center lobby for departure at 11 am.
11:00 am – 6:00 pm
*Buses sponsored by* Golden Calf Company

**TOUR STOP A: Rosy-Lane Holsteins LLC**
Paying attention to fresh water, ventilation and precise feeding practices has been a key focus of Rosy-Lane Holsteins calf barn management, where they house 130 head of calves. Open front gates to plastic calf cubicles have been beneficial for easy calf access, better observation and air flow for the calves. After weaning, calves are moved to small groups of 10 to 12 in the same barn. This tour will also feature an on-farm demonstration focusing on sanitation.
*On-farm demonstration sponsored by* Calf-Tel

**TOUR STOP B: Nehls Bros. Dairy Farm**
Focusing on one change at a time is a key management strategy at Nehls Bros. Farm in Juneau, Wis. After calf health challenges due to ventilation, this 2,100-cow dairy switched from a retrofitted calf barn to hutches and maintained focus on consistent calf care protocols. The calves are fed pasteurized whole milk and are weighed at birth, weaning and when they are transitioned into the heifer facility.
*Sponsored by* Vita Plus

**ADVOCATING AGRICULTURE THROUGH SOCIAL MEDIA**
6:30 – 7:30 pm | Trade Show
*Greg Peterson, Peterson Farm Brothers*
With Peterson Farm Brothers video views in the millions and over a quarter of a million fans on Facebook, Greg Peterson offers a unique insight into the role of social media on agriculture. Don’t miss out on a behind-the-scenes look at what goes into making a social media hit!
*Sponsored by* Merck Animal Health

**TUESDAY, APRIL 12**

**BREAKFAST & WELCOME**
7:15 – 8:00 am | Trade Show
*Sponsored by* Merial and Newport Laboratories

**KEYNOTE ADDRESS: ENERGIZE THE ENTHUSIASM...THAT EXISTS WITHIN**
8:15 – 9:15 am | Geneva/Mendota
*Paul Vitale, Vital Communications, Inc.*
Being able to define enthusiasm, identify your passions and what can be done to make those passions shine are keys to maintaining enthusiasm in the whirlwind of life. This seminar will not only reinforce why enthusiasm works, but also provide the tools necessary to embrace it each day.

**LEADING SUCCESSFUL TEAMS**
9:30 – 10:30 am | Geneva/Mendota
*Dr. Bernie Erven, Ohio State University*
Functioning as a successful team is a major challenge for those who lead teams and those who are team members. Learn how you can overcome roadblocks and lead successful teams through insights on team building, leadership and delegation.
BREAK
10:30 – 11:00 am | Trade Show
Sponsored by Merial and Newport Laboratories

DEVELOPING A QUALITY HEIFER: MANAGEMENT, ECONOMIC AND BIOLOGICAL FACTORS TO CONSIDER
11:15 am – 12:00 pm | Geneva/Mendota
Dr. Mike Van Amburgh, Cornell University
Most - if not all - dairies have increased management pressure on the lactating animals in order to optimize milk yield and return on investment. This session will touch on benchmarks important to maximize the resulting productive animal in the milking herd.
Sponsored by Zoetis

LUNCH
12:15 – 1:00 pm | Trade Show

DCHA ANNUAL BUSINESS MEETING
1:15 – 1:45 pm | Geneva/Mendota
Celebrate 20 years of DCHA as the source of calf and heifer information for the industry. During this time, the annual DCHA scholarship recipient will also be announced.
Scholarship sponsored by Merial and Newport Laboratories

INSPIRED TEAMWORK AND LEADERSHIP
1:45 – 2:30 pm | Geneva/Mendota
Paul Vitale, Vital Communications, Inc.
Uniting for a common cause, understanding and respecting diversity, and encouraging individuals through positive actions are all key elements of this empowering presentation.

TRACK OPTIONS - SELECT ONE
2:45 – 3:30 pm

TRACK A: ANTIBIOTICS AND CALVES: CURRENT AND FUTURE CONSIDERATIONS
Salon ABC
Danielle Mzyk, North Carolina State University
This session will discuss current and upcoming issues of antibiotic use in calf and heifer management including feeding of waste milk, antibiotic resistance, residue avoidance and implications of the veterinary feed directive on raising calves.
Sponsored by Milk Products, Inc. and Diamond V

TRACK B: NUTRITION IN THE POST-WEANED CALF
Salon DE
Dr. Tamilee Nennich, Famo Feeds
Learn more about the numerous recently conducted research studies that highlight the importance of feeding post-weaned heifers quality, grain-based diets as a way to increase growth and improve feed efficiency.
Sponsored by Arm & Hammer Animal Nutrition

TRACK C: MAKING THE TRANSITION TO AN ORGANIC HEIFER RAISING SYSTEM
Salon FGH
Ray Williams, Williams Dairy Heifer Raising
Going organic can be an exciting challenge. Hear how this producer made the switch and the lessons learned through the process.
Sponsored by DBC Ag Products

BREAK
3:30 – 4:00 pm | Trade Show
Conference Agenda | Tuesday, April 12, continued

TRACK OPTIONS - SELECT ONE

4:15 – 5:00 pm

**TRACK A: DAIRY BEEF PRODUCER PANEL**
Salon DE
Paul Jacobs, Jacobs Brothers Farm; Trista Brown-Priest, Cattle Empire
Moderated by TJ McClure

A panel of producers will discuss their experiences, successes and challenges raising dairy feeders for the beef market. Learning from peers has never been more important, and that is exactly what this panel will provide to conference attendees.

**TRACK B: BUILDING CLIENT RELATIONSHIPS PRODUCER PANEL**
Salon FGH
Mike Halderman, Buckeye Heifer Resources; Justin Ball, Deer Creek Feeding; Lane Sollenberger, Dream Farms
Moderated by Dr. Bernie Erven

This panel of producers will share their insights on building relationships with the producer-clients they serve. This candid discussion on successes and opportunities to learn from one another will be a unique conference offering.

**Sponsored by** Merck Animal Health

**MIXER**
5:00 – 6:30 pm | Trade Show

Connect with industry-leading companies, fellow producers, veterinarians and student attendees! Unwind from an eventful conference day two, all while enjoying appetizers and drinks.

**WIN**
a FutureCow® ComfortBrush™ for Calves!
Two lucky winners will be chosen from 2016 Dairy Calf & Heifer Association conference attendees.

VISIT OUR BOOTH & SIGN UP TO WIN!

CALL 855-388-7269  EMAIL info@futurecow.com
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Be sure to visit exhibitor booths for complimentary drink tickets!
Introducing smarter pre-weaning technology.

Natural SmartCare® for all milk and milk replacer calf diets — an integral part of Diamond V’s research-proven Calf Program.

Supporting:
- Calf Immunity and Health
- Gastrointestinal Development
- Growth and Performance

To help maximize lifetime productivity, get a healthy start with SmartCare today.

Get the facts about SmartCare! Contact your Diamond V representative or visit diamondv.com.
WEDNESDAY, APRIL 13

BREAKFAST
7:00 – 7:45 am | Trade Show
Sponsored by Merial and Newport Laboratories

IMPORTANCE OF A QUALITY DAIRY REPLACEMENT HEIFER
8:00 – 9:00 am | Geneva/Mendota
Dr. Mike Overton, Elanco
A quality replacement is the future of a dairy operation. This presentation will discuss the economic and performance impact of common health issues in dairy replacement heifers.

TRACK OPTIONS - SELECT ONE

9:15 – 10:00 am

TRACK A: OPPORTUNITIES AND CHALLENGES IN HEIFER REPRODUCTION AND MONITORING
Salon ABC
Dr. Mike Overton, Elanco
This session will focus on the opportunities and management options regarding reproductive performance in virgin heifers.
Sponsored by ST genetics

TRACK B: GROUP HOUSING AND FEEDING PROGRAMS PRODUCER PANEL
Salon DE
Dr. Ben Shelton, Rocky Creek Dairy; Kim Pahl, Brunmeier Dairy; Brian Houin, Homestead Dairy
Moderated by Dr. Bob James
Producers with a variety of housing and feeding systems will share their operation challenges and successes learned over time.
Sponsored by Purina Animal Nutrition

TRACK C: TMR AUDITS FOR IMPROVED FEEDING MANAGEMENT AND PROFIT
Salon FGH
Dr. Tom Oelberg, Diamond V
Discuss strategies on a key factor in feeding management - reducing variation during the TMR mixing process.

BREAK
10:00 – 10:30 am | Trade Show
Sponsored by Merial and Newport Laboratories

TRACK OPTIONS - SELECT ONE (repeated)

10:45 – 11:30 am

TRACK A: OPPORTUNITIES AND CHALLENGES IN HEIFER REPRODUCTION AND MONITORING
Salon ABC
Dr. Mike Overton, Elanco
Sponsored by ST genetics

TRACK B: GROUP HOUSING AND FEEDING PROGRAMS PRODUCER PANEL
Salon DE
Dr. Ben Shelton, Rocky Creek Dairy; Kim Pahl, Brunmeier Dairy; Brian Houin, Homestead Dairy
Moderated by Dr. Bob James
Sponsored by Purina Animal Nutrition

TRACK C: TMR AUDITS FOR IMPROVED FEEDING MANAGEMENT AND PROFIT
Salon FGH
Dr. Tom Oelberg, Diamond V

LUNCH
11:30 am – 12:15 pm | Trade Show
ANIMAL WELFARE: WADING THROUGH THE CONTROVERSY
12:30 – 1:30 pm | Geneva/Mendota
Sandy Stokes Goff, Stagecoach Consulting Services
Find out how good animal welfare programs facilitate better environments for dairy cattle; as well as, a better work environment for employees, all while increasing consumer confidence.

TRACK OPTIONS - SELECT ONE
1:45 – 2:30 pm

TRACK A: WELFARE PROGRAMS
PRODUCER PANEL
Salon DE
JJ Pagel, Pagel’s Ponderosa Dairy; Ken McCarty, McCarty Family Farms
Moderated by Sandy Stokes Goff
Listen, learn and ask questions of producers who have implemented animal welfare programs in their operation. They will share what that has meant for their supply chain partners, employees and consumer confidence.
Sponsored by Merck Animal Health

TRACK B: USING KNOWLEDGE OF CALF BEHAVIOR TO IMPROVE GROWTH, HEALTH AND WELFARE
Salon ABC
Dr. Trevor de Vries, University of Guelph
This presentation will identify some of the key welfare challenges and how we can use knowledge of calf behavior to identify housing and feeding programs that optimize growth, health and welfare.
Sponsored by DBC Ag Products

TRACK C: QUESTION EVERYTHING
Salon FGH
Dr. Dave Sjeklocha, Cattle Empire
Calf raising is steeped in traditions and paradigms that may not be as correct as we would like to think. We will examine some of these processes as they pertain to animal welfare, antibiotic use and animal performance.

BUILDING CONSUMER CONFIDENCE IN DAIRY!
2:30 – 3:00 pm | Geneva/Mendota
Stan Erwine, Dairy Management Inc.
Whose job is it? What’s your role? What’s at risk if you don’t engage with consumers? Join us for answers to these questions and more!
Sponsored by Zoetis

POST-CONFERENCE TOUR & LAB DEMONSTRATIONS
3:00 – 6:00 pm | Separate registration required
Dr. Don Sockett, Wisconsin Veterinary Diagnostic Lab; Dr. Theresa Ollivett, UW School of Veterinary Medicine; Dr. Keith Poulsen, Wisconsin Veterinary Diagnostic Lab
An exclusive tour of the Wisconsin Veterinary Diagnostic Lab will be combined with sessions and demonstrations on cleaning and sanitizing automated calf feeders, evaluating scouring calves and treating dehydrated calves.
Sponsored by Land O’Lakes Animal Milk Products
Calf Solutions™: Maximizing lifetime potential.

Consistently delivering quality nutrients to preweaned calves is the foundation for a lifetime of success. The Calf Solutions™ program provides the right nutritional tools to help calves meet their genetic potential from birth to weaning.

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INFORMATION & ORIGIN:

Nehls Bros. Farms is a third generation family farm in Juneau, Wis., owned by Greg and Royce Nehls. A split-location approach helps the producers care for 2,100 cows, 250 calves and 1,750 heifers and grow all crops on-site.

The operation has grown through several advancements, including an expansion in 2006 when the existing parlor was modified and expanded and the previous facilities were retrofitted for a calf facility, maternity area and a transition from a calf barn to 250 hutches in 2011. Dr. Jerry Gaska, an established dairy veterinarian, serves as the farm’s full-time veterinarian and dairy manager. He guides the calf care team to establish protocols and promote calf health. The team tracks benchmarks from birth to breeding to always make the best better.

CALF MANAGEMENT TIMELINE:

**DAY 1:** Newborn calf care is paramount on this farm. At birth, calves are weighed, tagged, given a respiratory vaccine and navel are dipped with 7% iodine. Four quarts of either colostrum or colostrum replacer are fed immediately, with an additional 2 quarts fed six hours later. Before calves are moved to hutches, each receives a coat, tails are banded, navels are checked and dipped again, and the sex and RFID tag numbers are confirmed.

**DAY 2:** The calf care team begins 3x a day feeding with the goal of each calf receiving 7.5 quarts of pasteurized whole milk per day. Dehorning paste is administered and an ear notch is collected from each calf for BVD-PI testing.

**DAY 7:** A blood sample is collected to test colostrum absorption.

**DAY 15–20:** Nutrient levels are increased, transitioning to 9.5 quarts of milk per day on day 15 and to 11.5 quarts on day 29.

**DAY 47–52:** The weaning process begins. On day 47, calves receive 4.5 quarts per day in one feeding. On day 52, calves are weaned and given a respiratory vaccine booster. Heights and weights are measured again. Calves receive a BRD vaccine and pour-on fly control before moving to group pens.

WHAT YOU’LL SEE:

- **Calf and heifer facilities:** 250 individual calf hutches, group weaning and heifer facilities. The previous calf facility is now used as a staging area for newborn calves and a calf care hub.

- **Standard operating procedures:** The farm focuses on having well-trained, dedicated employees. Employee training emphasizes five basics for calf care: colostrum, calories, cleanliness, comfort and consistency. Protocols are driven by calf age, rather than groupings or management schedules, resulting in ongoing individual calf care.

- **Improvement through benchmarking:** Calves and heifers are weighed, measured and monitored through each stage. Trends over time help the team determine processes for improvement and genetic improvement opportunities.
DAYS 2-7: Calves are given a respiratory vaccine along with a supplemental source of zinc, manganese, selenium and copper and dehorning paste is applied. Calves are fed 1.8 liters of milk replacer a day and receive free-choice grain starting at day four.

DAYS 8-48: Calves are fed 2.5 liters of milk replacer a day and continue to receive free-choice grain. Each calf receives vaccines for salmonella, Johne’s and blackleg.

DAYS 49-55: Feedings are reduced to 1x per day and calves receive an Infectious Bovine Rhinotracheitis (IBR) vaccine.

DAYS 56-60: Calves are weaned no sooner than day 56, perhaps later depending on calf barn population.

2-4 MONTHS: Calves stay in the same facility, but are transitioned to small groups of 8-10. The goal is for calves to learn to use lock-ups at month three and sand-bedded freestalls by month four. The oldest calves have 22 head in their group.

4+ MONTHS: Calves are transferred to the farm’s heifer barn just next door to calf barn. They are in a pen of about 40 head. A portion of Rosy-Lane’s calves go to a custom heifer grower at 6 months of age. The custom grower breeds the heifers starting at 12 months. These heifers return to Rosy-Lane pre-calving.

WHAT YOU’LL SEE:

• Ongoing employee training: Protocols are outlined to focus on animal comfort and productivity. Frequent and thorough staff training and record keeping promote staff accountability and help put calves and heifers first. The Calf Care Team Manager, Kristin Solum, oversees a staff of 1 full-time and 3 part-time employees.

• Low velocity ventilation system: The team worked with Dr. Ken Nordlund of the University of Wisconsin to design and install low-velocity ventilation and curtains. Routine individual pen fogging with a chlorine dioxide product is also used for disease prevention.

• Comfort brush: A calf brush was recently added to the heifer facility, helping to keep heifers content, adding to the team’s philosophy that comfortable animals are the most productive.
INFORMATION:

Features of the lab: Being a member of the University of Wisconsin System, the Wisconsin Veterinary Diagnostic Laboratory (WVDL) has access to the phenomenal infrastructure of the world class university, helping it stay ahead of the industry’s needs. The lab primarily serves the dairy and dairy genetics industries in Wisconsin and the United States. Because of this, it has developed a niche in both export and disease management testing.

What’s New: WVDL boasts a new group of pathologists and exciting test development occurring in the laboratory. The lab is expanding its caseload and receiving samples from across the country. Even with such exciting things as these, staff members say hosting groups such as DCHA is the highlight of their year.

WHAT TO EXPECT:

On the tour, attendees will participate in three “mini-lectures” on calf diarrhea, cleaning and sanitation, and fluid therapy. After the lectures, the group will break up into three smaller groups for hands-on experiences with cleaning and sanitation audits, placement and management of IV catheters, and displays of pathology samples taken from calves with gastrointestinal disease.

The segments in the tour are designed to teach attendees about the current state of practice for diagnosis and treatment of calf scours. Additionally, the importance of cleaning and how to troubleshoot use of IV catheters after the veterinarian leaves the farm will be discussed. For attendees who are already familiar with these topics, this will be a great opportunity to brush up on skills in order to train others.

The WVDL encourages all on the tour to ask questions! This will aid the lab in making continuing education events even better for DCHA members.

HISTORY:

In the early 1930's, the Dean of the College of Agriculture and the state Director of Agriculture made an agreement about the need for animal disease diagnostic assistance for both veterinarians and producers. This agreement was the beginning of veterinary diagnostic activities in Wisconsin. Originally, the laboratory was in Agriculture Hall at UW-Madison. In 1999, the WVDL was established by Wisconsin Act 107. Over time, the lab grew and expanded, including by playing a crucial role in the eradication of bovine brucellosis and bovine tuberculosis. With increasing demand for quality veterinary diagnostics, in 2006 construction began on the current state-of-the art facility on the UW-Madison campus.
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ADVOCATING AGRICULTURE THROUGH SOCIAL MEDIA

Greg Peterson, Peterson Farm Brothers

About Us

- We live on a 5th generation family farm near Assaria, KS
- Our farm raises beef cattle and grows wheat, corn, milo, soybeans, and alfalfa
- We are/were students at Kansas State University
- We love promoting agriculture

Who are the Peterson Farm Bros?

From L to R: Nathan (22), Greg (25), Kendal (19), and "honorary bro" Laura (15)

Music Video Parodies About Farming

- I'm Farming and I Grow It
- Farming Style
- A Fresh Breath of Farm Air
- Bale
- Chore
- All I Do is Farm
- All About That Beef, I'm So Farmer, Let It Grow
- Takin' Care of Livestock
- Farmers Feed the World
Strategies to support calf health

- Milk feeding temperature
- Fluids and electrolytes
- Be watchful, identify problems early
- Environment—dry, well-ventilated, draft-free
- Plane of nutrition
- Feeding management
- Warm water after each milk feeding
Strategies to support calf health

• Milk feeding temperature
• Fluids and electrolytes
• Be watchful, identify problems early
• Environment—dry, well-ventilated, draft-free
• Plane of nutrition
• Feeding management
• Warm water after each milk feeding
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ENERGIZE THE ENTHUSIASM...THAT EXISTS WITHIN
Paul Vitale, Vital Communications, Inc.

CHOOSE THE WOW OVER THE TOWEL
Energizing the enthusiasm that exists within begins with making a conscious choice. The choice of either recognizing the wow of your own unique life, or wanting to simply throw in the towel. Enthusiasm coupled with the right mental attitude sets the tone for excellent quality outcomes, one individual at a time!

The value of Optimism...
There always will be those who choose to look at the negative versus the positive. When this occurs, we must remember; it takes no more time to see the good side of life than it takes to see the bad...that’s the value of optimism...fulfilling each person’s needs through a commitment to service.

EXAMINE CONFIDENCE FROM WITHIN
Our background and circumstances may have influenced who we are, but we are responsible for who we become. Having self-confidence is not about being arrogant, but possessing a belief in the ability to succeed. Passion, resilience, and the willingness to learn are common denominators that equal accomplishment.

The value of Humility...
There always will be those who face greater obstacles in life than others. When this occurs, we have the opportunity to look toward them, not away...that’s the value of humility...reaching out to others, when no one else believes.

REACT STEADILY AND REMAIN COMPOSED
Circumstances will continuously occur and individuals will always act and react in various ways. You might not be able to control how others react, but you sure can control how you react. Often, it’s not what you say, it’s how you say it.

The value of Responsibility...
There always will be those who want to pass the buck—individuals who would rather not be accountable. When this occurs, we have the opportunity to lead through our example...that’s the value of responsibility...holding ourselves accountable so others will learn the importance of doing the same.

COMMUNICATE MEMORABLE MESSAGES
Two people can look at the exact same thing, yet have totally different perceptions. Just as two people can hear the exact same thing, and interpret it many different ways. Remember, expressing memorable messages hinges not only on verbal communication, but nonverbal as well.

The value of Selflessness...
There always will be those who take a little more than they give. When this occurs, we have the opportunity to convey through our example; everyone dies, but not everyone lives...that’s the value of selflessness...utilizing our talents and resources wisely to help with the needs of others, for the greater good of all.

NOTES
LEADING SUCCESSFUL TEAMS

Dr. Bernie Erven, Ohio State University

Introduction

Can you find a business that is succeeding while its people are failing?

The answer is No! Management and employees must succeed if a business is to succeed.

The importance of people succeeding:

- Drives the need for successful teams
- Makes team leadership a critical management challenge
- Causes managers to consider both the business as a whole and its various subgroups such as nutrition, health, feed supply, maintenance and office

Senior management's role

1. Embrace its role of ultimate responsibility i.e., farms are highly unlikely to be bottom up organizations
2. Generate a positive tone for the business, guide the organizational culture and set standards of performance
3. Lead middle managers which in turn determines to a great extent how they manage their people
The middle management role

1. Middle managers (team leaders) play a critical role
2. They are expected to:
   a. See both the big picture of the business and where they and their people fit in
   b. Be linchpins
   c. Function as “360 degree” managers
   d. Bridge management and labor ways of thinking

Outline

Part I. Foundation
Part II. Critical skills
Part III. Stumbling blocks

First foundation block for team leadership: *Team Building*

1. Building teams starts with promoting and/or hiring the “right” people
2. Some outstanding workers not suited to managing or working in a team environment
   - Teams frustrate some valuable and very hard working employees
   - Some people dislike team give and take

Gaining the most from today’s discussion

- Treat our discussion as an idea session
- Avoid looking for simple take home recipes for successful teams
- See things in your business and family as they really are

Part I. Foundation for leading a team

1. Team building
2. Leadership
3. Delegation

What is a team?

1. Integration of parts, e.g., bump, set, spike
2. Synergy: whole is more than the parts, e.g., \(1 + 1 + 1 + 1 = 5\)
3. Partnership, e.g., collaboration, interdependence, strength of multiple minds
**Team building is difficult**

- Easy to **say**, “We are a team.”
- Hard to actually **be** a team

**1. Commit to being a team**

- Team work requires a commitment by senior management and every other person in the dairy – person by person
- Workers cannot form a team without a leader’s guidance and support
- Training in team building skills is essential

**2. Train team leaders how to:**

- Make communication:
  - Free-flowing
  - Informal
  - Honest
  - Helpful
- Send clear messages and listen
- Give and receive feedback
- Encourage collaboration & synergy
- Handle conflict situations
- Develop cohesion

**3. Create a team culture and environment that helps teams succeed**

- Back leaders’ words with action
- Give team actions priority over individual actions
- Value what your teams do for the business
- Eliminate tail chasing
- Treat mediocrity as a deadly poison
- Reward contributions to the team

**4. Make expectations clear for every employee**

1. Accept change
2. Communicate
3. Show enthusiasm
4. Be fair
5. Work hard
6. Learn
7. Follow procedures
8. Tolerate defeat
9. Trust
10. Have fun
Concluding thought about team building

- Team building is difficult, time consuming and tedious

But

- People working together as a team easily outperform people working hard as individuals

Second foundation block: Leading

- Leadership is influencing what others do

- Managers and team leaders lead by influencing:
  - What their subordinates do
  - When they do it
  - How well they do it
  - With what attitude they do it

Two ways to lead

- By action: Conscious choices about influencing subordinates’ decisions
  - OR

- By inaction: Subordinates free to function without training or oversight

Senior managers should show other managers how to lead effectively:

1. Provide a vision for the business
2. Involve middle managers in major decisions

More characteristics of senior managers’ effective leadership

1. Gain respect, support and trust of subordinates
2. Empower middle managers through extraordinary training, coaching and delegation
3. Promote teamwork without loss of personal attention to each middle manager
4. Develop clear and bold goals for each middle manager
5. Help middle managers be change agents
More characteristics of senior managers’ effective leadership

8. Emphasize self-motivation and previous accomplishments in choosing middle managers

9. Emphasize communication with every middle manager

10. Delegate responsibility and authority

Third foundation block: Remove Barriers to Communication

- Communication & performance data must substitute for team leaders being able to see everything first-hand

- Communication provides the foundation for good relationships

- Communication barriers interfere with functioning of teams

Communication barriers

1. Muddled messages
2. Wrong channel for sending messages
3. Lack of feedback
4. Poor listening skills
5. Disorganization and confusion
6. Lack of communication aids
7. Personal characteristics

Personal characteristics

- Arrogant versus Humble
- Unlikeable versus Likeable
- Weak versus Self-confident
- Uncaring versus Caring
- Sour versus Humorous
- Unkind versus Kind

Good news

Communication skills can be:

- Learned
- Practiced
- Evaluated
- Improved
Strategies to support calf health

- Milk feeding temperature
- Fluids and electrolytes
- Be watchful, identify problems early
- Environment—dry, well-ventilated, draft-free
- Plane of nutrition
- Feeding management
- Warm water after each milk feeding

Am I a good delegator?

1. I tend to be a perfectionist.
2. I work more hours than most everyone else.
3. I often lack time to explain clearly and concisely how a task should be done.
4. I am often interrupted.
5. I still prefer to do the things I did before becoming a senior manager.
6. I have to spend a lot of time reviewing the work of people I supervise.
7. I am usually more committed than other managers.
8. I get upset when other people don’t do something right.
9. I feel a need to keep a finger in every pie.
10. I like to be in control of how and when things are done.

How to delegate

1. Define what is being delegated
2. Delegate to the right people
3. Assess ability and training needs
4. Explain assignment, importance, additional training, deadlines and why the person was chosen
5. Describe in detail the authority and responsibility being delegated

How to delegate? (Continued)

6. Solicit questions, suggestions and concerns
7. Incorporate on-the-job-training techniques into early efforts to handle the new task
8. Be encouraging
9. Provide feedback
10. Stay in contact without hovering
11. Provide recognition and reward upon completion or at appropriate intervals

Part III. Stumbling blocks leading to ineffective teams

- Team leadership is difficult, frustrating and challenging for managers
- Immensely helpful to anticipate likely stumbling blocks to team success
Common stumbling blocks

1. Lack of training for team leaders and team members
2. Unfairness and lack of trust of senior managers, team leaders and co-workers
3. Inappropriate standards of performance – too high, too low, unfair

(Continued)
4. Disappointment over lack of feedback, recognition, opportunity and awards
5. Human factors that affect team effectiveness and leadership
   - Unexpected reactions
   - Non-work issues
   - Lack of empathy and help from team leaders
6. Conflict among managers and workers

Contacting Bernie

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TAKE HOME MESSAGES

1. The pre-weaning period is a period of life where the calf is undergoing significant developmental changes and this development is directly linked to future productivity in the first and subsequent lactations.

2. Pre-weaning growth rate and primarily protein accretion appears to be a key factor in signaling the tissue or communication process that enhances life-time milk yield.

3. Anything that detracts from feed intake and subsequent pre-weaning growth rate reduces the opportunity for enhanced milk yield as an adult.

4. Nutrient supply, both energy and protein are important and protein quality and digestibility are essential.

5. There are no substitutes for liquid feed prior to weaning that will enhance the effect on long-term productivity.

6. Factors other than immunoglobulins in colostrum modify feed intake, feed efficiency and growth of calves and can enhance the effect of early life nutrient status.

7. As an industry and as nutritionists we need to talk about metabolizable energy and protein intake and status relative to maintenance and stop talking about cups, quarts, gallons, buckets and bottles of dry matter, milk, milk replacer etc. The calf has discrete nutrient requirements not related to dry matter and liquid volume measurements.

8. The effect of nurture is many times greater than nature and the pre-weaning period is a phase of development where the productivity of the calf can be modified to enhance the animal’s genetic potential.

LACTOCRINE HYPOTHESIS: COLOSTRUM’S ROLE

It has been well recognized that the phenotypic expression of an individual is affected by both genetic ability as well as environment. The environment contains multiple external signals that affect the development and expression of the genetic composition of an animal. While in the uterus, the mother controls the environment in which the fetus is developing, influencing in this way the expression of the genetic material and there is good evidence that the environment can play a role in long-term productivity in beef cattle (Summers and Funston, 2012). The effect and extent of maternal influence in the offspring’s development does not end at parturition, but continues throughout the first weeks of life through the effect of milk-born factors, including colostrum, which have an impact in the physiological development of tissues and functions in the offspring. This concept has been recently described as the “lactocrine hypothesis” (Bartol et al., 2008). Conceptually, this topic is not new but the terminology is useful and the ability of several groups to make a direct connection from a factor in milk to a developmental function at the tissue or behavior level is significant (Nusser and Frawley, 1997; Hinde and Capitanio, 2010). Data relating to this topic has been described and discussed by others in neonatal pigs (Donovan and Odle, 1994; Burrin et al., 1997) and calves (Baumrucker and Blum, 1993; Blum and Hammon, 2000; Rauprich et al. 2000). The implication of this hypothesis and these observations are that the neonate can be programmed maternally and post-natally to alter development of a particular process.

To maximize calf survival and growth, plasma immunoglobulin (Ig) status and thus colostrum management is of utmost importance. This is obviously not a new concept and there are hundreds of papers describing the management and biology surrounding colostrum quality, yield and Ig absorption by the calf although some recent research in colostrum handling and management suggest we can still make improvements (Godden, 2008). Until recently, the primary reason colostrum has been of interest in neonatal ruminants is due to the
importance of supplying Ig’s to calves born without any and lacking a mature immune system (Weaver et al., 2000). Thus, without sufficient levels of Ig’s, morbidity and mortality rates are increased. While Ig’s are important, colostrum provides the newborn calf with much more than Ig’s. There is an abundance of literature describing some of these other factors in colostrum and the role these compounds can have in the development of the calf, especially the role of colostrum components on energy metabolism (Hammon et al. 2012).

Colostrum, in comparison with milk, is known to be rich in immunoglobulins (60x cow), as well as hormones and growth factors such as relaxin (>19x pig), prolactin (18x cow), insulin (65x cow), IGF-1 (155x cow), IGF-2 (7x cow), and leptin (90x humans) (Odle et al., 1996; Blum and Hammon, 2000; Wolinski et al., 2005; Bartol et al., 2008) among many other factors that have biological activity in the neonate. For a long period of time, colostrum has been known to have a major effect on the development of the gastrointestinal tract, but the exact mechanisms are still not well understood. During the first few days of life in neonatal piglets, a notable increase in the length, mass, DNA content, and enzymatic activities of certain enzymes (lactase) occurs in the small intestine for neonates fed colostrum/milk versus a control of water (Widdowson et al. 1976, Burrin et al., 1994). This was originally thought to be mediated by differences in nutrient intake between milk and water (Burrin et al. 1992). However, other studies have demonstrated differences between animals fed colostrum that is rich in growth factors, versus milk with comparable energy values (Burrin et al., 1995).

Of interest are the studies that have described decreased growth rate and increased morbidity of calves with low serum immunoglobulin status (Nocek, et al., 1984; Robinson et al., 1988) and have demonstrated that milk yield during first lactation can be affected (DeNise et al., 1989) by this effect. Robinson et al. (1988) demonstrated that calves with higher Ig status were able to inactivate pathogens prior to mounting a full immune response which allows them to maintain energy and nutrient utilization for growth, whereas calves with low Ig status must mount an immune response which causes nutrients to be diverted to defense mechanisms. How severe is this difference or for how long does it persist? The data of DeNise et al., (1989) demonstrated that for each unit of serum IgG concentration, measured at 24 to 48 hr after colostrum feeding, above 12 mg/mL, there was an 8.5 kg increase in mature equivalent milk. The implication was that calves with lower IgG concentration in serum were more susceptible to immune challenges which impacted long term performance.

Some of the other components in colostrum, such as insulin, IGF-1, relaxin and other growth factors and hormones, are important factors in developmental processes; likewise, a lack or shortage of them in early life might alter developmental functions, leading to a change in nutrient utilization and efficiency (Hammon et al. 2012). To examine this concept, Soberon and Van Amburgh (2011) examined the effect of colostrum status on pre-weaning ADG and also examined the effects of varying milk replacer intake after colostrum ingestion. Calves were fed either high levels (4 liters) or low levels (2 liters) of colostrum, and then calves from these two groups were subdivided into two more groups being fed milk replacer at limited amounts or ad libitum. In this study, none of the calves exhibited failure of passive transfer. Comparing calves fed 4 liters of colostrum and ad libitum intake of milk replacer versus 2 liters of colostrum and ad libitum intake of milk replacer, calves fed the 4 liters of colostrum demonstrated an 8.5% increase in milk replacer intake, an 18% increase in pre-weaning ADG, a 12% increase in post-weaning feed intake, and a 25% increase in post-weaning ADG through 80 days of life, indicating that colostrum potentially affects appetite regulation, which enhances growth and possibly feed efficiency (Table 1). Therefore, it can be logically concluded that if colostrum induces changes in feed efficiency, then the first feeding can also potentially affect future milk production.

To further this concept, data from Steinhoff-Wagner et al. (2010) examined the effects colostrum has on the ability of neonates to regulate glucose, through both exogenous absorption and endogenous production. The results of this study demonstrated that calves fed colostrum had significantly higher plasma circulating glucose levels in comparison to formula fed calves, however the gluconeogenic ability did not differ between the two groups. This suggests that in colostrum-fed calves glucose absorption capacity are increased in comparison to milk replacer fed calves, as mentioned above. These results were verified by significantly higher postprandial glucose concentrations, and ensuing higher insulin concentrations, in colostrum fed versus milk replacer fed calves. During post-prandial periods, colostrum-fed calves had higher liver glycogen concentrations and g6pase activities, indicating better glucose and galactose hepatic absorption. This has implications for lactose digestion and absorption. First pass uptake of [U-13C]-glucose, or the glucose utilization in splanchnic tissue (intestine and liver), was lower...
in colostrum fed calves than milk replacer fed calves. This indicates that glucose was either less absorbed or more utilized in splanchnic tissue in formula-fed calves, resulting in lower percentage use in colostrum-fed calves. Additionally, [U-13C]-glucose concentration was significantly higher in calves fed colostrum over milk-replacer, similar to the xylose absorption data presented earlier. Again, this supports the idea that glucose absorption is enhanced in colostrum-fed calves versus milk-replacer fed calves. Finally, plasma glucose concentrations were significantly higher in colostrum-fed calves. This suggests that calves fed colostrum had higher glycogen concentrations and did not utilize protein catabolism. If the glucose uptake differences were to persist, it would help us understand the role of factors in colostrum other than Ig’s important for long-term productivity.

Table 1. Effect of high (4+2 L) or low (2L) colostrum and ad-lib (H) or restricted (L) milk replacer intake on feed efficiency and feed intake in pre and post-weaned calves (Soberon and Van Amburgh, 2011).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>HH</th>
<th>HL</th>
<th>LH</th>
<th>LL</th>
<th>Std dev</th>
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<tr>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth wt, kg</td>
<td>44.0</td>
<td>43.4</td>
<td>41.8</td>
<td>43.3</td>
<td>0.95</td>
</tr>
<tr>
<td>Birth hip height, cm</td>
<td>80.5</td>
<td>80.3</td>
<td>80.0</td>
<td>80.9</td>
<td>0.56</td>
</tr>
<tr>
<td>IgG concentration, mg/dl*</td>
<td>2,746a</td>
<td>2,480b</td>
<td>1,466c</td>
<td>1,417d</td>
<td>98</td>
</tr>
<tr>
<td>Weaning wt, kg</td>
<td>78.2a</td>
<td>63.5b</td>
<td>72.2c</td>
<td>62.4d</td>
<td>1.89</td>
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<tr>
<td>Weaning hip height, cm</td>
<td>93.0a</td>
<td>88.6a</td>
<td>91.5b</td>
<td>89.6c</td>
<td>0.60</td>
</tr>
<tr>
<td>ADG pre-weaning, kg</td>
<td>0.79a</td>
<td>0.42b</td>
<td>0.67a</td>
<td>0.39b</td>
<td>0.028</td>
</tr>
<tr>
<td>Hip height gain, pre-weaning, cm/d</td>
<td>0.248a</td>
<td>0.158b</td>
<td>0.227c</td>
<td>0.161d</td>
<td>0.009</td>
</tr>
<tr>
<td>ADG birth to 80 d, kg</td>
<td>0.78a</td>
<td>0.59b</td>
<td>0.66b</td>
<td>0.53c</td>
<td>0.034</td>
</tr>
<tr>
<td>Hip height gain, birth to 80 d, cm/d</td>
<td>0.214a</td>
<td>0.157b</td>
<td>0.184b</td>
<td>0.148b</td>
<td>0.008</td>
</tr>
<tr>
<td>Total milk replacer intake, kg DM</td>
<td>44.4a</td>
<td>20.5a</td>
<td>40.9a</td>
<td>20.0a</td>
<td>1.2</td>
</tr>
<tr>
<td>Grain intake pre-weaning, kg</td>
<td>2.5a</td>
<td>12.0b</td>
<td>2.1b</td>
<td>9.7b</td>
<td>1.5</td>
</tr>
<tr>
<td>ADG/DMI, pre-weaning</td>
<td>0.60</td>
<td>0.61</td>
<td>0.67</td>
<td>0.61</td>
<td>0.042</td>
</tr>
<tr>
<td>ADG post-weaning, kg</td>
<td>1.10a</td>
<td>0.97b</td>
<td>0.88b</td>
<td>0.92b</td>
<td>0.061</td>
</tr>
<tr>
<td>DMI post-weaning, kg/d</td>
<td>2.89a</td>
<td>2.89b</td>
<td>2.58b</td>
<td>2.66c</td>
<td>0.104</td>
</tr>
<tr>
<td>ADG/DMI post-weaning</td>
<td>0.359</td>
<td>0.345</td>
<td>0.335</td>
<td>0.358</td>
<td>0.020</td>
</tr>
</tbody>
</table>

1HH = high colostrum, high feeding level, HL = High colostrum, low feeding level, LH = Low colostrum, high feeding level, LL = Low colostrum, low feeding level. Rows with different superscripts differ P < 0.05.

From an on farm perspective, standardization or evaluation of colostrum with a refractometer to ensure the appropriate solids or protein content is also important. Using a calibrated Brix refractometer, a minimum of 22% Brix provides good sensitivity and specificity for Ig levels for fresh and frozen colostrum above 50 mg/mL (Bielmann et al., 2010). Thus, anything above 22% is adequate for the first feeding for calves and anything below 22% should be reserved for later feedings. Finally, to determine total solids with a Brix refractometer, the Brix value needs to be converted. An equation from Moore et al. (2009) can be used to do this effectively, and the equation is: percent total solids = 0.9984 x (Brix%) + 2.077. Given the regression coefficients, a quick calculation is Brix% + 2 units. An evaluation of the use of a Brix refractometer was recently published by Quigley et al. (2012) and they suggested a cut point of 21% was appropriate for their data.

Also, colostrum is the first meal and accordingly is very important in establishing the nutrient supply needed to maintain the calf over the first day of life. The amount of colostrum is always focused on the idea we are delivering a specific amount of immunoglobulins (Ig’s) to the calf, and many times we underestimate the nutrient contribution of colostrum. Further, many times of year, we tend to underestimate the nutrient requirements of the calf, especially for maintenance. For example, a newborn Holstein calf at 85 lbs birth weight has a maintenance requirement of approximately 1.55 Mcals ME at 72 °F. Colostrum contains approximately 2.51 Mcals metabolizable energy (ME)/lb, and a standard feeding rate of 2 quarts of colostrum from a bottle contains about 1.5 Mcals ME. Thus, at thermoneutral conditions, the calf is fed just at or slightly below maintenance requirements at its first feeding. For comparison, if the ambient temperature is 32 °F the ME requirement for maintenance is 2.4 Mcals, which can only be met if the calf is fed approximately 1 lb of DM or about 3.5 quarts of colostrum. This simple example illustrates one of the recurring issues with diagnosing growth and health problems with calves and that is the use of volume measurements to describe nutrient supply instead of discussing energy and nutrient values. Two quarts of colostrum sounds good because that is what the bottle might hold, but it has little to do with the nutrient requirements of the calf.

Managing the calf for greater intake over the first 24 hours of life is important if we want to ensure positive energy balance and provide adequate Ig’s and other components from colostrum...
for proper development. For the first day, at least 3 Mcals ME (approximately 4 quarts of colostrum) would be necessary to meet the maintenance requirements and also provide some nutrients for growth. On many dairies this is done via an esophageal feeder and the amount dictated by the desire to get adequate passive transfer. Those dairies not tube feeding should be encouraging up to 4 quarts by 10 to 12 hours of life to ensure colostrum is fed not only to meet the Ig needs of the calf, but also to ensure that the nutrient requirements are met for the first day of life.

**NUTRIENT STATUS AND LONG-TERM PRODUCTIVITY**

There are several studies in various animal species that demonstrate early life nutrient status has long-term developmental effects. Aside from the improvement in potential immune competency, there appear to be other factors that are impacted by early life nutrient status. There are several published studies and studies in progress that have both directly and indirectly allowed us to evaluate milk yield from cattle that were allowed more nutrients up to eight weeks of age. The earliest of these studies investigated either the effect of suckling versus controlled intakes or ad-libitum feeding of calves from birth to 42 or 56 days of life (Foldager and Krohn, 1994; Bar-Peled et al, 1997; Foldager et al, 1997). In each of these studies, increased nutrient intake prior to 56 days of life resulted in increased milk yield during the first lactation that ranged from 1,000 to 3,000 additional pounds compared to more restricted fed calves during the same period (Table 1). Although they are suckling studies, milk is most likely not the factor of interest, but nutrient intake in general and this is demonstrated in the more recent data.

In the study conducted at Miner Institute, Ballard et al. (2005), reported that at 200 days in milk, the calves fed milk replacer at approximately twice normal feeding rates produced 1,543 pounds milk more than the calves that received one pound of milk replacer powder per day. Calving age in that study was not affected by treatment. Overall, averaging the studies, there is a 1,500 pound response to increasing nutrient intake prior to weaning for first lactation milk yield. The significant observation is that the effect of intake level needs to be accomplished through liquid feed intake.

The responses in the studies of Shamay et al. (2005) and Moallem et al. (2010) are significant, specifically because they suggest that milk replacer quality is important to achieve the milk response, as is protein status of the animal post weaning. In that study, the calves were fed a 23% CP, 12% fat milk replacer containing some soy protein or whole milk. Further, post-weaning the calves were fed similarly until 150 days of gain, and the diets were protein deficient (~13.5% CP). Starting at 150 days calves from both pre-weaning treatments were supplemented with 2% fish meal from 150 to 300 days of life. The calves allowed to consume the whole milk (ad libitum for 60 minutes) and supplemented with the additional protein produced approximately 1,700 pounds more milk in the first lactation indicating that the early life response could be muted by inadequate protein intake post-weaning.

Finally the data of Drackley et al. (2007) again demonstrate a positive response of early life nutrition on first lactation milk yield. In this study, calves were fed either a conventional milk replacer (22:20; i.e. 22% protein, 20% fat) at 1.25% of the body weight (BW) or a 28:20 milk replacer fed at 2% of the BW for week one of treatment and then 2.5% of the BW from week 2 to 5 and then systematically weaned by dropping the milk replacer intake to 1.25% of the BW for 6 days and then no milk replacer. All calves were weaned by 7 weeks of age and after weaning all calves were managed as a single group and bred according to observed heats. The heifers calved between 24 and 26 months of age with no significant difference among treatments. Calving BW were also not different and averaged 1,278 lb. Milk yield on average was 1,841 pounds greater for calves fed the higher level of milk replacer prior to weaning.

The Cornell University Dairy Herd started feeding for greater pre-weaning BW gains many years ago and we have over 1,200 weaning weights and 3+ lactations with which to make evaluations outside of our ongoing study. What makes our approach to this unique is the application of a Test Day Model (TDM) (Everett and Schmitz. 1994; Van Amburgh et al., 1997) for the analyses of the data. This approach allows us to statistically control for factors not associated with the variables of interest and is the same approach that has been used to conduct sire summaries and daughter evaluations and develop heritabilities for genetic traits. Thus, the outcome is mathematically more robust and allows us to look within a herd over time with less bias and to look at herd responses independent of formal treatments. The resulting residuals are standardized which makes them additive over the life of the animal and they can be calculated for individual test days or over the lactation. The power of this type of analyses is much more significant compared to
comparing daily milk or even ME305 milk and helps us partition out variance not associated with the variables of interest.

Table 1. Milk production differences among treatments where calves were allowed to consume more nutrients than the standard feeding rate prior to weaning from milk or milk replacer.

<table>
<thead>
<tr>
<th>Study</th>
<th>Milk yield, lb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foldager and Krohn, 1991</td>
<td>3,092</td>
</tr>
<tr>
<td>Bar-Peled et al., 1998</td>
<td>998</td>
</tr>
<tr>
<td>Foldager et al., 1997</td>
<td>1,143</td>
</tr>
<tr>
<td>Ballard et al., 2005 (@ 200 DIM)</td>
<td>1,543</td>
</tr>
<tr>
<td>Shamay et al., 2005 (post-weaning protein)</td>
<td>2,162</td>
</tr>
<tr>
<td>Rincker et al., 2006 (proj. 305@ 150 DIM)</td>
<td>1,100</td>
</tr>
<tr>
<td>Drackley et al., 2007</td>
<td>1,841</td>
</tr>
<tr>
<td>Raith-Knight et al., 2009</td>
<td>1,582</td>
</tr>
<tr>
<td>Terre et al., 2009</td>
<td>1,375</td>
</tr>
<tr>
<td>Morrison et al., 2009 (no diff. calf growth)</td>
<td>0</td>
</tr>
<tr>
<td>Moallem et al., 2010</td>
<td>1,600</td>
</tr>
<tr>
<td>Soberon et al., 2012</td>
<td>1,217</td>
</tr>
<tr>
<td>Margerison et al., 2013</td>
<td>1,311</td>
</tr>
<tr>
<td>Kinzelback et al. 2015 (little diff. calf growth through entire phase)</td>
<td>0</td>
</tr>
</tbody>
</table>

We analyzed the lactation data of the 1,244 heifers with completed lactations using the TDM approach and statistically analyzed several factors related to early life performance and the TDM milk yield residuals (Soberon et al., 2012). The factors analyzed were birth weight, weaning weight, height at weaning, BW at 4 weeks of age and several other related and farm measurable factors. From a management perspective the most interesting observation was the relationship among two factors, growth rate prior to weaning and intake over maintenance and first lactation milk yield. In these analyses, the strongest relationship associated with first lactation milk production was growth rate prior to weaning and the findings are consistent with the data presented in Table 1. In our data set, for every 1 pound of average daily gain (ADG) prior to weaning (or at least 42 to 56 days of age), the heifers produced approximately 937 pounds more milk (P < 0.01) (Table 2). The range in pre-weaning growth rates among the 1,244 animals were 0.52 to 2.76 pounds per day and the range was actually quite puzzling to us. Our feeding program at the research farm is straightforward: 1.5% BW dry matter from day 2 to 7 and then 2% of BW dry matter from day 8 to 62 of a 28:15 or 28:20 milk replacer mixed at 15% solids. Free choice water is offered year around and starter is offered from day 8 onward. At that feeding rate, we are offering twice the industry standard amount and had assumed it was enough for overcoming the maintenance requirement and provide adequate nutrients for growth, even in the winter.

Figure 1. Test Day Model residuals in kg of milk, averaged by temperature at time of birth with mean temperature in Celsius. Columns with different superscripts differ (P < 0.05). (Soberon et al. 2012)

However, when we analyzed the TDM residuals by temperature at birth, a very significant observation was made (Figure 1). These data suggest that although we are meeting the maintenance requirements of the calves from a strict requirement calculation, we are not providing enough nutrients above maintenance to optimize first lactation milk production. We need to remember that the thermoneutral zone for calves is 68° to 82° F and that when the temperature drops below that level, intake energy will be used to generate heat instead of growth. In addition, when we analyzed the data by lactation, the response increased as the animals matured (Table 2). These data demonstrate there are programming or developmental events being affected in early life that have a lifetime impact on productivity. When we evaluated the 450 animals that had completed a third lactation, we found a lifetime milk effect of pre-weaning average daily gain of over 6,000 lb of milk depending on pre-weaning growth rates. Further, 22% of the variation in first lactation milk...
production could be explained by growth rate prior to weaning. This suggests that colostrum status and nutrient intake and or pre-weaning growth rate have a greater effect on lifetime milk yield and account for more variation and progress in milk yield associated with the management of the calf than genetic selection. Generally, milk yield will increase 150 to 300 lbs per lactation due to selection whereas the effect of management is three to five times that of genetic selection. 

Table 2. Predicted differences by TDM residual milk (lb) for 1st, 2nd, and 3rd lactation as well as cumulative milk from 1st through 3rd lactation as a function of pre-weaning average daily gain and energy intake over predicted maintenance for the Cornell herd. (Soberon et al. 2012)

<table>
<thead>
<tr>
<th>Lactation</th>
<th>n</th>
<th>Predicted difference in milk per lb of pre-weaning ADG</th>
<th>P value</th>
<th>Predicted difference in milk (lb) for each additional Mcal intake energy above maintenance</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>1244</td>
<td>850</td>
<td>&lt; 0.01</td>
<td>519</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>2nd</td>
<td>826</td>
<td>888</td>
<td>&lt; 0.01</td>
<td>239</td>
<td>0.26</td>
</tr>
<tr>
<td>3rd</td>
<td>450</td>
<td>48</td>
<td>0.91</td>
<td>775</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>1st - 3rd</td>
<td>450</td>
<td>2,280</td>
<td>0.01</td>
<td>1,991</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

In the Cornell herd, the effect of diarrhea or antibiotic treatment on ADG was not significant and ADG differed by approximately 30 g/d for calves that had either event in their records (P > 0.1). However, for calves that had both events recorded, ADG was lower by approximately 50 g/d (P < 0.01). Over the eight year period, approximately 59% of all of the calves had at least one of the recorded events. 

In the data from the Cornell herd, first lactation milk yield was not significantly affected by reported cases of diarrhea. Antibiotic treatment had a significant effect on TDM residual milk and calves that were treated with antibiotics produced 1,086 lb less milk in the first lactation (P > 0.01) than calves with no record of being treated. Regardless of antibiotic treatment, the effect of ADG on first lactation milk yield was significant in all calves (P < 0.05). Calves that were treated with antibiotics produced 1,373 lb more milk per kg of pre-weaning ADG while calves that did not receive antibiotics produced 3,101 lb more milk per kg of pre-weaning ADG. The effect of increased nutrient intake from milk replacer was still apparent in the calves that were treated, but the lactation milk response was most likely attenuated due to factors associated with sickness responses and nutrient partitioning away from growth functions (Johnson, 1998; Dantzer, 2006).

An analysis of all the lactation data and the pre-weaning growth rates, when controlled for study, suggests that to achieve these milk yield responses from early life nutrition, calves must double their birth weight or grow at a rate that would allow them to double their birth weight by weaning (56 days). This further suggests that milk or milk replacer intake must be greater than traditional programs for the first 3 to 4 weeks of life in order to achieve this response.

The papers and data described in Table 1 were analyzed in a meta-analyses to further investigate the impact of nutrient intake and growth rate prior to weaning (Soberon and Van Amburgh, 2012). The analysis excluded Foldager and Krohn, (1991) due to inadequate data and Davis-Rincker et al. (2011) because they did not measure full lactations. The Morrison et al. (2009) study was included in the analysis). The software used was Used Comprehensive Meta Analyses software (www.Meta-Analysis.com) (Borenstein et al. 2005) and the data included were study, treatment size (number of calves), mean milk yield, standard error or deviation, P value and effect direction. The data of Soberon et al. (2012) was initially excluded and then included to test for weighting effects since Soberon et al. contains many hundreds of animals. Inclusion of Soberon et al. did not change the outcome and the data were included in the analyses. The analysis indicated that feeding higher levels of nutrients from milk or milk replacer prior to weaning significantly increased milk yield by 959 ± 258 lb, P < 0.001, with a confidence range of 452 to 1,463 lb of milk. Further, if ADG was included as a continuous variable among the data set, the outcome was similar to that of Soberon et al. (2012) where for every pound of pre-weaning ADG, milk yield in the mature animal increased by 1540 lb (P = 0.001).

What changes in the animal are allowing for these differences? There is no one answer to that question but investigations are looking for several factors. Although mammary development as previously measured is probably not the appropriate factor (Meyer et al., 2006a, 2006b), it is intriguing to look at very specific cells within the mammary gland. There are a couple sets of data that demonstrate increased mammary cell growth based on early life nutrient intake. Brown et al. (2005) observed a 32 to 47% increase in mammary DNA content of calves fed approximately 2 versus 1 pound of milk replacer powder per day through weaning. Just like the milk production increases discussed earlier, this mammary effect only occurred prior to weaning. In fact,
this increase in mammary development was not observed once the calves were weaned, indicating the calf is more sensitive to level of nutrition prior to weaning and that the enhancement mammary development cannot be “recovered” once we wean the animal.

Meyer et al. (2006a) observed a similar effect in mammary cell proliferation in calves fed in a similar manner. The calves on their study demonstrated a 40% increase in mammary cell proliferation when allowed to consume at least twice as much milk replacer as the control group before weaning (Meyer et al., 2006a). Seijesen et al (2000) observed no negative effect on mammary development in calves allowed to consume close to ad libitum intakes. A more specific attempt to look at stem cell proliferation did not find increased stem cells in calves fed higher levels of nutrient intake (Daniels et al., 2008) and it was hypothesized that the stem cell proliferation might lead to greater secretory cells once the animal becomes pregnant.

**SUMMARY**

Early life events have long-term effects on the performance of the calf. Our management approaches and systems need to recognize these effects and capitalize on them. We have much to learn about the consistency of the response and the mechanisms that are being affected. Given the amount of variation accounted for in first and subsequent lactation milk yield, there are opportunities to enhance the response once we know and understand those factors. The bottom line is there is a positive economic outcome to improving the management of our calf and heifer programs starting at birth.

**REFERENCES**


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administration, immunoglobulin, and continued feeding of colostrum on calf gain, health and serum protein. J. Dairy Sci. 67:319-333.


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CELMANAX can also bind (agglutinate) some bacterial pathogens (Fig. 2) and prevent colonization of bovine colonic tissue by various types (serovars) of E. coli and Salmonella enterica.

Table 1. Crypto infections in calves fed CELMANAX from Day 1 and artificially infected with 1000 Crypto oocytes at Day 6.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control</th>
<th>CELMANAX</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calves/treatment, n</td>
<td>22</td>
<td>22</td>
<td>—</td>
</tr>
<tr>
<td>% calves naturally infected with Crypto at 6 days of age</td>
<td>50</td>
<td>22.7</td>
<td>0.06</td>
</tr>
<tr>
<td>Duration of Crypto shedding post C. parvum challenge, d (mean)</td>
<td>19.05</td>
<td>15.32</td>
<td>0.02</td>
</tr>
</tbody>
</table>


To learn more about CELMANAX, contact your nutritionist, veterinarian or Arm & Hammer Animal Nutrition representative or visit AHanimalnutrition.com.
INSPIRED TEAMWORK AND LEADERSHIP

Paul Vitale, Vital Communications, Inc.

DARE TO DREAM COURAGEOUSLY
To dream means to envision what may become. Throughout history, every organization and social movement grew from the seed of a dream. The dream or vision is the strength that creates the future. Leaders dare to dream often; however, some are unable to implement their vision because of the lack of courage.

ESTABLISH A COURSE OF ACTION
To set a dream or idea into motion, a leader must first be clear about the course of action. Create a plan and work the plan. Effective leaders do this through being precise and decisive in the plans they set into motion. This is an active, not passive process.

EMPOWER OTHERS TO IMAGINE
The imagination is an incredible tool. Leaders are learners who welcome collaboration, teamwork, and ideas from others. When individuals have the chance to share their imagination with the team, they develop a keen sense of ownership in the process. Effective leaders “talk up” the ideas of others, versus tearing them down.

BE RESILIENT LIKE NONE OTHER
It is extremely easy to become exhausted, frustrated, and disenchanted. However, during these moments difference makers dig deep to find the courage required to listen carefully to the needs of others, demonstrate promptness in their responses, and never underestimate this simple statement: Setbacks can be setups for enormous growth.
ANTIBIOTICS AND CALVES: CURRENT AND FUTURE CONSIDERATIONS

Danielle A. Mzyk, North Carolina State University

SUMMARY

Calfhood diseases have a major economic impact on beef and dairy operations, due to the costs of calf losses and treatment and the long term effects on performance. Judicious antimicrobial use by calf raisers includes selecting the most appropriate drug, at the correct dose, route and duration of treatment, to provide a positive clinical outcome while having minimum impact on the emergence of resistance. Producers and veterinarians often end up administering drugs to calves in an extra label manner due to the limited number of approved products in this class of cattle. The purpose of this presentation will be to provide producers with a summary of the current and future considerations of using antibiotics in both beef and dairy preruminant calves.

CLASSIFICATION OF CALVES

From a regulatory standpoint, a major issue that arises is the use of the term “preruminant” vs “ruminant” calf when it comes to selecting appropriate and legal drug use. Many producers and veterinarians have varying ideas on what constitutes a preruminant vs ruminant calf and issues arise when trying to distinguish both groups of calves from calves labeled for veal. In addition to the lack of approved drugs in preruminant calves, confusion remains when labels state “A withdrawal period has not been established for this product in pre-ruminant cattle,” giving the impression that certain drugs may be used in preruminant calves. Veal calves are defined as immature cattle, including beef and dairy breeds, that lack a functional rumen and are intended for meat production. Veal calves are recognized as a distinct regulatory class from suckling calves because of their handling, housing, and proximity to slaughter. Dairy calves are defined as dairy cattle from birth until weaning being fed a ration that includes milk or liquid milk replacer which excludes veal calves.

CURRENT CONSIDERATIONS

The Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA) provides veterinarians acting within a veterinarian-client-patient relationship (VCPR) with greater prescribing and dispensing options to treat disease in preruminant calves. With limited products approved for this class of cattle, the extralabel use of approved human or animal drugs is allowable, given that the veterinarian makes a diagnosis after evaluation of the animal, establishes a substantially extended withdrawal period, and takes appropriate measures to assure that the withdrawal times are met and no illegal drug residues occur. This is even more essential to producers that raise veal calves, due to their proximity to slaughter.

Medicated feed

The use of medication in milk replacers is a large source of antibiotics use in dairy calves. Neomycin and oxytetracycline have been approved for use in calf milk replacers to aid in either the prevention or treatment of bacterial enteritis (scours); these medications have often been fed continuously throughout the preweaning period. In addition, these two drugs constitute some of the highest residue violations in bob veal calves. In August of 2010, the FDA ruled that the combination drug of neomycin and oxytetracycline can no longer be used in a 2:1 dosage in milk replacer. It must be sold in milk replacer as a 1:1 concentration and used at either a low level continuously (0.05-0.10 mg/lb body weight) or high level (10 mg/lb body weight for 7-14 days). It is important to note that any extralabel use of medicated feed is not permitted by law and neither veterinarians nor their clients may use, or direct the use of, a medicated feed in an extralabel manner, which includes prescribing it for an unapproved species or higher or lower dose, including for use in preruminant calves.

Waste Milk

On dairy farms, it is common practice to feed calves milk from cows treated with antibiotics that have been withheld from human consumption. However, the feeding of waste milk has been noted to cause some drug residue violations in veal calves. Often these violative residues are when the waste milk is from a cow treated by an intramammary route of administration. In order to determine the risk of antibiotic residues from the ingestion of milk containing possible residues, there are several factors to consider. The inefficient
absorption of many orally administered drugs in calves could be caused by differences in the uptake from the gastrointestinal tract from a neonatal calf and binding of the drug to milk. Bioavailability which is defined as the fraction of an administered dose of unchanged drug that reaches the systemic circulation. When drugs are delivered in combination with milk, many drugs showed lower bioavailability. The presence of milk may decrease uptake of the drug due to binding with the milk proteins as well as gastrointestinal differences in different aged calves. Diet can affect the bioavailability of drugs, as well as disease status. Infection and inflammation has been shown to increase drug uptake and concentration in specific tissues and reduce the clearance of drugs in cattle and need to be considered when determining an adequate withdrawal interval. According to the FDA, the feeding of waste milk containing any drugs would be technically be considered an adulterated feed although enforcement would be up to the inspector, but could be prohibited from being fed to calves. More information is needed about absorption of antibiotics in calves after being fed milk from treated cows.

**Future Considerations**

**Veterinary Feed Directive (VFD)**

The FDA’s current veterinary feed directive (VFD) regulation, which begins in December 2016, establishes requirements relating to the distribution and use of VFD drugs and animal feeds containing drugs. This ruling states requirements associated with veterinary authorization, distribution, and use of VFD drugs in animal feed. This ruling also prohibits the extralabel use of medicated feeds, which includes using these products at a different concentration or extended dosing interval that is not on its approved label would be considered an illegal use. The biggest impact of the final VFD for dairy farmers and heifer raisers could be in medicated milk replacers. More than half of milk replacers are currently medicated. Many of these are medicated with coccidiostats to control coccidiosis, which is prevalent on many farms. These do not fall under the VFD unless they are fed in combination with shared-use antibiotics. But some portion of milk replacers are medicated with oxyneo, which is a combination of oxytetracycline and neomycin. It’s used to prevent and control bacterial pneumonia and scours. Both oxytetracycline and neomycin are on FDA’s Guidance 152 list of shared compounds medically important to humans. The new VFD will now likely require farmers to have a veterinary prescription for their use. It is important to note that with new VFD guidelines, producers will not be able to obtain medicated milk replacers without the VFD form in the future. Another consideration is that it would be illegal for a producer to do anything other than follow label directions for a medicated feed. If a veterinarian prescribes a drug the under extra-label use provisions including adding a drug to a milk replacer, which is considered a feed, would be illegal. Giving the drugs orally without adding them to a feed would be permissible for a layperson if the label directions if directed by a licensed veterinarian. For an extra label use, a veterinarian could prescribe a drug for oral dosing if all of the conditions under the code of federal regulations are met.

**Antimicrobial Resistance**

Antimicrobial resistance is an increasing problem and this increase in resistance is a concern both for the health and treatment of the calf and for humans and other animals in the same environment. Moreover, there is increasing evidence that transmission of antimicrobial drug resistant bacteria, like methicillin resistant Staphylococcus aureus (MRSA) and extended spectrum beta-lactamase producing Escherichia coli, from food producing animals to humans may occur. Administering antibiotics, whether through injection, waste milk or medicated milk has been shown to increase antibiotic resistant bacteria in the lower gut of calves, especially if fed at higher concentrations such as from cows starting treatment for mastitis. Producers and veterinarians need to consider public animal health when selecting proper antibiotic treatment for sick calves.
NUTRITION IN THE POST-WEANED CALF

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Tana S. Dennis, Calf and Heifer Specialist, Provimi and Ph.D. Candidate, Purdue University

TAKE-HOME MESSAGES

Proper nutrition of post-weaned heifers is necessary for the continued growth and development of heifers. At young ages, heifers appear to continue to need readily available energy sources as their rumen continues to develop. Realizing that post-weaned heifers are still developing and are not yet ready to be fed like cows facilitates an understanding that specific feeding strategies need to be developed to allow for optimal growth and development of these heifers. Using specific feeding strategies for post-weaned dairy heifers allows them to continue to meet their growth potential while reducing costs per pound of gain and reducing the overall costs of raising dairy heifers.

INTRODUCTION

Nutrition of dairy heifers is often talked about as a whole without referring to the age and growth stage of the heifer. Even though there is a lot of focus placed on feeding milk-fed calves, little research information is available regarding the best strategies for feeding post-weaned dairy heifers. Paying close attention to the diets of post-weaned heifers helps to make sure they are growing at a rate to make sure that they will be ready for breeding and that they are efficiently utilizing the diets they are fed. As feed costs are the greatest expense for raising dairy heifers, nutritional strategies to encourage growth and development while improving feed efficiency will be beneficial for both the animals and heifer raisers.

Nutrition of dairy heifers is often talked about as a whole without referring to the age and growth stage of the heifer. Similar to lactating cows in various stages of lactation, the nutrient requirements of dairy heifers vary substantially during their 2 years of development. Although milk-fed calves have obviously different feed requirements, the nutrient requirements of heifers continue to change, especially over the 6 months after weaning. It is important to keep in mind calves that were recently weaned have different nutrient requirements from year old heifers and, thus, need to be fed differently. Starter intake does help to promote the growth and development of the rumen in calves, but making the assumption that weaned calves are fully functional ruminants is not correct. Therefore, continuing to pay close attention to how post-weaned heifers are fed will allow for the rumen to continue to develop and will maximize the growth and development of these heifers.

FEEDING STRATEGIES FOR POST-WEANED HEIFERS

Feed Delivery Methods for Post-Weaned Heifers

Dietary composition is an important aspect of feeding heifers, but the delivery method can also have an impact when feeding heifers. A study was conducted to evaluate the effects of feeding heifers a total mixed ration (TMR), feeding them concentrate and hay side-by-side in a feed bunk (SBS), or feeding grain in a bunk and hay in a feeder (HF) on growth and intake of post-weaned heifers (Table 1). In this study, heifers fed using HF were significantly heavier (P ≤ 0.05) than heifers fed using SBS from d 49 throughout the end of the study. Delivering feed using HF resulted in heifers that were, on average, 12.1 lbs and 7.3 lbs heavier than heifers fed using SBS and TMR, respectively, over the course of the study. Average daily gains varied depending on the time period of the study, as heifers fed using a TMR had lower ADG from d 7 to 14 (P = 0.05) and d 14 to 21 (P = 0.07) compared with HF and SBS, but higher ADG compared to SBS from d 21 to 28 (P = 0.03). These results suggest that post-weaned heifers require more time to adjust to new diets when feeding a TMR compared with component-feeding.

During the grower period, heifers fed using HF averaged 1.1 lbs/d more DMI compared with SBS and TMR (P < 0.01). However, heifers fed using a TMR consumed more DMI daily from d 63 to the conclusion of the study. The results of this study suggest that, along with responses in ADG, component-fed heifers maintained intake and weight gains when transitioning to a new diet, while TMR-fed heifers caught up in terms of ADG and efficiency towards the end of the transition period and throughout the grower period. This study indicates that there may be a certain point during the growth of a heifer when it is ideal to be able to switch over to feeding a TMR.
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Table 1. Body weight, intake, and skeletal measurements of prepubertal dairy heifers fed common diets using different feed delivery methods.

<table>
<thead>
<tr>
<th>Item</th>
<th>HF</th>
<th>SBS</th>
<th>TMR</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Body weight, lb</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d 28</td>
<td>396.5</td>
<td>391.6</td>
<td>387.6</td>
<td>4.45</td>
<td>0.37</td>
</tr>
<tr>
<td>d 133</td>
<td>605.3</td>
<td>575.7</td>
<td>575.1</td>
<td>4.45</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>ADG, lb/d</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d 0 to 28</td>
<td>2.29</td>
<td>2.09</td>
<td>1.96</td>
<td>0.121</td>
<td>0.21</td>
</tr>
<tr>
<td>d 29 to 133</td>
<td>2.05</td>
<td>1.83</td>
<td>1.85</td>
<td>0.064</td>
<td>0.06</td>
</tr>
<tr>
<td>d 0 to 133</td>
<td>2.09</td>
<td>1.90</td>
<td>1.87</td>
<td>0.055</td>
<td>0.02</td>
</tr>
<tr>
<td>DMI, lb/d</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d 0 to 28</td>
<td>9.57</td>
<td>9.08</td>
<td>9.72</td>
<td>0.223</td>
<td>0.15</td>
</tr>
<tr>
<td>d 29 to 133</td>
<td>18.04</td>
<td>17.00</td>
<td>16.96</td>
<td>0.209</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>d 0 to 133</td>
<td>16.16</td>
<td>15.26</td>
<td>15.34</td>
<td>0.176</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Feed efficiency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d 0 to 28</td>
<td>0.224</td>
<td>0.228</td>
<td>0.188</td>
<td>0.010</td>
<td>0.03</td>
</tr>
<tr>
<td>d 29 to 133</td>
<td>0.114</td>
<td>0.111</td>
<td>0.109</td>
<td>0.003</td>
<td>0.58</td>
</tr>
<tr>
<td>d 0 to 133</td>
<td>0.124</td>
<td>0.127</td>
<td>0.115</td>
<td>0.004</td>
<td>0.10</td>
</tr>
</tbody>
</table>

¹HF = hay feeder; SBS = side-by-side; TMR = total mixed ration; SEM = standard error of the mean.
²Day of study.
³Average daily gain.
⁴Dry matter intake.
⁵Feed efficiency expressed as lb of ADG per lb of daily DMI.

Feeding Hay or Ensiled Forages

Forages are an important component of heifer diets. However, little research has looked at how well post-weaned dairy heifers are able to utilize ensiled forages as compared to dry forages. A study was done to evaluate the performance of post-weaned dairy heifers that were fed either dry hay or baleage. In this study (Dennis et al., 2012), heifers fed a diet containing either 40% of their dietary DM as hay or baleage for a 28 d transition period had improved ADG, and the increase in ADG continued when heifers were fed the dry hay at 60% of the dietary DM for an additional 56 d grower period (Table 2). Interestingly, the DMI of the heifers during the transition period was not decreased; thus, the decreased gain was not a result of lesser intakes. During the grower period, the DMI was decreased for heifers fed baleage though there was still an overall tendency for improved feed efficiency for heifers fed dry hay.

Table 2. Body weight, intake, and feed efficiency of prepubertal dairy heifers fed Hay or Baleage for 28 d Transition Period followed by a 56 d Grower Period (Dennis et al., 2012).

<table>
<thead>
<tr>
<th>Item</th>
<th>Hay</th>
<th>Baleage</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grower Period</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial BW, lb</td>
<td>373.5</td>
<td>369.6</td>
<td>3.99</td>
<td>0.47</td>
</tr>
<tr>
<td>Final BW, lb</td>
<td>482.2</td>
<td>467.5</td>
<td>4.37</td>
<td>0.02</td>
</tr>
<tr>
<td>ADG, lb/d</td>
<td>1.39</td>
<td>1.23</td>
<td>0.044</td>
<td>0.04</td>
</tr>
<tr>
<td>DMI, lb/d</td>
<td>12.5</td>
<td>11.9</td>
<td>0.15</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>NDF Intake,</td>
<td>5.78</td>
<td>5.71</td>
<td>0.035</td>
<td>0.25</td>
</tr>
<tr>
<td>Feed efficiency</td>
<td>0.113</td>
<td>0.107</td>
<td>0.002</td>
<td>0.06</td>
</tr>
</tbody>
</table>

¹Hay or Baleage fed at 40% of diet DM in the Transition Period and 60% of diet DM in the Grower Period.
²Body weight.
³Average daily gain.
⁴Dry matter intake.
⁵Feed efficiency expressed as lb of ADG per lb of daily DMI.

The results of this study indicate that feeding ensiled forages to post-weaned dairy heifers may result in decreased feed efficiency. In this study, the heifers fed hay were apparently able to better utilize the forage in their diet. Although measurements of rumen development were not determined in this study, it may be possible that the rumen of the post-weaned heifers was still undergoing development and the ensiled forage was not able to be fully utilized at that point in their development.

Grain and Forage Ratios

In most dairy systems today, calves are fed ad libitum amounts of palatable grain-based starters within a few days of birth. As calves grow, they continue to increase their starter intake until they are to the point where they are able to consume enough nutrients from the starter to support their growth without consuming milk. Once calves are weaned, their starter intake continues to increase substantially to make up for the nutrients that are no longer being consumed through milk and to cover the increased nutrient needs of the calf as they continue to grow. The timing as to when calves should begin to receive forage, the type of forage they should receive, and how much of that forage they should be given is still of some debate.
Research was conducted at Purdue University to look at different grain to forage ratios to help determine the best strategy for feeding post-weaned dairy heifers. Heifers began the study when they were approximately 330 lbs and 4.5 months of age and were assigned to diets containing either 80, 60, or 40% concentrate (on a DM basis) for 56 days before abruptly being switched to a common diet that was 40% concentrate.

In this study, increasing grain inclusion from 40 to 80% of the dietary DM resulted in a linear increase in BW and greater overall ADG (Table 3). Frame growth exhibited similar responses to those observed for BW and ADG. Hip heights, heart girth circumference, and body condition score linearly increased with increasing grain inclusion (P < 0.01) during the treatment period, resulting in higher growth overall during the study for heifers fed 80% grain during the treatment period.

Feed costs per lb of DMI averaged $0.11, $0.12, and $0.13 for heifers fed 40:60, 60:40, and 80:20, respectively, during the treatment period. Feed costs per lb of ADG were lowest for 60:40 heifers over the duration of the study compared to heifers fed 40:60, though they were statistically similar to the feed costs for the 80:20 heifers. When heifers were fed 60:40 or 80:20 during the treatment period, savings were $0.24 and $0.22 per lb of ADG compared to heifers fed 40:60.

This study demonstrated that feeding higher grain levels to post-weaned dairy heifers can improve growth and can actually decrease the cost of gain over higher forage diets. In addition, it reinforced that heifers fed high grain levels can be negatively impacted by abrupt changes to higher forages diets, with the heifers on the 80:20 treatment showing a definite decline in intake when they were switched to a 40:60 diet that took some time to recover from.

Table 3. Weight, skeletal measurements, and intake responses of prepubertal dairy heifers fed increasing levels of grain during the treatment period then switched to a common diet.

<table>
<thead>
<tr>
<th>Item</th>
<th>40:60</th>
<th>60:40</th>
<th>80:20</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Body weight, lb</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d 57&lt;sup&gt;2&lt;/sup&gt;</td>
<td>369.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>398.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>428.8&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>d 112</td>
<td>476.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>504.7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>524.9&lt;sup&gt;c&lt;/sup&gt;</td>
<td>6.03</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td><strong>ADG&lt;sup&gt;3&lt;/sup&gt;, lb/d</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d 0 to 56</td>
<td>1.37&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.87&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.29&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.088</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>d 57 to 112</td>
<td>1.94&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.92&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.72&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.064</td>
<td>0.07</td>
</tr>
<tr>
<td>d 0 to 112</td>
<td>1.65&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.90&lt;sup&gt;b&lt;/sup&gt;</td>
<td>2.07&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.042</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td><strong>DM intake, lb/d</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d 0 to 56</td>
<td>9.3&lt;sup&gt;c&lt;/sup&gt;</td>
<td>10.7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>12.7&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.198</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>d 57 to 112</td>
<td>14.3</td>
<td>14.1</td>
<td>13.7</td>
<td>0.291</td>
<td>0.31</td>
</tr>
<tr>
<td>d 0 to 112</td>
<td>11.8&lt;sup&gt;c&lt;/sup&gt;</td>
<td>12.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>13.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.165</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td><strong>Feed efficiency&lt;sup&gt;4&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d 0 to 56</td>
<td>0.147&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.178&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.196&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.008</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>d 57 to 112</td>
<td>0.136</td>
<td>0.139</td>
<td>0.128</td>
<td>0.005</td>
<td>0.31</td>
</tr>
<tr>
<td>d 0 to 112</td>
<td>0.142&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.158&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.161&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.004</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Hip height, in</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d 56</td>
<td>43.7&lt;sup&gt;c&lt;/sup&gt;</td>
<td>44.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>45.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.13</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>d 112</td>
<td>45.8&lt;sup&gt;c&lt;/sup&gt;</td>
<td>46.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>47.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.13</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>

<sup>1</sup>Grain:forage ratio.<br>
<sup>2</sup>Day of study.<br>
<sup>3</sup>Average daily gain.<br>
<sup>4</sup>Feed efficiency expressed as lb of ADG per lb of daily DM intake.<br>
<sup>a,b,c</sup>Means with differing superscripts are significantly different at P ≤ 0.05 level.<br>
<sup>xy</sup>Means tend to differ at 0.10 ≥ P > 0.05 level.
Non-Fiber Carbohydrates in Heifer Diets

Even though previous research found that feeding higher concentrate diets improved gain and feed efficiency, the concentrate portion of the diet may be made up of a wide variety of different ingredients and nutrient compositions. Understanding the best strategies for designing the concentrate portion of the diet could further help to improve the gains and feed efficiency of dairy heifers.

In order to evaluate the effects of the composition of the concentrate portion of the diet on heifer growth, intake, and feed efficiency, studies were conducted to look at the effects of feeding concentrates that were formulated to provide either high or low levels of non-fiber carbohydrates (NFC). In the first study, heifers (averaging 320 lbs and 4.8 months of age at the start of the study) were fed a low NDF diet (LNFC), a high NFC diet (HNFC), and a low NFC diet with added fat (LNFC+) formulated to provide the same amount of Mcals of energy as the HNFC diet.

Heifers fed LNFC+ were heavier on d 56 and d 112 of the study compared to heifers fed LNFC. Heifers on the HNFC diet were intermediate and tended to be lighter on d 56 and d 112 compared to heifers fed LNFC+. Overall, heifers fed LNFC+ gained 19.4 lbs more BW than heifers fed LNFC during the study (P = 0.05). Average daily gain in the first 56 d was 14.9% and 8.9% greater for heifers fed LNFC+ compared to heifers fed LNFC (P < 0.01) or HNFC (P = 0.05), respectively. During the first 56 d, treatment tended to affect feed efficiency (FE), as heifers fed LNFC+ were 12.7% more efficient than heifers fed LNFC and 9.3% more efficient than heifers fed HNFC, with a trend (P = 0.07) towards improved feed efficiency for LFC+ from d 0 to d 112 as compared to HNFC.

During the NFC study, heifers fed LNFC maintained the lowest cost per heifer/d throughout the study as was expected due to the high inclusion rates of by-product feeds. However, feed costs per lb of ADG were lowest for heifers fed LNFC+ compared to HNFC, resulting in a cost savings of $0.12 per lb of gain. However, feed costs per lb of ADG were similar among treatments overall. In our study, a larger proportion of the HNFC diet included
corn and DDGS, resulting in greater costs per ton for the grain mix, especially due to higher corn prices from the 2012 crop year. Paired with increased DMI for heifers fed HNFC, our data suggests that alternative energy sources, such as supplemental fat, may be more cost-effective for feeding growing heifers.

A second study was conducted to evaluate the effect of NFC level in the diets of post-weaned heifers after being started on either a conventional (22:20) or higher plane of nutrition (28:20) milk replacer. One of the goals of this study was to determine if how a calf was raised pre-weaning affects subsequent heifer growth and performance. In this study, animal receiving the HNFC diet had greater weight gain during the growing period from 12 to 28 weeks. Interestingly, when the animals were started on a higher plane of nutrition during the milk feeding period and subsequently fed LNFC diets, their body weight gain was significantly decreased as compared to animals that were started with a convention milk replacer program (Table 4). This study indicates that when calves are started on diets with a higher level of nutrition, maintaining a greater level of nutrition into the growing period may be even more important than when calves are started on a conventional milk feeding program.

### CONCLUSIONS

Using the best feeding strategies for post-weaned dairy heifers allows heifers to continue to meet their growth potential while reducing costs per lb of gain and reducing the overall costs of raising dairy heifers. Numerous recently conducted research studies continue to show the importance of feeding post-weaned heifers quality, grain-based diets as a way to increase growth and improve feed efficiency. Continuing to component feed heifers as they entered the growing phase was found to be advantageous as compared to switching young heifers (~300 lbs) onto a TMR feeding system. In addition, continuing to feed diets containing a higher level of grain and concentrates (60:40 grain to forage ratio) was found to improve ADG and growth, while decreasing the costs per pound of gain. Further research has shown that the nutritional program of calves was found to impact the growth and development of heifers after weaning. Paying close attention to the diets of post-weaned heifers helps to ensure that the diets they are fed are being utilized efficiently and their growth rates are preparing them for breeding at an early age.

### REFERENCES


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Table 4. Weight and skeletal growth responses of dairy heifers and steers at 28 wks of age fed a milk treatment (MILK) of either conventional milk replacer (CONV) or high nutrition plane milk replacer (HIGH) and fed a grower diet (GRWR) of high non-fiber carbohydrate (HNFC) or low NFC (LNFC) post-weaning grower diets from 12 to 28 wk of age.

<table>
<thead>
<tr>
<th>Item</th>
<th>CONV</th>
<th>HIGH</th>
<th>SEM</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HNFC</td>
<td>LNFC</td>
<td>HNFC</td>
<td>LNFC</td>
</tr>
<tr>
<td>BW, lb</td>
<td>516.4a</td>
<td>503.0a</td>
<td>522.1a</td>
<td>494.8a</td>
</tr>
<tr>
<td>28 wk</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADG, lb/d</td>
<td>2.12</td>
<td>2.03</td>
<td>2.14</td>
<td>1.98</td>
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<tr>
<td>0 to 28 wk</td>
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<tr>
<td>Hip height, in</td>
<td>47.6</td>
<td>47.2</td>
<td>47.4</td>
<td>47.3</td>
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<tr>
<td>28 wk</td>
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<tr>
<td>Hip width, in</td>
<td>13.9a</td>
<td>13.9a</td>
<td>14.1a</td>
<td>13.7a</td>
</tr>
</tbody>
</table>

1MILK = effect of pre-weaning milk treatment; GRWR = effect of post-weaning diet; MILK × GRWR = interaction of milk treatment vs. post-weaning diet effects.
2Body weight.
3Weeks of age.
4Average daily gain.
5Means with differing superscripts significantly differ at P ≤ 0.05 level.
6Means with differing superscripts tend to differ at 0.10 ≥ P > 0.05 level.
IMPORTANCE OF PRODUCING A QUALITY DAIRY REPLACEMENT HEIFER

Michael W. Overton, Elanco Animal Health

INTRODUCTION
Dairy replacement heifers, much like dry cows, are often overlooked, undermanaged, and simply viewed as a large source of cost since there is little to no income generated from them until they enter the milking herd. While it is true that replacement heifer programs usually rank as the second or third largest cost of producing milk (trailing only feed costs and perhaps labor), the costs should more properly be viewed as an investment towards the future. Much like any other investment, money is spent up front for a return that will not be realized until much later, i.e., after the heifer calves and enters lactation; and careful attention to the correct kind and approach to this investing can influence the anticipated future returns.

Broadly speaking, there are two basic approaches towards replacement heifer rearing – a conventional, low cost approach and a more intensive feeding and management approach. The conventional approach is founded on the primary principle of keeping costs, especially feed, as low as possible. One means to accomplish this goal is to minimize the amount of liquid feed provided in order to wean calves earlier in the rearing process. Consequently, dairy calves in these conventional systems are often fed limited amounts (usually about 9-10% of body weight or about 3.8 L (4 qt) per day divided into two feedings) of waste milk or a very basic milk replacer, typically about 20% crude protein and 20% crude fat, that is mixed to deliver about 12% solids. Calf starter that is usually fed ad libitum commonly contains 16-18% crude protein on a dry matter basis (Drackley, 2008). This feeding approach encourages earlier and higher levels of starter grain intake, therefore reducing the total amount and cost of liquid feed provided. As expected, this results in a lower daily feed cost but requires a longer total rearing time due to a slower rate of gain in height and weight and a resulting delay in reaching breeding size.

Under thermoneutral conditions, the provision of 0.45 kg (1 lb) of the aforementioned milk replacer powder per day to a typical 88 lb Holstein calf usually yields only about 0.22 kg (0.48 lb) of energy allowable gain or 0.25 kg (0.55 lb) of protein allowable gain (NRC, 2001). If environmental temperatures are lower than thermoneutral, maintenance requirements increase significantly, and this level of feeding fails to support body weight maintenance. As a result, calves fed these traditional diets often suffer from periods of weight loss or stunted growth. Additionally, outbreaks of diarrhea at 7-10 days of age along with increased incidence of preweaning respiratory disease are commonly observed. These health issues are caused (or at least worsened) by a compromised immune system and inadequate caloric and protein intake. A major complicating issue to this conventional feeding approach is the low protein content of the calf starter. The marginal level of calories serves to stimulate earlier and higher levels of starter grain consumption and can allow producers to wean calves at an earlier age, but these calves often fail to grow as desired due to the low metabolizable protein levels.

Assuming that a conventionally reared calf increases its consumption of starter grain and is consuming the identical level of crude protein as a calf on a diet that provides a higher level of milk volume and/or solids, the digestibility of the two diets is not comparable. Milk and milk replacer are generally more digestible than the proteins commonly found in most calf starters. Calves on a conventional diet usually have smaller frames and often have health issues that follow them through the remainder of the growing phase and into lactation. Also, with conventional rearing systems, typical age at first calving is usually between 25 and 27 months and the impact is a large delay in positive cash flow (milk production) and requires a greater number of youngstock to fill the gaps created by culling poor producing animals.

Conversely, the intensive rearing approach achieves higher daily gains preweaning via the provision of a more nutrient dense liquid diet that is usually fed in larger volumes. Increasing the volume provided and increasing the percent solids to feed a more nutrient dense milk offers improved protection against environmental challenges and supports much greater levels of growth as well as reduced morbidity and mortality risks. Milk-fed calves can safely consume 20% of body weight in liquid feed provided it is good quality milk or milk replacer, and the added benefits include greater rates of gain, improved feed efficiency, and reduced risk of typical calfhood disease (Khan et al., 2016; Khan et al., 2012; Khan et al., 2011). This increased rate and efficiency of...
gain continues throughout the rearing period if appropriate diets containing adequate levels of metabolizable protein are provided. Intensive feeding and management programs have received a lot of attention in the last decade or so with a number of studies showing that delivering more nutrients preweaning has been associated with improved health via reduced morbidity and mortality, greater weight and frame growth, earlier age at first service, earlier age at first calving, and increased milk yield during the first lactation (Davis Rincker et al., 2011; Jasper et al., 2002; Moallem et al., 2010; Raeth-Knight et al., 2009; Soberon et al., 2012; Soberon et al., 2013). Consequently, many farms have begun more aggressive nutritional approaches by providing more volume and/or more nutrient dense liquid feed, whether by providing more saleable whole milk, pasteurized waste milk, or higher volumes of milk replacer mixed at higher solids levels. Typical milk replacers used in these intensive programs are 25-28% protein and 15-20% fat and are fed at 12-15% milk solids with a total of 4-10 liters of fluid volume per day, depending upon the size and age of the calf, but pasteurized waste milk or saleable whole milk also work well to improve calf health and growth. Feeding higher levels of nutrients will allow 0.8 – 1.1 kg/d (1.7 to 2.5 lb/d) or more of body weight gain, depending on environmental conditions, volume of milk provided, and on the quality and intake of the calf starter grain mix. In addition, the higher level of nutrients can allow calves to withstand more environmental stressors without resulting in weight loss or spikes in morbidity. Of course, farms often fall somewhere in between a completely conventional approach and a fully intensive one. The most successful programs that have carryover impact well beyond weaning usually feed starter grains, grower grains and subsequent rations that provide higher levels of metabolizable protein without enough extra energy to promote fattening (Corbett, 2010; Soberon et al., 2012; Stamey et al., 2012; Van Amburgh et al., 2008, 2009; Van Amburgh et al., 2011).

A strong positive relationship between preweaning daily gain and first lactation milk production has been shown by a variety of researchers, specifically when the focus was on frame growth and not simply body weight change (Bach et al., 2008; Sadek et al., 2014; Soberon et al., 2012; Soberon et al., 2013; Van Amburgh et al., 2008, 2009; Van Amburgh et al., 2011). Generally, the relationship between preweaning gain and first lactation performance has been in the range of 850-1551 kg more first lactation milk for every 1 kg of preweaning average daily gain. When examining these impacts of improved nutritional management, there is confusion over how much of the associated impact is a direct consequence of the potential epigenetic effects of improved nutrition and how much is due to the reduction in calfhood disease challenges. Preweaning bovine respiratory disease (BRD) has been shown to have significant long-term costs including increased mortality, increased treatment costs, decreased rate of gain, delayed time to first calving, greater culling risk prior to first calving, and lower likelihood of survival through the first lactation (Bach, 2011; Donovan et al., 1998; Stanton et al., 2012; Waltner-Toews et al., 1986). The true effect of preweaning BRD on first lactation production is likely greatly underestimated due to survivorship bias (affected animals more likely to be culled prior to first calving) and the inconsistent detection, treatment and underreporting of BRD in many commercial dairy operations.

**PROJECT DESCRIPTION AND RESULTS**

The objective of this project was to examine commercial dairy data to evaluate the potential association between preweaning weight gain as recorded in the on-farm record system (DairyComp305) and performance of both heifers and first lactation animals, while controlling for a variety of potential confounders including genetics, season, and herd. In order to complete this task, herds had to have recorded birth weights, postweaning weights, genetic values (predicted transmitting ability or PTAM, in this case) and disease information (pneumonia and scours events) for animals that had already calved and entered lactation. Many herds have begun recording heifer growth information, but very few have been doing it long enough to generate lactation information, and fewer still have the full historical growth information and all of the other requirements for this retrospective analysis. Two herds were identified that met the above criteria. One herd was from the upper Midwest and one herd was from the West. Both herds milk Holsteins with a few crossbreds or Jerseys present, but only the Holsteins were used in this project. Pneumonia and scours were defined and recorded in each herd and the average incidence was 13 and 41%, respectively.

Birth dates for animals used in this project ranged from December 1, 2012 through December 1, 2013. A total of 3043 Holstein heifers were in the initial data extraction. The DairyComp305 data were imported into a spreadsheet and then moved into a statistical package for analyses (JMP 12.1.0). Birthweights (BWT) ranged from 52-133 lb with a mean of 84 lb. For both dairies, the majority of weights captured after birth were for ages 73-109 days. DairyComp305
software takes the recorded weight and reports an adjusted weight and an adjusted current daily gain for the period in question, in this case, 3 month age adjusted weights and 3 month calculated daily gains, hereafter referred to as WT3M and CDG3, respectively. The WT3M ranged from 141-335 with a mean of 227, and the CDG3 ranged from 0.7-2.39 with a mean of 1.56. Categorical variables, Early Pneumonia and Early Scours, were created based upon the presence or absence of pneumonia or scours occurring within the first 70 days of age. Birth month and calving month were used to create Season of Birth and Season of Calving variables where Dec, Jan and Feb = Winter; March, April and May = Spring; June, July and August = Summer; and Sept, Oct, and Nov = Fall.

The first step was to create multivariate regression models to fit least square means to examine the relationship between a number of variables and either WT3M or CDG3. Variables that might be biologically important were offered to the model as well as relevant two-way interactions. Due to the potential impact of both light birth weight and very large birth weights, BWT was also added as a squared term. Herd, Early Pneumonia, Early Scours, BWT, BWT², PTAM, and Season of Birth were each significantly associated with both WT3M and CDG3, as was the interaction of Herd x Season Born. Adjusting for the effects of the other significant variables in the model, Early Pneumonia and Early Scours were associated with 12.7 and 3.1 lb less WT3M and 0.14 and 0.034 lb less CDG3, respectively. The interaction of Herd x Season was significant most likely due to the vastly different environment of each herd with one located in a very cold climate and one in an area with greater heat stress issues.

A Cox Proportional Hazards model was created to examine the relationship between the same previously mentioned variables and time to pregnancy for the nulliparous animals. Across the two herds, neither WT3M or CDG3 was significantly associated with time to pregnancy. The only significant variables were BWT, BWT², Herd, Season Born, and the interaction of Herd x Season Born.

A Cox Proportional Hazards model was also created to examine the association between biologically relevant variables and time to culling prior to first calving. Early Pneumonia, CDG3 and Season Born were all significantly associated with time to removal. Heifers that experienced Early Pneumonia were 2.8 X more likely to be culled as compared to those heifers that did not. Heifers born during the Summer or Fall were 2.3 and 2.4 X more likely to be culled as compared to those born during the
winter. A higher CDG3 was actually protective against culling. To examine the relationships between preweaning performance and first lactation production, a multivariate regression model was built using plausible biological or management variables and first lactation projected 305ME milk production. Season Born, BWT, Early Pneumonia, Age at first Calving (AGEFR), AGEFR², Season Calved, CDG3, PTAM, Herd and Herd x Season Born were all significantly associated with Projected 305ME milk production, but Early Scours was not. Adjusting statistically for each of the aforementioned variables, Early Pneumonia was associated with 649 lb less 305ME milk and each additional lb of CDG3 was associated with 1728 lb more Projected 305ME milk in the first lactation. Since the expected range of CDG3 is relatively small, perhaps a more useful interpretation is that each additional 0.1 lb of CDG3 was associated with 173 lb more Projected 305ME milk in first lactation. Similar to before, a Cox Proportional Hazards model was created to examine the association between biologically relevant variables and time to culling following first calving. Culling was followed only until 150 DIM since many of the cows had calved during mid to late 2015. The only variables that were significantly associated with time to culling within the first 150 DIM were Herd and Projected 305ME milk, which was protective. There was a tendency for an association between Early Pneumonia and culling (p=0.09). Calves that experienced Early Pneumonia as a calf were 1.4X more likely to be culled by 150 DIM, but the p-value did not quite meet the selected 0.05 threshold used in this analysis.

CONCLUSION

As previously described, the management of young calves is strongly associated with future productivity well into and beyond the first lactation. In this retrospective evaluation, the associations and interactions between key biological and management variables were examined using a convenience sampling of two commercial dairy herds. The presence of Early Pneumonia was associated with 12.7 lb less WT3M, 0.14 lb less CDG3, a 2.8X higher risk of being culled prior to 600 days of age, and 649 lb less Projected 305ME milk production during the first lactation. There was also a tendency for a 1.4X increased risk of culling from calving to 150 DIM. Early Scours was also associated with losses but much less so than with Early Pneumonia. Early Scours was associated with 3.1 lb less WT3M and 0.034 lb less CDG3 but no quantifiable impact on culling or reproductive performance nor with first lactation milk production. As expected, PTAM was significantly associated with milk production during the first lactation, but this genetic prediction was also positively associated with both WT3M and CDG3. Similarly to the published results, rate of gain during the early growth period was positively associated with first lactation milk production, even after adjusting for the impact of PTAM and other variables. Each additional lb of CDG3 was associated with 1728 lb more Projected 305ME milk in the first lactation, while adjusting for genetics (PTAM), Herd, Season, Early Pneumonia, Early Scours, and other important variables. The consistency of this finding relative to the published estimates is very significant and should provide additional confidence that excellent management coupled with good genetics is key to achieving higher levels of productivity and lowering disease risk.

The impact of both Early Pneumonia and Early Scours was less than expected. Prior unpublished analyses by the author has identified larger impacts of these two diseases on early growth and culling. The reasons for the lower impact identified here are unknown but are likely related to the definition used on each farm, the detection approach employed, the completeness of the record system, therapeutic approach used, and on overall farm management factors. In general, underreporting of any disease usually leads to an underestimation of its impact due to misclassification of affected animals in the “non-affected” group. The best approach to correct for this problem would be to conduct a long term prospective study with careful screening for disease by trained staff. However, much improved information could be gleaned from herds such as the two used in this project if time was taken to carefully define each disease, thoroughly train each employee working with the heifers, and then to consistently record all disease information. With improved records such as this, more accurate and complete evaluation of the impact of disease on livestock would be possible.

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OPPORTUNITIES AND CHALLENGES IN HEIFER REPRODUCTION AND MONITORING

Michael W. Overton, Elanco Animal Health

One of the largest contributors to the cost of production on a dairy, usually ranking behind only feed and sometimes labor, is the replacement heifer program. Considerable time, effort and expense is incurred to produce sufficient replacement heifers to meet a dairy’s needs. While costly, the expense associated with feeding and rearing heifers should be more properly viewed as an investment towards the future, and bringing replacement heifers into the herd at an earlier age, yet well grown and free of lingering disease issues, helps to secure a greater return. There are three key drivers for achieving a more efficient and profitable earlier age at first calving: nutritional management, health management, and reproductive management. This paper will describe some opportunities to improve performance and offer a few suggestions on how to better monitor the process and performance.

Nutritional management is the cornerstone for a successful replacement heifer program. Proper nutrition is key to achieving the most optimal rates of growth and also helps to reduce the risk of disease by enhancing the immune system and reducing nutrition-related stresses. For a dairy replacement heifer, proper nutrition begins with the timely and appropriate administration of colostrum. For a typical Holstein heifer, four quarts fed as soon as possible following birth is likely to provide sufficient levels of immunoglobulins (Godden, 2008). Alternatively, some provide 3 quarts immediately after birth and another 3 quarts within 12 h for an even greater level of risk reduction and improved nutritional support. But, the value of colostrum goes well beyond the immunoglobulins provided by the calf. Colostrum contains higher protein, fat, vitamins and minerals than milk and is in an easier form to digest as well.

Classically, calves have been intentionally underfed or at least limit fed milk or milk replacer in an attempt to lower cost and promote a more rapid transition from liquid diet to a grain-based diet. However, this approach has often led to issues with gastrointestinal disease, respiratory disease, and less than optimal rates of gain or even stunted growth. There is also greater risk of disease in this conventional feeding approach, especially during periods of environmental stress such as cold, wet weather due to the greater maintenance requirements that are present.

Alternatively, higher daily gains are possible preweaning via the provision of a more nutrient dense liquid diet that is usually fed in larger volumes. Increasing the volume provided and increasing the percent solids to provide a more nutrient dense milk offers improved protection against environmental challenges and supports much greater levels of growth as well as reduced morbidity and mortality risks. Milk-fed calves can safely consume 20% of body weight in liquid feed provided it is good quality milk or milk replacer. The added benefits include greater rates of gain, improved feed efficiency, and reduced risk of typical calfhood disease (Khan et al., 2016; Khan et al., 2012; Khan et al., 2011). When also provided with a highly digestible starter grain containing 20-24% crude protein on a dry matter basis and weaned in a progressive manner, high rates of gain with lower risks of neonatal disease challenges and stunted growth is possible.

This more intensive feeding approach should be continued throughout the entire rearing program for optimal results. Feeding rations postweaning that achieve a greater protein-allowable growth than energy-allowable growth helps to promote greater lean tissue accretion, improved frame growth, and less risk for excessive body condition. Modeling work by the author has demonstrated that this feeding approach costs more per day but results in significantly fewer total days on feed, less total feed consumed over the heifer’s growth and development, and actually results in a lower total cost of production (Overton et al., 2012).

Another critical component for achieving more efficient, profitable and earlier age at first calving is health management and monitoring. Health management is a very broad term, but for the purposes of this paper refers to the appropriate housing, vaccination, therapeutic strategies, and culling decisions for replacement heifers. “Appropriate” housing depends on the geographic location in which the heifers are reared and the prevailing weather conditions, but at a minimum, should provide a clean, dry area for animals to lie upon, provide ample access to a balanced diet and clean, readily available water,
and allow animals to move about freely without undue stress. Along with the provision of appropriate housing is the need for the administration of the proper vaccines at the correct time. This will provide the desired level of acquired immunity to help diminish the risk of morbidity and mortality. There is not a universally appropriate vaccination protocol that fits the needs of all heifers. Instead, each farm manager/owner should work with his or her own veterinary consultant to customize a protocol specifically for the needs of the individual farm.

Similarly, each farm should have predefined treatment protocols designed in collaboration with the veterinarian. The protocols should be developed for specific disease issues that have been clearly defined so that everyone working with the animals on that farm has a clear understanding of what each disease represents and its most appropriate therapeutic option.

An essential component of health management that is frequently overlooked is the area of culling management. Dairy managers rarely consider the economic impact of rearing poorly performing heifers or the risk that heifer diseases create for very poor lactation and early removal. Prevention of disease is the absolute best approach. Once an animal has developed lung damage due to bovine respiratory disease and has experienced stunted growth and development, much of the potential future productivity value of that animal has already been lost. The best decision may be to promptly cull such an animal instead of continuing to invest more time, effort and resources into its rearing and development.

A key component of replacement heifer management is the monitoring of both disease and growth and recording this information into the on-farm record system on an individual animal basis. Frequently, producers estimate the birth weight and then weigh trailer loads of heifers while moving them from one pen to another. While this approach can provide some basic information regarding how the group has performed, it actually provides very little useful information upon which individual animal decisions can be made. For example, the average birth weight of Holstein heifers tends to be about 84-90 lb. The standard deviation for birth weight may be 10 lb or more. If a herd used 86 lb as the estimated mean, with a standard deviation of 10 lb, this estimate would be expected to represent, within a range of +/- 10 lb, the birth weight for 68% of the population. What about the remaining 32%? How can one even begin to detect any impact of pneumonia or scours on weaning weight? Based on modeling work by the author, pneumonia likely impacts the adjusted weaning weight by 10-15 lb or more after adjusting for other variables. Imagine for a moment a group’s mean weaning weight is 195 lb. The standard deviation of this weight may be 20 lb. If we take the birth weight range of 76 to 96 lb and subtract it from the weaning weight range of 175-215 lb (expected for 68% of the population), what information can truly be gleaned from this result? The potential expected impact of a disease such as scours or pneumonia is completely lost in the variation that is part of the reported group mean; there is too much variation to truly gather any reliable information relative to how disease might be impacting performance or whether a feeding change has truly had any effect. The monitoring of growth at the individual animal level can help to identify hiccups in the feeding and/or management approach that can be corrected earlier in the process. Monitoring can also help identify individual heifers with lower than expected performance to date that might be considered at risk for poor lactation performance in the future.

In setting up a health and growth monitoring program, there are a few critical time points and disease events for consideration. Throughout the following description of times for data recording, though not explicitly stated, animal height should be recorded as well as weight to ensure not only that animals are gaining total body mass at an acceptable rate but that frame is increasing as desired as well. First, the individual birth weight should be recorded for each calf. Next, an adjusted weaning weight, representing a weight at approximately 60 d of age is important to be able to assess preweaning growth. Almost equally important would be the gain from 60 d until 3-4 months in order to assess how well calves are performing immediately postweaning. Ideally, another data point to capture would be a prebreeding measurement at 10-12 months of age followed by a weight at the time of entry into the springer pen. With these multiple data points, estimated current daily gain between each time point can be calculated to assess individual animal growth.

From a disease perspective, the two critical events that should be consistently defined, detected and recorded are respiratory disease and scours, along with the treatment protocol used for each. From this information, the cumulative incidence for each disease, disease risk by age category, time to first event, and number of total cases per animal can be calculated. Consistent disease recording can help detect trends in disease risk and can be used to help identify animals that should be considered for culling.

The final critical component for achieving a more efficient and profitable
earlier age at first calving is reproductive management. The time from birth until entry into the breeding pen is dependent on the feeding, housing and general management. All of these areas could be excellent and still result in less than optimal age at first calving if reproductive management is not excellent. Once an animal becomes pregnant, her remaining time in the replacement program is now set. Thus, it is critical to present animals for breeding management at the appropriate size and age, to manage the reproductive program to achieve a high 21-d pregnancy rate, and then to continue the nutritional management to facilitate the ongoing growth and development necessary to produce a high quality heifer at first calving.

There are a variety of reproductive management approaches including estrus detection based breeding programs, programs that rely heavily on timed AI (TAI), and natural service. Natural service should be discourage from use, especially in virgin heifers since these animals represent the most current, highest level of genetic potential and due to the increased concern of dystocia. From an AI perspective, heifer programs are usually managed either via direct observation of estrus or by use of estrus detection aids such as tailhead paint, Kamars, or other heatmount detection devices. Activity systems may be used as well, but due to the relative ease of detection estrus in heifers, these are less frequently used. One inexpensive technology that is often overlooked is the use of prostaglandin (PGF2α) injections to aid in the synchronization of estrus. One common and very successful approach is to administer a dose to each heifer as she enters the breeding pen. Evaluate for estrus expression for the next 1-2 weeks and repeat the injection for any animal not yet observed and inseminated.

Another approach that could be used either at the initiation of the breeding period or as a safety net for those not yet inseminated following two injections of PGF2α is a TAI protocol. A traditional Ovsynch program can work on virgin heifers but is not advised due to the following factors: heifers have a faster rate of follicular growth than lactating cows, heifers are more likely to have three-wave follicular cycles, and heifers are less likely to ovulate a dominant follicle in response to the first GnRH (Pursley et al., 1997; Sartori et al., 2004). Instead, a modification of the traditional Ovsynch program has most often been recommended for virgin heifers with expected pregnancy per AI of approximately 50-60% (Bridges et al., 2008;
Lima et al., 2011; Lima et al., 2013; Silva et al., 2015). This program has several slight variations but the most successful approach utilizes an IM injection of GnRH and the placement of a CIDR device intravaginally. In five days, the CIDR is removed and an injection of PGF2α is administered. Twenty-four h later, a second PGF2α is administered. After 48 h, another injection of GnRH is administered and the heifer is inseminated at the same time (Lima et al., 2013). This TAI approach has been shown to reduce the median days to pregnancy, to increase the proportion of pregnant heifers by d-84 of the study, and to be more advantageous economically as compared to a traditional estrus detection based program (Silva et al., 2015).

In general, there are a few major points to be followed to achieve optimal reproductive performance in dairy replacement heifers. Heifers should be moved into the breeding pens weekly, once reaching the appropriate height/weight/age. How early heifers achieve the desired size and age is largely a function of the feeding and care delivered to them as calves and growing heifers, and the management preferences of the farm. For Holstein heifers, 850 lb by 11-12 months of age is very achievable. Once heifers are in the breeding pens, exceptional estrus detection and/or the use of TAI protocols can help to drive a high insemination risk. Finally, the heifer group should be evaluated for pregnancy frequently and as early as the attending veterinarian is comfortable with making the diagnosis. Usually, on larger farms, heifer pens are checked weekly beginning at 28-35 d depending on the diagnostic approach preferred. The key is to promptly identify non-pregnant heifers and then to re-enroll them back into a PGF2α-based program or a TAI program to efficiently deliver the next service. Also important is to move pregnant heifers out of the breeding pens to reduce the issues caused by maintaining high stocking densities.

In summary, properly run replacement heifer programs offer tremendous opportunity to improve growth rates, decrease morbidity and mortality and to improve future milk production potential while simultaneously achieving an earlier, more cost effective age at first calving. Appropriate monitoring includes growth, morbidity, mortality and reproduction, all on an individual heifer basis in order to improve the decision making value of the data. Heifer reproductive management is often a hidden economic opportunity and is a key component to getting the full benefit from an intensive heifer rearing program.

REFERENCES
**TMR AUDITS FOR IMPROVED FEEDING MANAGEMENT AND PROFITS**

**Thomas J. Oelberg,** Dairy Field Technical Specialist, Diamond V

**SUMMARY**

The goals of a heifer-feeding program are to raise healthy heifers to calve at 22 to 24 months of age and to have the heifers consistent in body weight and size. One of the keys to raising consistent heifers is to have the nutrition to be the same for every bite, every heifer and every day. Total mixed rations (TMR) are formulated to contain a combination of feedstuffs that provide the right balance of nutrients in every bite taken by an heifer. Poorly mixed TMRs negatively impact animal performance and health. A system has been developed to monitor how well the feedstuffs are blended and delivered to the feed bunk. This system is called the TMR Audit(1). There are eleven factors in the TMR mixing process that each can create variation in the TMR before it is delivered to the feed bunk. Time-lapsed game cameras are utilized to evaluate animal access to the TMR and feed push up routines.

**TMR AUDIT**

The TMR Audit(1) was first introduced in 2008 and has been a very effective tool in reducing variation in TMRs, reducing fuel, labor and feed loss due to shrink. Most recently the audit has used time-lapsed game cameras to help evaluate feed bunk management. This manuscript will focus on the ten mixing factors that cause variation in TMR particle size and on key learnings from time-lapsed video of feed bunks.

**THE ELEVEN FACTORS DURING TMR LOADING AND MIXING THAT CAUSE VARIATION**

There are ten factors in the TMR loading and mixing process that can contribute to TMR variation individually or in combination. Each of these will be discussed in detail. They are:

1. Worn mixer augers, kicker plates and knives
2. Auger timing in mixers
3. Un-level mixers
4. Mix time after the last added ingredient
5. Loading position on the mixer box
6. Load size
7. Hay quality and processing
8. Loading sequence
9. Liquid distribution
10. Vertical mixer auger speed
11. Forage restrictor settings on vertical mixers

**MIXER WEAR AND TIMING OF AUGERS**

TMR particle size consistency as well as moisture and nutrient consistency along the feed bunk (TMR mix quality) can decrease significantly with worn blades, kicker plates and augers (1). The easiest way to evaluate wear on augers is to look for feed under horizontal augers or reels and to look for the feed ring inside vertical mixers. The mixing efficiency on vertical auger mixers depends on the condition of the edge on the auger flighting and on the condition of the kicker plate, shoe or deflector. The edge of the flighting should not have rounded corners. The degree and speed of wear on the augers, kicker plates and knives depends on the size of the feedlot and the amounts of hay, baleage or straw fed. Routine replacement of blades, kicker plates and augers are required to keep TMRs consistent.

**AUGER TIMING**

Make sure both horizontal and vertical augers are properly timed according to manufacturer’s handbook. The easiest way to check for proper timing on vertical mixers is to watch and make sure the kicker plates do not meet in the same location at the same time in twin- or triple-auger pull-type mixers. However, this does not apply for truck-mount twin-auger mixers as most are hydraulic driven. Pull-type vertical mixers with automatic transmissions will also have timed augers. Horizontal mixer augers have timing marks that need to be set properly before the drive chain is attached to all augers.
UN-LEVEL MIXERS

Un-level mixers cause migration of the heaviest and most dense materials in the TMR to the lowest section of the mixer wagon. Figure 1 shows a shaker box analysis of ten samples taken from a triple-auger vertical that was parked in a ramp that was too short causing the grain-concentrate portion of the TMR to migrate to the back of the mixer box. Notice how the levels in the bottom screen increase from sample 1 (front) to sample 10 (back) and the opposite trend can be observed for the middle screen which would have less dense feedstuffs such as haylage, corn silage and small particles of hay. This is a very typical pattern in the Penn State particle separator analysis for both un-level mixer boxes and for improper loading position on vertical wagons.

LOADING POSITION ON THE MIXER BOX

Loading position on the mixer box refers to the location on the mixer box where the feeder is dumping ingredients in. Improper loading position on the mixer box will create a poorly mixed TMR (1). Figure 2 shows the influence of loading a liquid protein supplement in the back of a dual-auger vertical wagon on moisture and protein levels in the TMR. Both moisture and protein increase linearly as you move from front to back of the wagon. This resulted in a very inconsistent TMR along the feed bunk. Because cows are quite territorial within the pen, not all cows will get the same nutrition nor will they get the same effective particle size. This leads to differences in rumen health and digestion, rumination patterns and manure consistency among cows within the pen fed this ration. Most dual-auger and triple auger vertical wagons move feed back and forth in the wagon, but it takes time. These results show that feed dumped in either end of these wagons does not get completely mixed during routine mixing. If mixing time is increased so that the TMR is completely mixed then there is increased risk of decreasing effective particle size in the TMR. The increased mixing time would also increase fuel and labor cost. It best to load the mixers at the proper position.

MIX TIME AFTER THE LAST ADDED INGREDIENT

One of the most common mistakes in TMR mixing is lack of mix time after the last added ingredient (usually corn silage or liquid supplement) (1). Often times the corn silage at the top of the load does not get mixed and is delivered towards the end of the load as pure corn silage. This is even more prevalent as mixer boxes are over-filled. Suggested mix times after the last ingredient with tractors/trucks at nearly full power (1700 to 2000 rpm engine speed) are 2 to 5 minutes. Inadequate mix times resulted in an inconsistent TMR (Table 1) comparing 3.5 versus 5 minutes of mix time in a 4-auger horizontal mixer on coefficients of variation for the average levels observed in the shaker box screens.

LOAD SIZE

Over-filling

Over-filling the load capacity can occur on all types of mixer wagons resulting in poor mix quality of the TMR (1). It is a very common mistake in TMR mixing on many dairies and feedlots. Overfilling occurs for several reasons:

- Under sizing the mixer box for the dairy
- In-accurate pen counts
- Changes in forage moisture levels, i.e. drier silages take up more space
- Too large of an increase in bunk calls where the mixer box is already at full capacity

Reducing the load size in a 4-auger mixer by 5000 pounds decreased the coefficient of variation (table 2) of the average levels of TMR in all three trays of the Penn State Particle Separator and improved TMR mix quality.

Under filling vertical mixers

Under filling of vertical mixers occurs when the TMR does not reach the top of the augers so that all of the ingredients are pushed off the augers and mixed. This happens often on many dairies that are mixing for small pens such as close-up dry and fresh pens (1).

HAY QUALITY AND PROCESSING

Poor hay quality and inadequate processing make TMRs very inconsistent and can affect both variation and level of milk components in a herd. Clumps of hay and straw in TMR indicates poor processing and mixing of the forage which leads to poor rumen health and growth performance of heifers. Most feedlots and dairies pre-process the hay before mixing into a TMR. This drastically reduces TMR mixing
time, improves loading accuracy of the hay and improves consistency TMR. Hay particle length should be the width of a heifer’s mouth and straw should be processed to 1.5 to 2 inches to prevent sorting.

LOADING SEQUENCE
Generally, lower density and large particle feeds are loaded first, followed by dry more dense feeds followed by wet feeds and last with liquid. One exception to loading liquids last is liquid molasses. Of the dry more dense feeds, the lower-inclusion level feeds are added first so that they can be blended properly(2). Use the ratio of 50:1 to blend lower inclusion dry feeds such as rumen by-pass fats and vitamin/mineral premixes(2). Example, if 50 lb. of rumen by-pass fat is being added, then the load size should be no more than 2500 lb. The mixer should be running to allow the lower inclusion feed to mix. TMR mix quality was improved dramatically by increasing mix time after the last added ingredient from 2 to 4 minutes and then changing mix order to further improve the mix quality.(Figure 3).

LIQUID DISTRIBUTION
Liquids such as water, whey and cane molasses are routinely added to TMR to add moisture, sugar or are used as a carrier for micro ingredients. Another important reason liquids are added to the TMR is to help reduce sorting by cattle. The liquids, especially cane molasses and liquid whey are sticky and they help bind the smaller particles to the larger forage particles. As a result, the levels of on the bottom pan of the Penn State shaker box will shift to the middle and top screens by as much 5 to 7 percentage units depending on type and level of liquid added directly to the TMR.

Except for liquid molasses, it is best to add water and liquid whey last to the TMR to prevent any balling or clumping of the drier ingredients (2). The best method of adding liquid molasses to a TMR is adding it first to an on-farm premix and then add the premix to the TMR. If loading liquid molasses directly to a TMR, add it to the dry ingredients in the beginning of the loading process and be sure to have augers turning at high rotational speed. The goal is to avoid feed balls with the molasses and avoid dumping the molasses directly on the metal mixer parts. There are two challenges of adding liquid directly to the TMR, time and distribution. Depending on the amount of liquid added to the TMR and the sizes of the pumps and pipes to load the liquid, the amount of time it takes to add liquid can range from 2 to 10 minutes per load and sometimes even longer. This can create a bottleneck in getting cattle fed on time for larger operations. Many dairy operations are adding the liquid to the on-farm commodity blend(1). Improper distribution of the liquid can make the TMR very inconsistent along the feed bunk(1).

VERTICAL MIXER AUGER SPEED
The influence vertical auger speed on TMR mix quality and apparent improvement in dairy cattle performance has been documented in a case study (1). Improved milk and energy-corrected milk (Figure 4) were associated with improved TMR mix quality after vertical auger speed was increased with proper engine speed and mixer gear box setting. Vertical auger speeds are based on tractor pto standard speed of 1000 rpm. A list of various brands of TMR mixers with suggested augers speeds are shown in table 4. When in doubt on correct auger speed, use the TMR Audit sampling and Penn State Particle Separator procedures to determine if TMR mix quality standards have been met with a given auger speed.

FORAGE RESTRICTOR SETTINGS
Most brands of vertical mixer have forage restrictors mounted on the side of the mixer box. The forage restrictors, when properly set, improve hay processing without impeding TMR mix quality. If the forage restrictors are moved too far into the mixer box, mixing can be impeded resulting in a poorly mixed TMR (table 3).

MONITORING FEED BUNKS WITH TIME-LAPSE CAMERAS
Time-lapse game cameras set to record photos of feed bunks of lactating and dry cows every 5 seconds for several consecutive days have shown the following:
  • There are cows at the feed bunk at all hours of the day
  • Cows are often out of feed for 4 to 7 hours mostly during the time from 10 pm to 4 am
  • Uneven TMR delivery along the bunk often
results in partially empty bunks

- There is no efficient way to re-distribute feed along the feed bunk even in J-bunks that run partially empty during the early morning hours
- Level of feed push out is a poor indicator of feed access
- More frequent push up of feed has improved performance on many dairies where cattle had limited access to feed
- Robots are an effective tool to push up feed on a routine basis
- Shifting feed deliveries to later in the day allows more feed in bunks during the early morning hours when there is less labor to watch the bunks and to push up feed

CONCLUSIONS

An on-farm system to test TMR consistency along the feed bunk and to evaluate mixer performance has been developed. Implementation of this system has improved TMR consistency on many dairies across the U.S. The standard for TMR particle size consistency determined on 10 samples is 2.5% or less coefficient of variation for the average levels on middle and bottom screens of the Penn State Particle Separator. Frequent feed push is a critical part of a good feeding management program.

REFERENCES


TABLES
FIGURES

Figure 1. Influence of un-level mixer box on TMR particle size distribution on the Penn State Shaker box screens.

Figure 3. Influencing of mixing time after the last added ingredient and loading sequence on TMR variation.

Average, % | CV, %
--- | ---
Top | Middle | Bottom
Mixing Time | 6.7 | 82.8 | 37.9 | 14.2
Loading Sequence | 4.7 | 57.4 | 38.0 | 6.2
Normal | 4.4 | 32.2 | 38.4 | 3.1

Figure 2. The influence of loading a liquid protein supplement in the back of a dual-auger wagon on moisture and crude protein levels in the TMR.

Figure 4. Influence of vertical mixer auger speed on TMR mix quality and milk production.
ANIMAL WELFARE: WADING THROUGH THE CONTROVERSY

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The evaluation of welfare involves both individual and groups of animals by measuring their behavior (natural versus abnormal), changes in physiology (hormonal responses to stress), health parameters (disease, injury, pain), and productivity (milk production, growth rates, reproductive rates). Independently, these parameters have limited or may have a biased representation of the issue. The AVMA defines animal welfare as how an animal is coping with the conditions in which it lives. It further states that protecting an animal’s welfare means providing for its physical and mental needs, by providing diseases prevention, veterinary treatment, shelter, management, nutrition and humane handling/slaughter.

Discussing animal welfare can lead to an antagonistic debate between people with various perceptions of animal use. It is important to understand the difference between animal welfare and animal rights. Proponents of animal welfare are those who seek to improve treatment and well-being of animals. This segment believe that humans can interact with animals in entertainment, industry, sport, recreation, but that interaction should also include providing responsible care. This group is more prone to utilize scientific evidence to base animal care and handling guidelines. Whereas animal rights advocates have the philosophical view that animals have rights similar to or the same as humans. This group believes that humans do not have the right to use animals at all and wish to ban all use of animals by humans. People with this mind-set do not want scientific justification for how animals are raised or used.

Ultimately, no one wants to see animals abused or hurt. Welfare proponents have provided some good guidelines to defend basic animal care. Some of these defend our production practices (dehorning), and some of these make us question our production practices (tail docking). Many interactions between people and animals occur in dairy production. Aversive handling at young age can create problems for that heifer throughout its life cycle on a dairy. Negative experiences with human caretakers can establish fear in animals, making them more difficult to handle. This will be intensified as the heifer grows to the age of calving and lactation.
where she will be expected to go through a parlor at least twice each
day. Increasing the gentle handling of younger animals has been
shown to decrease their fear of humans. Dr. Temple Grandin has
long advocated that one of the primary factors in determining how
animals are treated is the attitude of the caretaker. Caretaker training
can improve the skills, as well as the attitudes, of animal handlers
and thus reduce the reactionary fear in animals they are handling.
Food companies are being challenged to address consumer concern
of how animals are treated on-farm. This issue is being pushed back up
the food chain to the supplier and, ultimately, to the producer. Many
farms looking to their future are developing animal care programs to
socially defend their production practices to their neighbors, their
community, and their consumers. They are very concerned about
being the next social video. While some of the activist videos may
misrepresent production practices, some of these have exposed
major problems. The majority of problems seen have been around
animal handling (use of prods, tail twisting), untreated lameness,
calf processing procedures (handling, dehorning, castration), and
non-ambulatory care and handling. From all of these videos, there
appears to be a serious disconnect between management intentions
(Standard Operating Procedures) and daily employee actions.
Root cause analyses from many of these videos traces back to the
training program of caretakers. Often times, there simply isn’t one.
Caretaker training programs need to convey (1) the protocol details
(tasks), (2) the risks of not using the protocol, and (3) management’s
commitment to animal welfare. Animal welfare is truly dependent on
the owner’s values and attitudes; it is not related to size of facility, as
social media tends to portray. The main goal of any on-farm animal
welfare program should be to create team behavior, so working
together to resolve problem situations (non-ambulatory animals,
etc.) is the norm. This goes far toward reducing the potential for
animal abuse. Welfare is a truly a combination of facilities and people.
There are many areas around a dairy that should challenge us to
review how animals naturally behave. Great strides have been made
in our knowledge of cow comfort in dairy housing: whether it is our
understanding the cows’ need for adequate space (to allow natural
behavior in resting and rising) or her desire to lie on well-bedded
surfaces and stand on soft floors. Best management practices have
also supported her desire to drink after being milked, and thus the
provision of water troughs at the parlor exit were recommended.
Like any management strategy, creating an animal welfare program
is not going to be a one-time effort and writing the final draft. This
is an on-going process that involves refining daily tasks toward
best animal care. There is usually a better way of doing things, so
continual review and improvement should be the driving energy
behind all programs. The primary resource needed to implement
an animal welfare program is management commitment - not
any different than any other successful business endeavor.
Science alone will not prevail. Food companies and farms are
feeling more and more pressure to provide proof they are actually
doing what they say they are doing. On-farm audits can provide
third-party verification of production practices for consumers.
Additionally, regular audits can provide feedback to management
that what they WANT done is actually BEING done. This can give
a manager an evaluation of procedural drift that may be occurring
and allow them to alter their training to address the drift. A common
misconception is that welfare audits dictate the management of the
farm; this is not true. However, they do set acceptable outcomes of
farm management, such as the percentage of acceptable lameness,
thin cows, dirty cows, etc. Animal welfare audits should verify
that animals are cared for properly, to contemporary standards,
but allow management will meet each standard in its own way.
All animal welfare programs should be based on continual
improvement, not on punishment, to encourage producer
advancement in animal care. But to truly engage the industry,
there needs to be an incentive for the producer to improve. For
many producers in the industry, the incentive may be pride in their
operation and their reputation. For other, the incentive may be
their market has put a condition on their selling their product.
Differentiating between evaluations and audits involves the verification
process and the subsequent follow-up action. The value of third-
party audits is that they provide more credence to the farm program
in that the auditor is not financially vested in the farm and whether it
passes or not. Additionally, there are a follow-up process for non-
conformances to ensure continual improvement. An audit involves
verification of parameters to the extent the auditor is comfortable
that what is said is actually happening. For example: The herd health
plan states that all animals are observed once daily and any animal
suspicious of health complications is pulled for further evaluation.
Verification for this could include: (1) viewing the Standard Operating
Protocol, (2) asking employees about the protocol, (3) observing
throughout the herd if there are any animals that need attention, (4)
looking at animals in the hospital for the severity of their illness, or (5) reviewing hospital records for length of stay. An auditor should use several types of verification to support their conclusion. Just one of the above observations may not give an accurate representation of how the process works on a regular basis. The intent behind the original question is whether animals are looked at on a daily basis for abnormalities AND that abnormalities are given review and treatment on a timely basis.

Whether an evaluation or an audit, any and all aspects of the farm where livestock pass through are to be viewed. This encompasses the calf barn, the milking parlor, the hospital, loading areas, and all housing types.

COMPONENTS OF ANIMAL WELFARE PROGRAMS/AUDITS

Standard Operating Procedures. Basic SOPs should be developed for all major stations across the dairy: maternity, calf care, milking, herd health, hospital/non-ambulatory, foot health program, and euthanasia. Additional SOPs that traverse the dairy may include employee training, facility maintenance, animal handling and transportation, and records. This is not an exhaustive list, but hopefully gives thought to areas for consideration. Initially, many audits accepted non-written protocols or herd health plans IF more than one person could corroborate the same information when questioned independently. However, this issue has evolved to where protocols are required to be written down (herd health plans, milking protocols, calf care protocols, etc.). It is in the best interest for producers to have this information written down in the event of an emergency where an “extra” has to fill in for a caretaker. Having the SOP written down helps ensure the animals are taken care of in a consistent manner. These protocols do not have to be fancy or exhaustive, but do need to reflect the basic care expected to be given. Additionally, caretakers need to be trained on them and they need to be available for review to the caretakers that might need to use them.

Caretaker Training. As mentioned above, caretakers need to be trained on the expected protocols for their area. Additionally, training must include managements’ expectations of animal care. A no-tolerance of abuse policy should be included and each caretaker should have a signed care statement on file. All training should be reviewed at least annually, with a protocol for oversight or re-training sooner, if needed. While this may sound awkward, it will go far in supporting management if an event occurs. This is even encouraged in family operations. Furthermore, outside contractors (foot trimmers, haulers, breeders, etc.) must be made aware of the animal care policy and have signed statements on file with the facility as well.

Animal Observations. A primary barometer for evaluating animal care is letting the animals tell as much of the story as they can. The audits I am familiar with have similar observations, including:

- **Body condition**: evaluates the nutrition programs’ ability to meet the production status of the animal
- **Locomotion**: verifies the foot care program, as well as parts of the herd health plans intent to observe all animals daily and catch abnormalities quickly
- **Hygiene**: assesses the routine efforts of facility cleanliness
- **Hock and knee lesions**: gages cow comfort in their housing type

COMMERCIAL ANIMAL WELFARE AUDIT PROGRAMS

There are several commercial programs available to the dairy industry. They vary in how they are implemented on-site or how the program is managed, but they all contain the core parameters listed above. There are evaluation programs, such as National Milk Producers Federation FARM Program (Farmers Assuring Responsible Management). This program does not contain a pass/fail option, but is developing an action plan protocol to improve conditions that don’t meet their criteria. Other programs are true audit programs and do contain pass/fail options. These programs, such as Validus’ Animal Welfare Review – Dairy and American Humane Certified, have been available for several years. Other programs may include various state, association, and/cooperative programs more specific to associations or niche markets.

CONCLUSIONS

Good animal welfare programs facilitate better environments for cows, as well as better work environments for the employees. Comfortable, well-cared animals are easier to work with and may be more productive. Implementing a third-party audit of your program can identify problem areas and improve the welfare of your animals. These programs can provide valuable feedback and help manage procedural drift in daily tasks.
INTRODUCTION

Despite many advances in our knowledge of calf management and nutrition, the dairy industry continues to be challenged with finding ways to raise calves in such a manner that not only optimizes health, growth, and efficiency, but also is best for their welfare. This paper will identify some of those welfare challenges and how we can use knowledge of calf behavior to identify housing and feeding programs that optimize growth, health, and welfare. A primary focus will be on identifying those factors, including the level of milk feeding, timing and method of weaning, impact of solid feed type, and housing, that contribute to a smooth transition from milk to solid feed at the time of weaning.

MILK FEEDING LEVELS

There are a range of viewpoints on how best to feed and manage dairy calves early in life. Traditional approaches to rearing dairy calves have focused on stimulating early solid feed intake through restricting intake of milk or milk replacer. A conventional milk feeding rate is approximately 10% of a calf's birth weight, an amount that translates to between 4 and 5 L/day, supporting under 0.5 kg/d of weight gain (Appleby, 2001; Jasper and Weary, 2002). This conventional approach to feeding calves facilitates early weaning and has been viewed as economically appealing due to reduced feed costs. However, there is increasing on-farm adoption of alternative feeding programs which provide a higher plane of nutrition. Feeding programs which provide greater milk allowances support greater growth relative to outcomes of conventional restricted feeding, and thus are typically referred to as “intensified feeding,” or “feeding for accelerated growth” or “feeding for biologically normal growth”. These feeding programs provide quantities of milk that more closely resemble intake levels of a suckling calf, and allow “biologically appropriate” growth rates (Drackley, 2008), which fall between 0.75 and 1 kg/d (Appleby, 2001; Tedeschi and Fox, 2009). In supporting increased intake, intensified feeding programs provide a number of immediate benefits, including greater growth prior to weaning, performance of natural feeding patterns, and improved welfare. Further, recent interest has turned to longer-term impacts of greater rates of weight gain early in life, such as improved performance in lactation.

In contrast to the restricted amounts of milk provided in conventional feeding programs (10% of BW, or 4 to 5 L/d), calves provided more milk are able to double their nutrient intake (Khan et al., 2011a), consuming between 8 and 16 L/d when milk is provided ad libitum (Appleby, 2001; Jasper and Weary, 2002; Miller-Cushon et al., 2013a). In terms of milk replacer, conventional feeding programs typically provide 1 to 1.5% of BW on a dry matter (DM) basis whereas intensified programs provide milk at 2 to 3% of BW on a DM basis. Some intensified feeding programs also alter the DM content of the milk replacer in addition to the feeding amounts; for example, providing milk replacer prepared with 18% compared to 12% DM (Terré et al., 2009). Improved growth in intensified feeding programs can be accomplished by providing higher amounts of milk replacer (Diaz et al., 2001; Brown et al., 2005) as well as whole milk (Jasper and Weary, 2002). However, a calf’s protein requirement increases with rate of body weight gain; thus, feeding a conventional milk replacer (containing 20 to 22% CP and 20 to 21% fat) at a greater rate will not supply sufficient protein for lean tissue growth and surplus energy will be converted to fat (Drackley, 2008; Brown et al., 2005). When energy is not limiting, calves have increased lean tissue growth when milk replacer contains 26 to 28% CP, and 15 to 20% fat (Diaz et al., 2001). In comparison, whole milk contains approximately 27%...
protein and 26 to 28% fat (Appleby, 2001; Shamay et al., 2005).

Intensified feeding programs have marked impacts on performance of the calf early in life, including improved rate of weight gain, structural growth, and efficiency of feed conversion (Diaz et al., 2001; Khan et al., 2007). Whereas conventional feeding programs typically support 0.3 to 0.6 kg/d in growth, intensified feeding programs allow weight gain ranging from 0.6 to over 1 kg/d. For calves provided milk ad libitum, average daily weight gain is typically between 0.8 and 1.2 kg/d (Appleby, 2001; Miller-Cushon et al., 2013a; Jasper and Weary, 2002). Advantages in structural growth (girth and height) in calves managed in an intensified feeding program have been noted both preweaning and postweaning (Khan et al., 2007).

In addition to impacting growth, the milk feeding program greatly influences feeding behavior patterns of the calf. Intensified feeding systems, especially those that provide ad libitum access to milk or milk replacer, allow calves to exhibit a diurnal pattern of milk intake (Miller-Cushon et al., 2013a). Calves provided milk ad libitum have peaks of feeding activity at sunrise and sunset, and consume milk in 8 to 10 meals/day (Appleby, 2001; Miller-Cushon et al., 2013a). This pattern of milk intake and resembles the natural behavior of a calf nursing the dam (Lidfors et al., 1994; de Passillé, 2001). In contrast, calves fed according to conventional practice typically receive their milk allotment in two feedings per day, such that total time spent feeding during the day is greatly reduced. For example, calves provided milk at a rate of 5L/d spent about 10 min/d feeding, whereas calves provided milk ad libitum spent 45-60 min feeding (Appleby et al., 2001; Miller-Cushon et al., 2013a).

Calves fed restricted quantities of milk have frequent unrewarded visits to the feeder (De Paula Vieira et al., 2008; Borderas et al., 2009), suggesting that they are hungry (De Paula Vieira et al., 2008). Further, calves are highly motivated to suck and will spend considerable amounts of time engaged in non-nutritive sucking when provided restricted amounts of milk (Miller-Cushon et al., 2013a). In addition to differences in feeding behavior, calves provided restricted amounts of milk spent less time lying (Borderas et al., 2009; De Paula Vieira et al., 2008), vocalized more frequently (Thomas et al., 2001), and performed less play behavior (Krachun et al., 2010). Thus, intensified feeding systems have clear welfare implications for the calf, allowing performance of natural feeding behavior patterns and reducing hunger.

From an economic perspective, motivation for feeding greater amounts of milk to calves depends in part on the potential long-term impacts of this feeding practice on performance of the calf. In controlled studies, early plane of nutrition has been found to have a number of impacts on longer-term production potential. In comparison to providing calves with restricted access to a low-energy milk replacer (23% crude protein, 15% fat), provision of whole milk to calves in ad libitum amounts was reported to have a range of long-term positive effects across different studies, including reduced age at conception and calving (Bar-Peled et al., 1997), increased BW at calving (Bar-Peled et al., 1997; Moallem et al., 2010), and improved milk production (Bar-Peled et al., 1997) or milk fat yield (Shamay et al., 2005; Moallem et al., 2010).

Similarly, results of studies comparing different amounts and qualities of milk replacer suggest that an intensified milk replacer feeding program reduces age at first calving (Raeth-Knight et al., 2009; Davis Rincker et al., 2011). Regression analysis of several published data sets suggests a positive impact of preweaning growth on later milk production, with an improvement in milk production of 225 kg for an increase in pre-weaning ADG of 100 g/d (Bach, 2011). Soberon et al. (2012) also reported a positive correlation between preweaning ADG with first lactation milk yield, suggesting an improvement in milk yield of 850 to 1,113 kg for every 1 kg of preweaning ADG. Davis Rincker et al. (2011) reported an economic analysis suggesting that, although cost of intensified feeding was greater than conventional, total costs by time of first lactation were not different.

Despite significant effects of intensified feeding programs on feeding behavior of the calf prior to weaning, there is little evidence to suggest that preweaning milk feeding level has a persistent effect on feeding patterns (Miller-Cushon, 2013a). However, Miller-Cushon (2013a) reported that, in the week after weaning, calves previously provided restricted amounts of milk consumed their solid feed more quickly and had larger meals, compared to calves provided milk ad libitum. Although differences in meal characteristics did not persist, differences in rates of intake after weaning suggest that previous experience with a restricted feeding scenario may have some impact on feeding motivation.

**WEANING STRATEGIES**

Although intensified feeding programs hold much potential to improve short and long-term performance and welfare of dairy calves, there remain challenges with their implementation. The
long-standing popularity of conventional restricted milk feeding programs was based on encouraging solid feed intake early in life and facilitating a smooth transition at weaning. Solid feed intake early in life is critical for rumen development, and consistent weight gain through weaning requires that the calf be consuming sufficient amounts of solid feed prior to removal of milk (Khan et al., 2011a). When provided greater quantities of milk, calves have less frequent and smaller meals of concentrate (Miller-Cushon et al., 2013a). Consequently, rumen development is delayed, such that post-weaning nutrient digestibility is lower in calves provided more milk (Terré et al., 2007; Hill et al., 2010). Thus, a challenge with an intensified feeding program is to support consistent growth through weaning.

Although greater weaning weights as a result of increased pre-weaning nutrition can be maintained into the post-weaning period (e.g. 8 kg weight advantage at 20 d post-weaning (Jasper and Weary, 2002) and 20 kg weight advantage at 56 d post-weaning; Miller-Cushon et al., 2013a), these results are not consistent. A number of studies indicate that weight gain of calves provided great quantities of milk may suffer at time of weaning if solid feed intake prior to weaning was low. For example, weight gain of calves provided milk replacer ad libitum may plateau during weaning whereas restricted-fed calves maintain consistent growth (ADG of -0.03 vs 0.6 kg/d; Miller-Cushon et al., 2013a). In some cases, differences in weight gain through weaning negated any body weight advantage arising from the pre-weaning feeding program (Borderas et al., 2009; DePassillé et al., 2011). This suggests that maintenance of greater body weights is extremely sensitive to weaning method.

The most important aspect of a weaning program is encouraging sufficient intake of solid feed intake prior to removal of milk. A gradual weaning process that encourages greater solid feed intake appears to maintain weight advantages for calves managed in intensified feeding systems. Khan et al. (2007) employed a step-down weaning method, reducing milk quantity 20 d prior to weaning at 7 weeks, and found that calves previously fed milk ad libitum maintained a weight advantage 40 d post-weaning. In a study by Sweeney et al. (2010), calves were fed up to 12 kg of milk/d by automated feeders, and weaned at 41 d abruptly or over 3 gradual weaning periods (4, 10, or 22 d). Those researchers found that during the 9 d following weaning, the calves weaned over 22 and 10 d ate more starter and had better weight gains than abruptly weaned calves and those weaned over 4 d. Further, they found that abruptly weaned calves lost weight during that period. These studies suggest that a gradual weaning program is necessary, particularly when feeding higher levels of milk.

Another important factor influencing the success of weaning, as well as post-weaning performance, is the age at which weaning occurs. de Passillé et al. (2011) reported that calves provided greater quantities of milk had no weight advantage over conventionally-fed calves after abrupt weaning at 7 weeks, but when weaned later (at 13 weeks), calves had begun consuming more solid feed and maintained a weight advantage over calves provided less milk. In a more recent study, Eckert et al. (2015) compared weaning calves at 6 vs 8 weeks of age; in that study calves were fed 8 L/d of milk, which was stepped down to 4 L/d for one week prior to weaning. The results of that study demonstrated that the later weaned calves (at 8 weeks) had more nutrient intake, higher growth rates post-weaning, more gastrointestinal development at weaning, and fewer behavioral signs of weaning distress compared with those weaned at 6 weeks of age.

**SOLID FEED INTAKE AND SELECTION**

In addition to the milk feeding program, solid feed provision is an important component of early management. When managed in conventional feeding systems, calves are typically provided ad libitum access to a high-energy grain concentrate alongside restricted quantities of milk. Early intake of concentrate is critical for rumen development, as rumen papillae development occurs in response to butyrate produced through fermentation of carbohydrates (Warner et al., 1956; Sander et al., 1959). Provision of forage has long been discouraged, out of concern that it will displace concentrate intake and, consequently, impair rumen development (Hill et al. 2008; Kertz et al. 1979). However, there is evidence to suggest that forage provision does not need to reduce concentrate intake (Khan et al. 2011b; Castells et al. 2012) and, further, may positively impact ruminal environment, reducing acidity of ruminal fluid (Suárez et al. 2007; Khan et al. 2011b) and improving feed efficiency (Coverdale et al. 2004). Provision of chopped forage has also been noted to reduce non-nutritive oral behavior of the calf (Castells et al., 2013; Montoro et al., 2013) suggesting that it may satisfy a motivation to perform oral foraging-type behavior. Results of feeding hay seem to depend on the form and type of hay. The positive effects of hay intake on nutrient digestibility are reduced when hay is finely ground, suggesting that benefits of hay are, in
part, due to its physical effectiveness (Montoro et al., 2013). It has also been shown that providing alfalfa hay may reduce concentrate intake, as calves consumed larger amounts of alfalfa hay compared to other types of hay, such as ryegrass (Castells et al., 2012).

It is interesting to note that when offered a choice of hay and concentrate, calves selected a proportion of hay ranging between 5 and 30% of total DM intake (Castells et al., 2012; Miller-Cushon et al., 2013b; Khan et al., 2011b), depending on the type of hay provided and, potentially, other nutritional factors such as milk intake. Selection in favor of hay has been found to decrease after weaning, suggesting that calves may alter dietary selection patterns in response to energy requirements (Miller-Cushon et al., 2013b).

In all, these research results indicate that, in addition to provision of a high-quality starter concentrate, offering limited amounts of a physically effective fiber from forage (limited to 5 to 10% of total DMI) may also be ideal for calf growth and development.

**SOCIAL HOUSING AND FEEDING MANAGEMENT**

Implementation of intensified feeding programs can also impact feeding management on a larger scale. Whereas conventionally-raised calves are typically housed individually, intensified feeding systems are often being adopted hand-in-hand with group-housing systems. Group housing of calves allows for the social facilitation of feeding behavior, resulting in calves beginning to consume solid feed earlier in life and consuming more solid feed prior to, and at, weaning (Hepola et al. 2006; De Paula Vieira et al. 2010; Miller-Cushon and DeVries, 2016). Group-housed calves also vocalized less during weaning (De Paula Vieira et al., 2010), suggesting that social contact is beneficial during this stressful transition. Calves housed with social contact gain weight more consistently through weaning (Chua et al., 2002; Miller-Cushon and DeVries, 2016), likely due in part to both greater intakes of solid feed prior to removal of milk and reduced stress. Thus, social contact may contribute to a successful weaning transition of calves managed in an intensified feeding program. Further, results from Miller-Cushon and DeVries (2016) suggested that providing a social environment for calves early in life may have positive impacts meal patterning, which persist post-weaning, and that early social contact may increase the longer-term preference for social feeding.

A major factor helping the implementation of intensified feeding programs is the growing adoption of computerized calf-feeding systems. These systems reduce the manual labor associated with increasing milk allotments, facilitate group-housing for calves while allowing for monitoring of individual intake, and provide control over feeding patterns and weaning programs. Calves fed by a computerized feeder are typically managed in larger groups, with 10 to 15 calves per feeder (Weber and Wechsler, 2001; Jensen and Holm, 2003).

One of the perceived challenges associated with group-feeding of calves has been cross-sucking. Dairy calves are highly motivated to suck when they taste milk (De Passillé, 2001). If calves do not have the opportunity to express this behavior while eating (i.e. when consuming milk from a bucket), they start “sucking” objects (non-nutritive sucking) or other calves (non-nutritive cross-sucking) after drinking, trying to cope with the lack of a teat and fulfill the desire to suck (De Passillé, 2001). Researchers have demonstrated that calves are provided more milk, particularly through some type of teat-based system (automated feeder or otherwise), calves will have longer feeding periods, which is positively associated with feeling satiation and reduced non-nutritive sucking (De Passillé, 2001; Veissier et al., 2002). For calves fed by automated feeders, De Passillé et al (2004) concluded that cross-sucking is controlled if sufficient time to suck is allowed.

Controlling competition is, thus, also key factor in group-housing situation. Competition could be reduced when milk allowance and number of meals are increased (Jensen and Holm, 2003; De Paula Vieira et al., 2008; Herskin et al., 2010), and when calf age and size range in the pen is minimized (Færevik et al., 2010). The number of available feeding places (for milk and/or solid feed) plays a role in competition as well. Even minimal competition for access to artificial teats (1:2 ratio of teat to calf) has been shown to reduce milk intake in the early weeks of life for calves fed ad libitum (Miller-Cushon et al., 2014). Further, calves chose to stand and feed at the same time, even when provided a single feeding space (Miller-Cushon et al., 2014), suggesting that calves may be motivated to feed in synchrony rather than adopting different feeding schedules.

Exposure to a competitive feeding environment also has potential to have longer-term impacts on feeding and social behavior. Compared to calves reared in a non-competitive feeding environment, calves reared with restricted teat access were found to persistently displace each other more frequently and consume their feed more quickly after weaning, despite having unrestricted access to feed buckets during the post-weaning stage (Miller-Cushon et al., 2014). Persistent competitive behavior has potential to pose problems later in life, as
competition for access to feed in adult cattle encourages large and infrequent meals (Hosseinkhani et al., 2008; DeVries and von Keyserlingk, 2009), which can negatively affect ruminal pH (Krause and Oetzel, 2006). Thus, as intensified feeding systems are increasingly adopted, further work is encouraged to assess longer-term effects of different management strategies on both performance and behavioral development of dairy calves.

CONCLUSIONS

In summary, varied approaches to calf management and nutrition have both immediate and longer-term implications for calf performance, behavior and welfare. When managed in intensified feeding systems, calves will consume at least twice the amount of nutrients typically supplied according to conventional feeding strategies, supporting greater rates of growth and reducing hunger. Feeding behavior is greatly influenced by feeding program, with access to greater quantities of milk allowing the expression of more natural feeding behavior patterns, such as those exhibited by a calf suckling the dam, and reducing behavioral indicators of hunger. Further, greater rates of gain prior to weaning are associated with earlier calving ages and improved milk production, suggesting that there may be a longer-term economic advantage to providing calves with more milk.

Successful weaning of calves, especially those provided greater quantities of milk, requires a gradual process of reducing milk intake to encourage sufficient solid feed intake prior to removal of milk. There is also growing evidence that provision of hay may be beneficial in encouraging greater total intake prior to weaning. Group-housing is becoming more prevalent and social housing for calves holds a number of benefits including encouraging greater solid feed intake and reduces stress through weaning. However, competition in group-housed calves may reduce milk intake when access to teats is restricted. Further research in this area is needed to refine approaches for housing calves in large social groups, and to identify the longer-term behavioral and performance implications of early life factors.

ACKNOWLEDGEMENTS

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QUESTION EVERYTHING

David Sjeklocha, DVM, Cattle Empire

PERSPECTIVE

Before I begin, I think it is important to know where I am coming from. So, the introduction will be written in the first-person narrative. I want to give you my perspective. I work for Cattle Empire Feedyards (CE), who also owns Empire Calf Ranch (ECR). Our feedyards have capacity for over 190,000 head of cattle and our calf ranch can hold about 50,000 calves, with about half of those being in hutches. All four feedyards and the calf ranch are located in Haskell County, Kansas.

I grew up on a beef cow-calf operation in Missouri. We also raised row crops and Quarter Horses. I had very little experience with dairies while growing up, and I am most decidedly not a dairy veterinarian.

I went to college at age 25 to pursue my DVM because I wanted to work with feedyards. I consulted with multiple feedyards in five states, with CE being one of my clients. While I was in my consulting practice, CE bought a 6,000 cow dairy and wanted me to consult there, as well. It was a great opportunity to learn about the dairy industry and I certainly enjoyed the opportunity. CE closed the dairy and sold it a few years ago. But it was while CE owned the dairy that their interest in bull dairy calves as a feedlot animal was cultivated. CE was sending their bull calves offsite to be raised and then would bring them to the feedyard at about 5-6 months of age to finish them out. CE was not satisfied with the way their calves were being raised, so it was decided to build a calf ranch and raise our own. In 2011, 3 years after the calf ranch had accepted its first calf, CE asked me to come on staff and oversee the health and welfare of all the livestock in all the operations. It was a good fit for both of us, so I accepted the opportunity.

My perspective is undeniably beef-cattle oriented. There are many areas of management and operations that beef producers question about dairy producers and vice versa. I am comfortable raising dairy bull/steer calves for beef production. I would not be comfortable raising dairy heifers for breeding and milk production. Hopefully, this will help the reader to understand my views.

EMPIRE CALF RANCH

At ECR, calves come into the hutches at about one day old and spend 90 days there. At 90 days they are moved to 100 head group pens and stay there for about 45 days. Then, they are sorted up and put into 300 head group pens for another 45 days before they go to the feedyard - so they are about 180 days of age when they leave the calf ranch. ECR deals with only bulls and steers; no heifers are raised (unless the heifers are to go to the feedyard). ECR buys bull calves, turns them into steers and they all go to the feedyard.

The design of the calf ranch was primarily handled by the calf ranch manager, who had fairly extensive experience with calf ranch management in the Tulare, California, area. This operation is extremely manual labor intensive, as one may have guessed. There are 135 people who work on this one operation.

Being consistent with these calves is so important. Getting the milk out at the right temperature, at the right time, and even the manner in which the milk powder is added to the water are all very important and must remain consistent. Different people mixing milk in different manners can result in digestive upset.

HUTCHES

ECR has California-style hutches. These sit on slatted decks, so all the excrement can drop through. Half of the hutches are on concrete curbs and there is a flush system underneath them; the rest are sitting on ground. Each hutch unit has 3 stalls/ unit. Some of the good things about these hutches include: they are relatively inexpensive and they save space. Ventilation is adequate, but ammonia odors can be evident at times. Some negatives are that they are not terribly user-friendly. It’s not easy for the workers to get in the hutch if they need to treat a calf. Nose to nose contact is still possible. The flush system has the potential to aerosolize pathogens and spread them down the hutch line. The slatted floor does not provide thermal protection in cold, windy weather. If air can get underneath the hutch and in inclement weather, hypothermia can quickly set in, even with calf coats on the calves. The problem with putting calf coats on calves in southwest Kansas is that there is so much temperature variation from day to day that the coats were constantly being put on and taken off. Workers’ time get occupied applying and removing jackets, instead of being able to do other things.

Another challenge with these hutches is the water buckets, especially in the summer. It can be difficult to keep water in front
of these calves. The standard seems to be having a crew or crews go through several times each day, filling each individual bucket. During the hot summer months, it can be very difficult to keep adequate water in front of these calves, so calves that develop diarrhea may be slightly dehydrated even before the disease process begins. In cold weather, ice can limit water intake, as well.

**ANTIBIOTIC USE**

Antimicrobial resistance is a problem that must be addressed. There are many paradigms, beliefs and much wizardry in regards to antibiotics. For instance, there seems to be a belief that once that antibiotic is on the ranch, it can be used for treatment of any disease. Of course, federal law restricts the use of fluoroquinolones to respiratory disease only. Many calf ranch workers are surprised to learn this, even though this has been the law for nearly 20 years. Whenever an antibiotic is used, it is an indication that our management practices have failed. Some find this philosophy difficult to grasp, especially those who believe that antibiotics are a crutch for poor management. This does not mean that antibiotics should never be used. Antibiotics are necessary. But there must be an effort to constantly improve and fine tune management and biosecurity. The belief that good management can be purchased in a bottle must be rejected.

**HUTCH TREATMENTS**

It is very difficult to apply epidemiology to treatment regimens in calf ranches. Feedyards have some very good animal health tracking software, but that software programming is based on the fact that feedyards assign a lot number to a group of cattle. It is very difficult to make the feedlot software work in a calf ranch. Some have attempted to apply Dairy Comp with varying success. So, tracking animal health data is very challenging.

Once a treatment regimen has been established, it can be very difficult to be sure that it is being followed. Thanks to RFID, calves can be identified rather easily, but finding individual calves by RFID can be very time consuming. Some calf ranches flag individual calves by hanging a feed or water bucket in a specific place on the hutch, but when this is done, the calf may be denied feed or water for a few hours, due to not being able to access the bucket. Simply numbering the hutch has saved a considerable amount of time for the workers and has helped to assure that the right calves get the right treatment.

Many antibiotics have an extended duration of therapy. There are those that believe that administering a lower dose multiple days in a row allows the antibiotic to be more effective. For some antibiotics, this may be true. However, the difference in efficacy is minimal in most cases, and is probably more than offset by the worker administering those multiple treatments acting as a Typhoid Mary for the rest of the calves on the ranch.

Another mindset that seems to be rather strong is that providing fluids (oral or IV) takes a backseat to administering another antibiotic. It is simply easier to squeeze a syringe than it is to bottle feed fluids, tube feed fluids or administer IV fluids. Workers must be reminded frequently that calves with diarrhea die of dehydration, not antibiotic deficiency. With the level of antimicrobial resistance being seen today, the importance of fluid therapy cannot be overstated.

**FINDING SICK CATTLE IN GROUP PENS**

Finding and treating sick cattle in group pens can be very challenging. Often, a crew of workers will enter a pen as a group, and each of them will be looking for sick calves independently. Once a sick calf is identified, workers typically chase that calf around the pen until they catch him and then hold him while he is treated. Calves soon begin to associate humans being in the pen with being chased and being scared. When calves become nervous or scared, and they will mask their disease signals. Cattle are prey animals and, if humans do not earn their trust, calves will see humans as predators. Sending as few people through the pens as possible, and allowing them to walk slowly and observe provides much more opportunity to find sick cattle that are early in the disease process. Then, once they find that sick calf, it can be quietly removed from the pen and treated away from the main group.

Physically running down and manhandling calves for treatment provides several problems. Often, the calves are controlled by grabbing and restraining with the ears and tail. This is a bad habit that is not animal welfare friendly. Also, by virtue of the physical nature of capturing calves, workers are more likely to delay treatment because it is simply easier to catch and manhandle a really sick calf than it is to manhandle a calf early in the disease process. This is further exacerbated as the calves get bigger and bigger. A hospital facility that can be used to restrain calves for treatment after they have been removed from the pen will improve animal welfare and
encourage workers to treat cattle earlier in the disease process.

FEED MANAGEMENT IN GROUP PENS

One of the most obvious points of contention between beef producers and dairy producers is feed management. For beef producers, and more specifically, cattle feeders, feed management includes making sure the cattle clean up all their feed at least once per day (usually in the morning). The calves are expected to have a healthy appetite when the feed truck goes by for the first feeding in the morning. The vast majority of calves are expected to get up and come to the feed when the truck arrives. This helps to get the calves on a feeding schedule. It also helps with animal health, because sick cattle generally are not interested in eating, so the workers can be in the pen observing eating behavior to help them find the sick calves in a more timely manner.

Prior to adapting the “slick bunk” approach for feeding calves at ECR, calves were not interested or stimulated by the arrival of the feed truck. Yet, the workers would go into the pen and push the calves up to the feed in an attempt to get them to eat. It is very difficult to get a calf that is not hungry to eat. Also, because the animal health workers were catching calves in the pen and this method caused sick calves to mask their disease signals, the workers resorted to catching calves with loose stools and treating them, rather than calves with respiratory disease. Many calves that were bright, alert and responsive were being given antibiotics to treat a loose stool – not because the calf was sick, but because a loose stool was hard to mask and the workers believed they were not doing their job if they weren’t finding something to treat. Often, it was clear that the use of antibiotics in this situation only intensified the loose stools. From here, ration adjustments were being made, which may have caused even more loose stools. Since adapting the slick bunk method, loose stools are virtually no longer an issue and antibiotic use has dropped precipitously.

CONCLUSION

Producers are under more and more scrutiny from consumers about animal welfare, animal husbandry and antibiotic use. The many paradigms and traditions that are very prevalent in raising calves must be evaluated objectively – Question Everything. There is a story about a young bride who was making a pot roast for her new husband. As she prepared the roast, she cut the ends off the roast and then placed the roast in the pan. Then she took the ends she cut off and laid them on top of the roast. Intrigued, the husband asked why she did that. She said, “Well, that’s the way my mom always did it.” So, the husband called his mother-in-law and asked her. Her response: “Well, that’s the way my mom always did it.” So, he called his grandmother-in-law and asked her. She said, “Oh, honey, I only did that because my roasting pan was too small for the roast to fit in.”
BUILDING CONSUMER CONFIDENCE IN DAIRY

Stan Erwine, Vice President of Farmer Relations and Activation - Dairy Management, Inc.

A PASSION FOR DCHA AND BUILDING CONSUMER CONFIDENCE

The professional development and support of science, products, management practices and the skills to raise and nurture young stock and enhance the success of the dairy industry by improving dairy calf and heifer management has been a passion of mine. I fondly remember the early organizational meetings when we were of the Professional Dairy and Heifer Growers Association. Contract Calf and Heifer raising was in the early stages of development. It’s been rewarding to watch the organization and its’ contribution to the dairy community grow. Note that I used the term Community not Industry. Why? I’ll get to that. I’ve have another passion that I was thrilled to be invited to share with you today. Building dairy consumer confidence like dairy calf and heifer management is mission critical to growing dairy consumption and sales. This year’s conference theme couldn’t say it any better - Together, we are committed to GROWING OUR FUTURE.

SOMETHINGS NEVER CHANGE

Your passion for dairy calf and heifer management excellence and mine for communicating dairy’s story to our customers and their families have been unwavering. In 2006 the editorial staff of Dairy Herd Management - took a fresh look at our June Milk Quality Emphasis Issue and determined we need to make a significant strategic content shift. This shift was precipitated by our experience during the 2005 Front Range Dairy Food System Tour where we encountered retailers confused about claims being made by my farms, processors and the labels that appearing on our products. We dedicated the 2006 June Milk Quality Issue of Dairy Herd Management to helping farmers and the dairy community better understand and communicate about milk, management practices and values directly to consumers. We worked closely with Dairy Management Inc. to develop and share consumer research and talking points. We even created an educational brochure entitled Questions and Answers about Milk for use at the retail dairy case.

OTHERS CHANGE A LOT

• I’ve worked for dairy farmers as a member of Dairy Management Inc. since November 2008.
• Dairy Herd Management was recently sold to another Publishing Company
• The number of U.S. dairy farms has declined from 105,000 in 2006 to 43,000 in 2016
• Internet users have grown from 400 million to 3.2 Billion
• Facebook wasn’t born until February of 2004. It now has 1.5 Billion Users
• Twitter wasn’t born until March 2006 and now has 307 million users.
• Milk Production has increased from 182 Billion Pounds in 2006 to 209 Billion Pounds in 2016
• 48% of meals are eaten outside of or away from home
• Checkoff shifted from Generic Fluid Milk and Cheese advertising to brand partnerships.

TOUGH QUESTIONS

• Is trust in dairy, food or agriculture increasing or decreasing?
• Who’s job is it to communicate to consumers about what we do?
• Who do consumers want to hear from?
• How often do you communicate with consumers?
• How large is your consumer audience and voice?
• What are you doing to grow it?
• What’s at risk if you don’t?
• Who or what are you waiting for?
SOCIETAL AND TECHNOLOGICAL CHANGE HELP DRIVE DAIRY AND CONSUMER DISCONNECTS

We like to talk about how consumers are disconnected from dairy but I’ve discovered we are also disconnected from consumers? We live during a period of some of the most profound demographic changes since the 1890’s.

- 55+ Population will increase 45% by 2020
- Asian Population +43% since 2000
- 63% Own pet and spend $60 billion on them
- 50% Growth 2000 - 2010 Hispanic
- 53% of the population is less than 30 years old
- Couples with Children Declining

The evaporation of trust

The 2015 Edelman Trust Barometer conducted by Edelman Public Relations documented developments instructive for each of us, at all levels of the dairy industry.

1. 2015 saw the evaporation of trust in Business, NGO’s and Media
2. Over ½ the respondents felt the pace of Innovation was too fast
3. Over ½ felt innovation was driven by the wrong priorities

The majority of respondents felt business innovation was driven by technology, business growth targets, greed, money and personal ambition. Consumers asserted it was important for them to know how business innovations would improve their lives or make the World a better place. When innovation moved too rapidly and did not address consumer’s societal and emotional needs, 51% of respondents looked to Government to provide protection and regulate business.

MOST TRUSTED SOURCES FOR NEWS AND GENERAL INFORMATION

The 2015 Trust Barometer also documented that Search Engines are now the most trusted source of news and information. Among Millennials that trust is even higher. In other words, “the University of Google” is where society now gets its news. What does that mean as we work to inform, motivate and empower change among our owners, managers, peers, employees and consumers?

Rapid change, information access & social media has increased consumer skepticism

According to Edelman’s 2012 Field to Fork consumer study:

- Only 47% agree with the statement that farming is performed in a responsible way
- Only 40% agree that US farmers take good care of the environment
- Only one-third agree livestock are treated in a humane manner.

The moveable middle

It’s important to note a significant group of consumers simply don’t know or haven’t formed an opinion on these statements as a result of lack of interest, time or information. This group is called the “Moveable Middle” and is the target audience we must engage
Consumers want to hear from and ask farmers questions. They want to learn about your farms, your practices and your values, from YOU! This is a huge opportunity. In order to be successful we must reprogram our messages and approach. We must examine where and how we engage consumers including millennials.

Consumers also want to hear from credentialed experts - like DCHA members!

Why are millennials Important to Dairy?

1. They are the next generation of dairy consumers and parents
2. Their purchasing power is growing:

<table>
<thead>
<tr>
<th>Year</th>
<th>Milk (Million)</th>
<th>Cheese (Million)</th>
<th>Yogurt (Million)</th>
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<td>2014</td>
<td>$150 Billion</td>
<td>32 Gallons per Household</td>
<td>31 Pints per Household</td>
</tr>
<tr>
<td>2020</td>
<td>$290 Billion</td>
<td>27% of Retail Milk Volume</td>
<td>28% of Retail Yogurt Volume</td>
</tr>
<tr>
<td></td>
<td>96% Buy Milk</td>
<td>34 Pounds per Household</td>
<td>28% of Retail Cheese Volume</td>
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<td></td>
<td>98% Buy Cheese</td>
<td>31 Pints per Household</td>
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<td></td>
<td>90% Buy Yogurt</td>
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USING CONVERSATIONS, RELATIONSHIPS AND SOCIAL MEDIA TO RECONNECT CONSUMERS WITH DAIRY.

We’ve all experienced the positive conversations and discoveries that occur when consumers or a group of thought leaders visit a dairy. We’ve also experienced and benefitted from the relationships that are formed and trust that is built. This is the ultimate act of transparency. How do we get 319 Million Americans to visit 43,000 U.S. dairy farms?

SEISMIC SHIFT IN THE COMMUNICATIONS AND ACTIVIST LANDSCAPE

It’s readily apparent there has been a seismic shift in the communication landscape, more markedly in the last few years. Communication has transformed from one-way communication, and “push” messages, via traditional media, featuring voices of traditional authority – experts, leaders, CEOs, government officials to real-time interactive and multi-platform communications.

Today, we all experience the intense speed of information on a moment-by-moment basis. Maybe you’re checking your phone right now to keep up with email, your twitter feed or a breaking news story. But the more connected we are, the less we trust traditional news and information sources. Today, social media is also mainstream media, and we consume it very differently. Do you sit and watch television with single minded focus today? More likely, you are checking your phones for e-mails or reading along with Twitter as a live TV event happens.

Game Changer – Market Pressure vs. Regulation + Social Media

NGO’s like Green Peace, the Humane Society of the United States, PETA and Mercy for Animal (to name a few) discovered that global brands can do what government cannot.

“We attack the weakest link in the company’s value chain”

“Discovering brands was like discovering gunpowder”. - Kurt Davies – Green Peace

“We thought we could sit in Bentonville, take care of customers, take care of associates and the world would leave us alone. It doesn’t work that way anymore.” - Former Wal-Mart CEO Lee Scott
The rise of social media provided those who have stated they want to put us out of business, ways to connect with consumers that we were not using. These organizations messages and messengers are consistent and nimble. They sought to and in many cases connected with disconnected dairy consumers through emotion and fear.

**Need: A common voice and system to proactively tell our story in today’s channels**

We were mired in old messages and old channels while our detractors and opponents were staying on message and nimbly using Social Media to misinform and confuse our customers.

Dairy had too many voices and too many messages. What happens when a consumer receives too many messages? Confusion at best. Doubt and distrust at worst.

April 2014 Consumer Confidence Summit gave birth to the Common Voice Network which now numbers over 140 company and association communicators from all levels of the dairy community.

### PEOPLE DON’T BUY WHAT WE DO – THEY BUY WHY WE DO IT.

Author and speaker Simon Sinek looked across many leading organizations and discovered what separated the great organizations from all the others. He calls it the “Golden Circle” which he described in his book and TED Talk, or Starting with Why. He makes the point that all business know what they do, many know how but few can articulate the why or the purpose. Profitability is not a purpose – it is a result.

**How does Sinek’s principle apply to dairy?**

What’s your businesses’ purpose and reason for being? How does what you do enrich people’s lives or make the World a better place? That’s the why today’s consumer wants to emotionally connect with and that most businesses are missing. Help your owners, employees, peers and consumers discover, understand and communicate the “why” to inspire cooperation, trust and change. Simon Sinek: How great leaders inspire action | TED Talk ... 18:04 https://www.ted.com/.../

DairyGood.org – a system to provide our industry with a consumer facing voice.

### HOW DO WE BUILD RELATIONSHIPS?

Begin with mutually respectful conversations where common interests and common ground are discovered. Gain permission to stay in touch by establishing a foundation of mutual care and interest. President Theodore Roosevelt put it this way, “people don’t care how much you know...until they know how much you care”.

**Remember three things:**

1. Conversations + Transparency = Relationships and Trust
2. Relationships = Information, service or support proven reliable over time.
3. Trust is rejuvenated through relationships

Social Media Newsroom

Monitors and respond as needed with the appropriate expert voices and information.
2015 Successful Social Media campaigns initiated

It uses Myth Busting Videos that borrow from Jimmy Kimmel’s Mean Tweet approach and a Webisode Series paring millennial dairy farmers with millennial urbanites to discover shared values, as they walk in each other shoes, boots and flip-flops.

The Udder Truth: a three-part video series launched in July aimed at busting some of the most common myths about dairy, including cow care, antibiotics, and large farms. Videos featured real farmers telling the truth about what happens on farms, and viewership was driven by an unusual partnership with humor news website The Onion.

Farmers and industry shared the content far and wide, more than a million watched the videos and consumers responded positively. Visit UdderTruth.org to view.

Acres + Avenues: The momentum created by The Udder Truth continued through another video series, Acres + Avenues which launched in October. To show that farmers and the average urban Millennial have some things in common, we paired them up to spend time in each other’s lives and reveal shared values. Videos can be found on Dairy Good and AcresandAvenues.org. More than 5.2 million people watched the series, and it proved to be so successful another season is being planned for 2016.

Training is available through the Telling Your Story program, to help you and others at your farm with general communications, issues and crisis communications and social media. If interested, contact Don Schindler at don.schindler@dairy.org.

Want to learn how to share these videos and hundreds of other pieces of dairy content? It’s easy, join the Dairy Hub Amplification Center. This center gives you the flexibility to link your social networks and share dairy related content with one click of a button. To learn more, contact Stan.Erwine@dairy.org.

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Nielsen, Meet the fastest growing multi-cultural segments in the U.S. – June 2015
Simon Sinek, Start with Why, TED Talk YouTube
U.S. Census Bureau – March 2015
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The first 12 months is a crucial time in a heifer's life. Pneumonia or Bovine Respiratory Disease (BRD) can occur from multiple factors, including *Mycoplasma bovis.* BRD-induced complications during this time can have a long-term effect, including reduced milk production later in life. With a rapid, powerful response, ZACTRAN can help the genetic potential of your heifers.

**IMPORTANT SAFETY INFORMATION:** For use in cattle only. Do not treat cattle within 35 days of slaughter. Because a discard time in milk has not been established, do not use in female dairy cattle 20 months of age or older, or in calves to be processed for veal. The effects of ZACTRAN on bovine reproductive performance, pregnancy and lactation have not been determined.

2 ZACTRAN product label.
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**ZACTRAN**

(gamithromycin)

150 mg/mL ANTIMICROBIAL
NADA 141-328, Approved by FDA
For subcutaneous injection in beef and non-lactating dairy cattle only. Not for use in female dairy cattle 20 months of age or older or in calves to be processed for veal.

**Caution:** Federal (USA) law restricts this drug to use by or on the order of a licensed veterinarian.

READ ENTIRE BROCHURE CAREFULLY BEFORE USING THIS PRODUCT.

**INDICATIONS**
ZACTRAN is indicated for the treatment of bovine respiratory disease (BRD) associated with *Mannheimia haemolytica*, *Pasteurella multocida*, *Histophilus somni* and *Mycoplasma bovis* in beef and non-lactating dairy cattle. ZACTRAN is also indicated for the control of respiratory disease in beef and non-lactating dairy cattle at high risk of developing BRD associated with *Mannheimia haemolytica* and *Pasteurella multocida*.

**CONTRAINDICATIONS**
As with all drugs, the use of ZACTRAN is contraindicated in animals previously found to be hypersensitive to this drug.

**WARNING:** FOR USE IN CATTLE ONLY. NOT FOR USE IN HUMANS. KEEP THIS AND ALL DRUGS OUT OF REACH OF CHILDREN. NOT FOR USE IN CHICKENS OR TURKEYS.
The material safety data sheet (MSDS) contains more detailed occupational safety information. To report adverse effects, obtain an MSDS or for assistance, contact Merial at 1-888-637-4251.

**RESIDUE WARNINGS:** Do not treat cattle within 35 days of slaughter. Because a discard time in milk has not been established, do not use in female dairy cattle 20 months of age or older. A withdrawal period has not been established for this product in pre-ruminating calves. Do not use in calves to be processed for veal.

**PRECAUTIONS**
The effects of ZACTRAN on bovine reproductive performance, pregnancy, and lactation have not been determined. Subcutaneous injection of ZACTRAN may cause a transient local tissue reaction in some cattle that may result in trim loss of edible tissues at slaughter.

**ADVERSE REACTIONS**
Transient animal discomfort and mild to moderate injection site swelling may be seen in cattle treated with ZACTRAN.

**EFFECTIVENESS**
The effectiveness of ZACTRAN for the treatment of BRD associated with *Mannheimia haemolytica*, *Pasteurella multocida* and *Histophilus somni* was demonstrated in a field study conducted at four geographic locations in the United States. A total of 497 cattle exhibiting clinical signs of BRD were enrolled in the study. Cattle were administered ZACTRAN (6 mg/kg BW) or an equivalent volume of sterile saline as a subcutaneous injection once on Day 0. Cattle were observed daily for clinical signs of BRD and were evaluated for clinical success on Day 10. The percentage of successes in cattle treated with ZACTRAN (58%) was statistically significantly higher (p<0.05) than the percentage of successes in the cattle treated with saline (19%).

The effectiveness of ZACTRAN for the treatment of BRD associated with *M. bovis* was demonstrated independently at two U.S. study sites. A total of 502 cattle exhibiting clinical signs of BRD were enrolled in the studies. Cattle were administered ZACTRAN (6 mg/kg BW) or an equivalent volume of sterile saline as a subcutaneous injection once on Day 0. At each site, the percentage of successes in cattle treated with ZACTRAN on Day 10 was statistically significantly higher than the percentage of successes in the cattle treated with saline (74.4% vs. 24% [p <0.001], and 67.4% vs. 46.2% [p = 0.002]). In addition, in the group of calves treated with gamithromycin that were confirmed positive for *M. bovis* (pre-treatment nasopharyngeal swabs), there were more calves at each site (45 of 57 calves, and 5 of 6 calves) classified as successes than as failures.

The effectiveness of ZACTRAN for the control of respiratory disease in cattle at high risk of developing BRD associated with *Mannheimia haemolytica* and *Pasteurella multocida* was demonstrated in two independent studies conducted in the United States. A total of 467 crossbred beef cattle at high risk of developing BRD were enrolled in the study. ZACTRAN (6 mg/kg BW) or an equivalent volume of sterile saline was administered as a single subcutaneous injection within one day after arrival. Cattle were observed daily for clinical signs of BRD and were evaluated for clinical success on Day 10 post-treatment. In each of the two studies, the percentage of successes in the cattle treated with ZACTRAN (86% and 78%) was statistically significantly higher (p = 0.0019 and p = 0.0016) than the percentage of successes in the cattle treated with saline (36% and 58%).

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Key information for all your dairy’s key players!

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<thead>
<tr>
<th>LIVESTOCK ACTIVITY</th>
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<tr>
<td>Dairy herd size (milking and dry)</td>
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<td>Heifer calves (birth to weaning)</td>
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<td>Heifer adolescents (weaning to breeding)</td>
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<td>Bred heifers</td>
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<td>Alfalfa acres</td>
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