Dear Friends,

It's a pleasure for the Animal Sciences Department to bring you the Producer's Update for 2012. This is a year of change, and it's also a year to remember institutions that have sustained us for over a century. The Department and College are in transition, which means new opportunities. First, we are excited to have Dr. Dan Faulkner joining us. Dr. Faulkner is filling the position vacated by Dr. Bob Kattnig, our former Livestock Specialist. A Westerner and native of Idaho, Dan comes to Arizona following a distinguished career as a faculty member at the University of Illinois. His extension and applied research program in beef cattle nutrition and management will continue here in Arizona where we are confident he'll be a great asset to our industry. In addition to Dr. Faulkner, Dr. John Smith has joined us from Kansas State University as our Extension Specialist in Dairy Management, and Dr. Ben Renquist, a new assistant professor originally from Colorado, will teach and conduct research in nutrition. These new faces will enhance our department's teaching, research and extension efforts.

The second area of transition this past year has been at the College level. Dr. Shane Burgess took the reins from Gene Sander to become the new Vice Provost and Dean of the College of Agriculture and Life Sciences; as a veterinarian and scientist, he brings high energy and commitment to the Land Grant mission of our College and University. In addition, our three associate deans, Colin Kaltenbach, Jim Christenson and Dave Cox all retired after many years of dedicated service to the College and State. Dr. Jeff Silvertooth, former head of the Department of Soil Water and Environmental Science, has replaced Dr. Christenson as Associate Dean for Economic Development and Director of Cooperative Extension. Jeff brings years of experience in extension, applied crop research and teaching here at the University of Arizona. The new Associate Dean for Academic Programs and Career Development is Dr. Joy Winzerling. Joy has stepped in to continue our College's strong commitment to our students and their future success. Dr. Winzerling has been on faculty here at the University for many years in the Nutritional Sciences Department, most recently as Department Head. Also, Joy is no stranger to ranching; she and her brother continue to operate their family ranch in eastern Oregon. Finally, I have moved into the job of Associate Dean for Research and Director of the Agricultural Experiment Station. Colin Kaltenbach left some pretty big boots to fill, but we'll continue the Experiment Station's mission of producing research that targets important issues for Arizona agriculture and Arizona families.

Now let's talk about the strength and stability of two important institutions with noteworthy birthday's this year. We're continuing our celebration of the 100th anniversary of Arizona statehood. Many of today's Arizona agriculture families pre-date statehood and for generations have played important roles in the growth of Arizona. Likewise, the University of Arizona and its first college, the College of Agriculture, have been serving Arizonans since territorial days, which brings me to the second important birthday. On July 2, 1862 President Lincoln signed the Morrill Act, championed by Justin Morrill who was a Vermont farmer and son of a blacksmith that never had an opportunity to go to college. Mr. Morrill was elected to Congress in the 1850s and began his push for legislation that would grant land in every state for establishing colleges to "feed, clothe and enlighten the great brotherhood of man" and to make higher education available to all citizens, not just the elite. Thus began what we now know as the Land Grant system of universities across our country. Subsequent legislation established the Agricultural Experiment Stations and Cooperative Extension Service, the other two legs of our three legged stool that stands on Research, Education and Extension. It's not hard to make the argument that our country's longstanding position as the world's leader in safe, efficient and sustainable food production is largely the result of Mr. Morrill's vision. Not only has the Land Grant system been an economic driver for agriculture and rural America, but many programs that came out of the education, research and extension missions are interwoven into the very fabric of our agri-culture, such as 4-H, county fairs and livestock “exhibitions”. We in the College of Agriculture and Life Sciences are proud of this legacy and proud to be able to continue in this service to you.

Sincerely,

Ronald Allen, Former Head
Department of Animal Sciences

Special thanks to Debbie Reed for compiling and editing this edition of the “Producer's Update and Research Highlights” and to Dr. Dean Fish and Barbara Jackson for organizing the Cattlemen's College.
Schedule

Cattlemen’s College

Arizona Cattlemen’s Association Convention
July 17, 2012
Prescott, Arizona

Presented by the University of Arizona Department of Animal Sciences

12:30  Introduction and Welcome

12:40  Life is About Relationships: a Communications Toolbox
Dr. Robert Milligan, Senior Consultant, Dairy Strategies LLC and
Professor Emeritus, Cornell University

1:40  Beef Quality Assurance and Adding Value to Your Calves
Dr. Dan Faulkner, Extension Beef Specialist, Department of Animal Sciences,
University of Arizona

2:10  Arizona Livestock Incident Response Team (ALIRT) Program Update and a Closer Look at
the Poisonous Plant Problem in Arizona
Dr. Peder Cuneo, Extension Veterinarian, Arizona Veterinary Diagnostic Laboratory,
University of Arizona

2:30  Adjourn
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Cover Photo Credit: David W. Schafer
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Alice S. Green, Xiaochuan Chen, Antoni Macko, Miranda J. Anderson, Amy C. Kelly, Ronald M. Lynch, and Sean W. Limesand

Removal of the Fetal Adrenal Medulla at 0.7 Gestation Alters Glucose-insulin Homeostasis at 0.9 Gestation: Role of Norepinephrine in Normal Versus Growth-restricted Fetal Sheep
Antoni R Macko, Dustin T Yates, Xiaochuan Chen, Miranda J Anderson, Amy C Kelly, and Sean W Limesand

Epinephrine Acutely Suppresses Glucose Oxidation in Rat Islets and Min6 cells
Amy C. Kelly, Dustin T. Yates, Alice S. Green, and Sean W. Limesand

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Dan Kiesling

Collegiate Cattle Growers Association
Dan Kiesling

Livestock Judging Team
Dan Kiesling

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David P. Matt and Kenleigh Hobby

Breeding and Farm Management Masters Program
Mark J. Arns

Faculty Bios and Research Interests

Department of Animal Sciences Faculty List and Contact Information
Proceedings
Life is about Relationships:
A Communications Toolbox

Dr. Robert Milligan
Senior Consultant, Dairy Strategies LLC
Professor Emeritus, Cornell University

Phone: (651) 647-0495
Email: rmilligan@trsmith.com

Dr. Robert A. Milligan is Senior Consultant with Dairy Strategies, LLC – a business, leadership and human resource consulting business focused on agriculture. Bob is also Professor Emeritus, Cornell University. At Cornell he was an award winning instructor in the top ten undergraduate business program. Bob is best known in extension for developing and leading the PRO-DAIRY Program – a program that developed and taught leadership and management principles and concepts. These ideas and materials have been used throughout the country. Bob's vision is to provide insight to managers by presenting complex human resource and business concepts in formats that are understandable and useable. Bob is a pioneer in Webinar teaching. He is co-author of a personnel management book for the Golf Course Superintendents of America and is a member of their teaching faculty and of the Cornell Dairy Executives Program. Dr. Milligan has received numerous teaching and extension awards including being named a J. Thomas Clark Professor of Entrepreneurship and Personal Enterprise and the National Association of Colleges and Teachers of Agriculture Teaching Award of Merit. Bob lives in St. Paul, Minnesota.

A Communications Toolbox –
As beef production becomes more complex and our ranches larger, a productive and focused workforce is increasingly critical to ranch success. Excellent communication and trusting relationships are the necessary ingredients. Participants will both a) better understand what it takes to become a great partner and/or supervisor and b) learn key communication/supervisory skills. Skills will include providing meaning to work, “chalking the field,” feedback and listening.
Communication Begins with Listening

When listening to, friends, family, employees, and co-workers; what percentage of the time do you listen:

- [ ] Pay little or no attention.
- [ ] Listen but you are also thinking about or doing other things.
- [ ] Listen but you are also thinking about how you are going to respond to what is being said.
- [ ] Listen with nothing else in your mind. Only after he/she has finished speaking do you begin thinking about how to respond.

100%

**Establish a realistic goal** for the percentage of the time you will listen with nothing else in your mind. Only after he/she has finished speaking do you begin thinking about how to respond.

**Goal** ________%

**Become a Better Listener**

1. Pause 1-2 seconds before replying
   - Show you are carefully listening
   - Avoid risk of interrupting
   - Hear the other person better

2. Ask questions for clarification
   - “What do you mean?”
   - “Tell me more?”
Relationships -- The Foundation

<table>
<thead>
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<th>Control Focused</th>
<th>Relationship Focused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees are costs. Supervisors (bosses) tell employees what to do</td>
<td>Employees are assets. The business and supervisor (coach) work to ensure that employees succeed</td>
</tr>
<tr>
<td>Compliance is expected of the employee</td>
<td>Supervisor is based on fairness and trust</td>
</tr>
<tr>
<td>Response to employee issues and problems is mostly reactive</td>
<td>Employee supervision is approached proactively</td>
</tr>
<tr>
<td>Supervision is focused on controlling employee behavior</td>
<td>Supervision is focused on developing the supervisor-employee interpersonal relationship so motivated and engaged employees will produce extraordinary results</td>
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</table>

The fundamental difference

- Control focused: The supervisor’s role is to control employee behavior.
- Quality or relationship focused: The supervisor’s role is to create the conditions where those they supervise can succeed and contribute in exceptional ways to the success of the business.

Unique Attributes of People

- People – employees – can think and make decisions.
- People – employees – can speak so they can ask questions and provide input.
- People – employees – can feel and thus have emotional responses.
Clarity or “Chalking the Field”

Answer the following question:
How clear are you about the expectations your supervisor has of you?
Use a 1 to 10 scale with 1 being complete clarity and 10 been complete lack of clarity.
Clarity Score ________________

Dr. Bob’s Four Characteristics of complete clarity
1. Every detail clearly explained
2. Explained why the expectation is important and/or needed
3. There are opportunities to ask questions and, where appropriate, provide input (engagement)
4. The detailed description can be accessed by the employee (employee manual, job description, policy manual, etc.

Each employee then requires clarity in three areas:
• Vision, mission, values (meaningful work)
• Behavior & performance expectations
• Daily tasks

Answer the following question:
How much clarity have you provided to those you supervise?
Use a 1 to 10 scale with 1 being complete clarity and 10 been complete lack of clarity.
Clarity Score ________________

In what areas can you improve the clarity of behavioral expectations, business policies, team operating rules, and job responsibilities for those you supervise?
Positive Performance Feedback

Why positive feedback:

To Motivate:
- Positive feedback is motivating. “Feelings of personal accomplishment” and “recognition for achievement” are two of Herzberg’s motivators.

To Improve Performance:
- Positive feedback focuses the recipient on success.
- Positive feedback builds confidence.
- Excellent, specific positive feedback engages the employee in their performance.

Use Positive Feedback to Coach the Development of Personal Capabilities

A. “Catch your employees doing something right.” - Ken Blanchard
B. Give four compliments for every constructive criticism.
C. Practice Appreciative Inquiry - The process of asking questions about what is going well, rather than what is going badly.

Providing Excellent Positive Feedback

Step 1: Observe good behavior.
Step 2: Compliment the employee on the positive behavior or performance you desire.
Step 3: State the specific current behavior or performance you are complimenting.

An Example

Step 1: You have been stressing the importance of attention to detail. You observe an example of attention to detail.
Step 2: “Jack, thank you for following through on our emphasis on attention to detail.”
Step 3: “I noticed you going out of your way to remove the leaves that had blown into the alleyway.”
Performance Feedback – Inadequate Performance

Responding to inappropriate behavior or inadequate performance

- Inadequate performance is when behavior or performance falls short of expectations.
- Don Shula (legendary football coach) in Everyone’s a COACH states “Good performance should always be treated differently than poor performance.” Although this seems almost obvious, most supervisors do not always follow this advice.
- Too often confronting inappropriate behavior or unacceptable performance is procrastinated. Meeting Coach Shula’s admonition requires:
  1. Being proactive.
  2. Understanding that not all inappropriate behavior and inadequate performance is intentional on the employee’s part.
- Redirection: Failure to perform was caused by the situation or the context of the performance – lack of training, ineffective supervision, unpredictable circumstances, unreasonable expectations.
- Negative: The situation cannot explain the failure; the failure to perform can only be explained by the employee's personal characteristics -- motivation, effort, commitment.
- The choice between redirection and negative is instrumental to successful supervision.
Redirection or Negative Feedback

For each situation below, decide whether you would use redirection feedback – the performance shortfall is caused by the situation/ context – and/or negative feedback – the performance shortfall is caused by the employee’s actions or lack of actions (energy, focus, motivation, etc.). Be prepared to explain your choice.

A. Julie, a full-time employee at a clothing store decided to take initiative in improving customer service by greeting each customer at the door. Even though the intention was good, there are now not enough employees to help customers make purchasing decisions.

B. Bill is a member of a four-person construction crew building new homes. All too frequently there are days (usually Mondays and Fridays) when his work is clearly unacceptable. You have talked to him on numerous occasions with little or no improvement.

C. The performance expectation for Ted, the short order cook in the conference center, is to prepare the grill items in 3 minutes or less. Ted has met and exceeded these expectations for several months, but recently, has been barely meeting and often failing to meet the expectation resulting in very long lines during the 12-2 p.m. rush.

D. Jean was hired three weeks ago to fill a vacancy at the local computer store. For the first 2½ weeks, Jean seemed to be doing exceptionally well with her training and seemed to understand what she needed to know about the products focused on during each day’s training. Recently, however, she seems to be confused about the new products and even some of those previously discussed.
Dr. Bob Milligan’s Reading List


# Key Takeaways and Next Steps Worksheet

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<th>Key Insight</th>
<th>Next Step</th>
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<td>Control vs. Relationship Building</td>
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<tr>
<td>Clarity - “Chalking the Field”</td>
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<tr>
<td>Performance Feedback</td>
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Removing horns and castrating bull calves is the first management step to increase value. Preconditioning programs offer further opportunities for producers to improve the market value of their calves. There is a BQA preconditioning program for the state of Arizona or many pharmaceutical companies have programs. Calves that have been preconditioned generally bring a premium compared to other calves. This premium has been as high as $10 per cwt in some sales.

Developing a breeding program that creates a group of calves that are uniform in color, size and muscling should be a priority. Producers should not give up the advantages of crossbreeding, but a breeding program that involves Angus (black) genetics could maximize income. Generally the premiums are at least $20 per head and they seem to be getting larger over time. Crossbred bulls are one way to maintain desired breed composition and still take advantage of heterosis.

Once basic breeding and management programs are in order, producers can enroll in programs to add further value to their cattle. Process verified programs (PVP) have gone through USDA to document and define a system of management needed for verification. These programs include auditing the producer to make sure the program is followed. The programs will also satisfy Country of Origin Labeling (COOL) requirements. For a complete list of programs go to [http://processverified.usda.gov/](http://processverified.usda.gov/).

Producers can put in tags and enroll their cattle in age and source verification programs as a marketing tool for their calves. There are PVP with other requirements besides age and source verified. These include Naturally Raised (no hormones or antibiotics), Organic, animal care, or are associated with a breed of cattle.

The cost of PVP varies with the different companies. Producers don't need to buy readers, scanners, computer software and all the other equipment to fully utilize the EID tags. Producers can put EID tags in the calves and fill out paperwork to enroll the calves without all the equipment. The cost for the tags and enrollment is generally between $3-8 per head depending on the program. These programs will usually offer producers premiums beyond “commodity beef”.

Naturally Raised or Organic markets continue to grow and allow producers an alternative to traditional systems. Cost differences are small for the cow-calf producer but can be quite large in the feedlot. Current USDA Organic standards require that cattle have access to pasture. Naturally Raised cattle can’t have antibiotics or implants for either their lifetime (never ever) or in the feedlot depending on the PVP utilized. It is important to understand the increased costs associated with these programs to evaluate the potential economic benefit of Naturally Raised programs. It is also important to identify a market that will pay a sufficient premium to cover additional production and transportation costs prior to starting a Naturally Raised program.

Developing a program to add value to your calves is a high priority if you want to capture increased value. There are substantial premiums available for producers willing to go to the effort to enroll in PVP and follow the guidelines. The premiums become larger as the standards become more stringent. Naturally Raised or Organic feeder cattle have the most stringent standards and the highest premiums at this time.

The 2011 National Beef Quality Audit suggests that “how and where the cattle are raised” is important throughout the supply chain to meet consumer expectations. This information will likely be required for participation in programs in the near future.
**Beef Quality Assurance and Adding Value to Your Calves**

Dan B. Faulkner
Extension Beef Specialist
University of Arizona

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Arizona BQA is a joint effort of:
- Arizona Cattle Growers' Association
- University of Arizona
- Arizona Department of Agriculture
- Allied Industry Partners

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<table>
<thead>
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<th>Primary focus includes Training in:</th>
<th>Secondary Focus:</th>
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<tr>
<td>Record Keeping</td>
<td>Development of a certified pre-conditioning program</td>
</tr>
<tr>
<td>Care and Husbandry Practices</td>
<td>Minimize animal health problems</td>
</tr>
<tr>
<td>Processing/Treatment</td>
<td>Assure buyer the animal has received adequate pre-shipment conditioning</td>
</tr>
<tr>
<td>Injectable Animal Health Products</td>
<td>Three levels</td>
</tr>
<tr>
<td>Feedstuffs/Feed Additives and Medications</td>
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**Process Verified Programs (PVP)**

- Large number of programs
- Basic program is “Age and Source”
- Additional premiums for “Naturally Raised” or “Organic”

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**The National Beef Quality Audit 2011**

Driving Change

Executive Summary
The Phases of the Audit

- Phase I - Determine how each market segment defines seven identified quality categories
- Phase II - Assess the current status of quality and consistency of U.S. fed steers and heifers
- Phase III - Quantify cattle producer BQA-related practices
- Strategy Workshop - 41 representatives representing each sector met in Denver to review results and discuss implications for U.S. beef industry

Based on the results of the survey, what are the -

“Challenges Facing the Industry?”

Changes in Challenges (1991-2011)
Identified by the NBQA

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<tbody>
<tr>
<td>(1) External fat</td>
<td>(1) Color Uniformity</td>
<td>(1) Tenderness</td>
<td>(1) Marbling</td>
</tr>
<tr>
<td>(2) Excessive weight</td>
<td>(2) Tenderness</td>
<td>(2) Uniformity of cuts</td>
<td></td>
</tr>
<tr>
<td>(3) Injection site in meat</td>
<td>(3) Exposure of meat</td>
<td>(3) Uniformity of cuts</td>
<td></td>
</tr>
<tr>
<td>(4) Searl fat</td>
<td>(4) Overall palatability</td>
<td>(4) Flavor</td>
<td>(4) Flavor</td>
</tr>
</tbody>
</table>

Examples of Phase 1 Challenges:

The entire industry prides itself on humane animal treatment but, retailers, foodservice and packers are under additional customer/societal pressures to ensure humane treatment.

Barriers to Continued Progress

1. A low level of written protocols
   - Many producers rely on habit or memory. (Only 31% of respondents said they used a written protocol)
   - BQA and record-keeping must become more consistent throughout the supply chain

2. Balancing the needs of all industry segments
   - The market signal throughout the chain is based on price-per-pound. This signal may not be the only one to communicate
   - The industry MUST create a system that transmits information and data flow and communicates the proper signal throughout the supply chain
3. Lack of trust among industry segments

- Transparent and accurate information-sharing between segments would increase trust and build a more authentic and sustainable beef industry.
- Because of low information flow, many cattle processing procedures are duplicated unnecessarily adding cost.
- 100% of feedyards had active BQA programs but only 38% required suppliers to be BQA-certified and only 25% of truckers were properly trained.

4. Disconnect with dairy beef

- Dairy animals supply a significant portion of the beef marketed and communicating the importance of BQA is crucial either through veterinarians, managers, milk coops or directly.
- 9.5% of carcasses were from dairy animals but fewer than half (44%) of dairy respondents attended a program that taught BQA principles.
- The goal for conformance on withdrawals must be the same for both dairy and traditional beef: 100%.

5. Carcass inconsistency

- The industry must eliminate costly non-conformers and provide better market signals that lead to better selection, production practices and post-harvest fabrication.
- As an example, for ribeyes, more than 25% were outside the 12-16 sq inch range creating inconsistencies that cause issues up the chain.
- Produce cattle with appropriate yield and quality grades.

A challenge is to improve consistency

5. Continued:

- New growth enhancements and production practices have led to tremendous efficiency in our industry.
- All technologies and practices must have substantial rationale and meet the needs of both domestic and international consumers.
6. No common language

- Different segments of the industry define terms like food safety, animal welfare and product quality in completely different ways.

- Each segment of the supply chain defines value differently. For example, cow-calf producers may not see the increasing value of cattle in branded beef programs.

When you ask a rancher "What is your definition of quality?"

<table>
<thead>
<tr>
<th>Trait</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthy cattle</td>
<td>1</td>
</tr>
<tr>
<td>Safe and wholesome beef</td>
<td>2</td>
</tr>
<tr>
<td>Eating satisfaction</td>
<td>3</td>
</tr>
<tr>
<td>Free of defects</td>
<td>4</td>
</tr>
</tbody>
</table>

When you ask a rancher "How do you influence quality?"

<table>
<thead>
<tr>
<th>Method to improve</th>
<th>Ranking by Cow-calf producers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal handling</td>
<td>1</td>
</tr>
<tr>
<td>Health program</td>
<td>2</td>
</tr>
<tr>
<td>Nutrition program</td>
<td>3</td>
</tr>
<tr>
<td>Genetics</td>
<td>4</td>
</tr>
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</table>

Identified Challenge:

- Terminology about “quality” is not consistent nor is it standardized.

- To reduce consumer confusion, definitions must be consistent.

Do We Define “Quality” with Similar Language?

<table>
<thead>
<tr>
<th>Sector</th>
<th>Food safety</th>
<th>Eating satisfaction</th>
<th>How and where cattle were raised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeders</td>
<td>Produce a safe and wholesome product</td>
<td>Tenderness</td>
<td>Received a vaccination program</td>
</tr>
<tr>
<td>Packer</td>
<td>No detectable E.coli O157:H7</td>
<td>Tenderness</td>
<td>Animal well-being</td>
</tr>
<tr>
<td>Retailer</td>
<td>Produced in food safety environment</td>
<td>Flavor</td>
<td>Origin of product</td>
</tr>
<tr>
<td>Food Service</td>
<td>Tested for pathogens</td>
<td>Flavor</td>
<td>Animal well-being</td>
</tr>
<tr>
<td>Government and Allied industries</td>
<td>Everything</td>
<td>Tenderness</td>
<td>Practices</td>
</tr>
</tbody>
</table>

7. Potential FOOD SAFETY Issues

- Although the U.S. beef industry has a stellar food safety record, emerging pathogens lurk on the horizon and the industry must monitor closely.

- E.coli strains and salmonella remain a concern.

- Must be addressed by solid research, industry interventions and communication to consumers.
8. Tell the story of beef production

- The industry must "step up its game" when it comes to telling consumers what it does and why it does it

Out of the Strategy Session, Three Broad Emphasis Areas Emerged

1. Product Integrity
2. Eating Satisfaction and
3. Proactively tell the beef story

As an industry, how do we drive change?

Top Priorities for Food Safety and Animal Health

1. Develop and implement animal ID-sharing system
2. Develop effective full supply chain safety interventions
3. Increase focus on E. coli and salmonella
4. Implement BQA and demonstrate conformance through written records
   - Encourage dairy and veterinarian BQA engagement
   - Continuously improve health of calves and feedlot cattle

Eating Satisfaction

Premium value could be captured if tenderness and flavor were consistently provided

Priorities to Improve Eating Quality

1. Develop an information system to improve supply chain coordination in the industry
2. Develop strategies for management and determination of the impact of beta-agonists
   - Match growth promotant strategy to specific production systems/consumer targets
   - Increase research funding to improve eating satisfaction
   - Use genetics to optimize cutability and palatability
### Priorities to Optimize Value and Eliminate Waste

1. Develop and implement an effective animal identification-sharing system
2. Enhance market signal/communications between sectors of the industry
3. Reduce the extremes in REA, fat thickness and carcass weight
4. Define more precisely the product/weight inconsistency problems
5. Document the economic value/market recognition of BQA

### Has the BQA effort been successful?

When responding to “Visual Characteristics” the items not mentioned in this survey were:

- injection site lesions
- hide damage due to mud/brands
- liver condemnations

### Themes from the data:

**Concerns expressed about**

1. animal welfare,
2. how and what animals were fed,
3. origin of the product,
4. hormone, antibiotic and feed additive use

### Telling our Industry’s Story

- Beef Quality Assurance is an industry success
- Beef producers operate for more than just a profit motive
- Animal welfare has always been a top priority for cattlemen
- The industry has a terrific story to tell when it comes to:
  - Food safety
  - Flavor of the product
  - Tenderness

### The industry must be authentic, honest and transparent

Negative issues must be dealt with quickly, openly and honestly
Arizona Livestock Incident Response Team (ALIRT)

Peder Cuneo

The University of Arizona Veterinary Diagnostic Laboratory
Tucson, Arizona

Phone: (520) 621-2356
Email: cuneo@email.arizona.edu

An animal health crisis in your herd is just a matter of time, “NOT IF .....BUT WHEN”. This may impact a significant number of animals in your herd, or a significant number in a specific geographical area. Either way, diagnosis may be costly, slow or inconclusive. The ALIRT Program has been designed to address these issues and improve diagnostic success rate. The sooner a potential incident is identified and a response is activated, the better the opportunity to minimize economic impacts and to protect public health.

Who is ALIRT?

ALIRT is a response team composed of Veterinarians, University of Arizona Cooperative Extension, Department of Agriculture Livestock Officers and other specialists as dictated by the situation.

What is ALIRT?

ALIRT is designed to enhance the diagnosis of unexplained animal deaths. It was developed by the Arizona beef industry, industry related agencies the Arizona Department of Agriculture and the University of Arizona College of Agriculture and Life Sciences. The ALIRT goal is to minimize response time during an animal health crisis. Collection of critical information and timely, adequate laboratory analysis are often the keys to a successful diagnosis. ALIRT is NOT designed to respond to normal production animal health events or to replace normal responses between producers and veterinarians. However, if after examination by a veterinarian a potential general threat is perceived, ALIRT intervention may be warranted.

What is the Producer's First Step

ALIRT will only respond at the invitation of the owner or manager, or in response to specific agency requests. If you suspect a health problem, contact your local veterinarian, ALIRT Veterinarian, the local University of Arizona Extension Office or an Arizona Department of Agriculture Livestock Officer. It is imperative to call as soon as a problem is suspected. The Arizona climate degrades carcasses quickly and can greatly reduce the amount of material available for examination and sampling. Without samples for laboratory testing finding a definitive diagnosis is much more difficult and in some cases impossible. The producer will also need to compile a herd history with respect to health programs, pasture moves, supplementation, contact with outside livestock, etc.

ALIRT Telephone Numbers:

Office of the Arizona State Veterinarian 1-888-742-5334
Arizona Veterinary Diagnostic Laboratory 1-520-621-2356

Scene Preservation and Biosecurity

At this time it is important to minimize disturbance at the location the animals are found. It is important to view the scene as a potentially infectious site. This action and attitude is imperative if an infectious disease is to be contained, controlled, and eradicated before major harm can be inflicted on the cattle industry. It is important that access be limited to prevent possible contamination of other areas and other livestock.
What Information is Needed for ALIRT?

- Type and number of livestock ill, dead or dying
- Type and duration of symptoms exhibited
- Herd history over the last 30 days:
  - Herd movements
  - Type and amount of supplements
  - Animal handling and processing
  - Vaccinations
  - Spray application
  - Parasite control
  - Castration/Branding
- Pasture information, including fertilization, irrigation, poisonous plants, etc.
- Recent weather events
  - Frost
  - Rain
  - Lightening
- Location and directions to animals or to contact point
- Ranch contact information, including telephone numbers for ALIRT committee to respond
Producer’s Update
and Research Highlights
Management Techniques to Improve Feed Efficiency

Sam R. Garcia, John A. Marchello, James D. Allen, LaunW. Hall and Tyler E. Dal Molin
Department of Animal Sciences
The University of Arizona

Arizona’s feedlot industry is mainly composed of Holstein cattle. Cattle’s feed efficiency can be greatly reduced by extreme heat that is experienced during the summer months. Feed efficiency is compromised due to the elevated temperatures, causing a reduced feed intake, reduced body weight gain, and death in extreme cases (Mader et al., 2002). Davis et al., 2003, propose that by changing cattle’s feeding time and the amount of feed fed can reduce body temperature of feedlot cattle. Mader and associates 2002 suggest that limit feeding is a proven, successful management technique that reduces the negative effects of climatic and metabolic heat load, therefore improving animal comfort. Even though there are benefits to limit-feeding, Felix and associates 2011 suggest that it can result in a decreased percentage of carcasses grading USDA Choice or better. Also, reported by McCurdy et al., 2009 that cattle that are placed on a grass-growing program before finishing, will cause them to have lower marbling scores compared to cattle finished right after weaning. However, there will be no significant difference if cattle are fed grain during the growing phase (similar to limit-feeding). Furthermore, if all cattle are fed to the same fat thickness (12th rib) end point, there will not be any significant difference in carcass quality and composition (McCurdy et al., 2009).

There are other factors that can contribute to reduce feed efficiency in cattle. Extreme bird predation will cause feed efficiency to decrease and cost per pound to increase. Bird predation in feeding operations has been an issue for several decades (Lee, 1987), where both migratory and sedentary bird populations can be responsible for grain losses (Dolbeer et al., 1978). Most bird predation studies have been performed in the Midwestern United States, where bird predation is caused mainly by European starlings, especially during the winter months (Depenbusch et al., 2011). In the southern Arizona, other species, including feral pigeons and various dove species, are more prevalent in cattle operations. Previous research has reported this unique Arizona bird population is capable of consuming approximately 20% of the corn in a 77.5% corn-based diet fed to feedlot cattle within 6 hours of feeding and 30% within 24 hours of feeding, which may result in decreased cattle performance (Allen et al., in press).

There are many approaches to feeding cattle. Limit-feeding is a management practice that manipulates feed intake to better utilize nutrients and to improve feed efficiency (Wertz et al., 2001). Additionally, animals that have undergone nutrient restriction will have compensatory gain when nutrients in excess are present (Reinhardt et al., 1998). This presents an opportunity to manage cattle’s harvest time (harvest cattle at a more profitable time). Lower intake will cause the rate of passage to be slower allowing more digestion and absorption to occur. Consequently, long-term ruminal health is improved (Reinhardt et al., 1998). This program is designed to target a specific average daily gain allowing the animal to have constant growth. This constant growth allows cattle to have a better structural development, resulting in greater REA’s, thus more muscle at the same body weight of non limit-fed animals (Felix et al., 2011). Moreover, McCurdy et al., 2009 reported that undergo a growing program will have higher HCW when compared to cattle that were fed a finishing diet right after weaning; suggesting that frame development is very important. Furthermore, cattle that are limit fed have lower daily intake and highest feed efficiency when compared to cattle fed at libitum (Loerch and Fluharty, 1998).

Materials and Methods

A study was designed at the University of Arizona to determine if limit-feeding is beneficial for use in Arizona. The start date was February, 16 2012. 40 steers and heifers were separated into eight pens by weight and sex, 4 pens received at libitum feed (2 steers and 2 heifers) and 4 received a limited intake ration (2 steers and 2 heifers). Steers
were weighed upon arrival to the feedlot and every 28 days after. Fat thickness measurements are obtained by using an ultrasound. Ultrasound readings will be initiated once steers reached 900 lbs. and every 28 days until desired back fat thickness is reached. Steers will be harvested when fat thickness at the 12th rib reaches 1 cm. Steers that do not reach 1 cm fat thickness will be harvested when weight gain plateaus. Boleman 1998 suggest that “the optimum steer should possess sufficient marbling (0.4” of fat thickness opposite the ribeye) and still maintain a yield grade in the 2.0-2.9 range”. Following this method allows for the determination of the necessary fat thickness to obtain the optimum yield and quality grade. Feedlot performance, carcass merit, chemical composition and fatty acid analysis data will be collected and analyzed.

To further quantify the impact of birds on feeding operations in Arizona, a follow-up study to Allen et al. (in press) is being performed at the University of Arizona feedlot. Eight pens of growing cattle are separated into 2 groups: open feed bunks that allow bird predation and feed bunks covered to prevent bird predation (Figure 1). All pens receive the same 76.4% corn-based diet (Table 1). Diet samples from the feed bunks are sampled at 0, 7, and 24 hours after feeding. These will be analyzed to distinguish impact between bird and cattle on diet nutrient changes across time (i.e. how well the birds are at sorting versus how well the cattle are at sorting). Cattle body weights are recorded every other week. These data will determine the impact of bird predation on cattle performance.

Table 1. Step 5 Finishing Diet

<table>
<thead>
<tr>
<th>Commodity</th>
<th>% of Ration</th>
</tr>
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<tbody>
<tr>
<td>Corn</td>
<td>76.39</td>
</tr>
<tr>
<td>Alfalfa</td>
<td>9.11</td>
</tr>
<tr>
<td>Molasses</td>
<td>6.28</td>
</tr>
<tr>
<td>Soybean Meal</td>
<td>4.19</td>
</tr>
<tr>
<td>Mineral Mix</td>
<td>2.13</td>
</tr>
<tr>
<td>Pre-mix (Rumensin/Tylan)</td>
<td>1.00</td>
</tr>
<tr>
<td>Urea</td>
<td>0.90</td>
</tr>
</tbody>
</table>

Figure 1. Covered Bunk and Steer Feeding
Results and Discussion

Although the study is ongoing, preliminary data shows the following. Initial body weights range from 487.5 lbs to 595 lbs. As of May 16, 2012 weights range from 737 lbs to 907.6 lbs. Average daily gains (ADG) for all pens range from 2.34 lbs to 3.36 lbs. Feed to gain range from 5.74 lbs to 7.20 lbs. Results show that feed efficiency is improved by excluding the bird population from the bunk as shown in figure 1. It appears that limited feeding has no effect on feed efficiency. ADG is higher for full fed cattle as it was expected.

Table 2. Feedlot Performance as of May 18, 2012

<table>
<thead>
<tr>
<th>Item</th>
<th>Limit Fed</th>
<th>Full Fed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pen 1&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Pen 2&lt;sup&gt;a,b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Initial BW&lt;sup&gt;¹&lt;/sup&gt;, lbs</td>
<td>578.8</td>
<td>507</td>
</tr>
<tr>
<td>Final BW, lbs</td>
<td>825</td>
<td>737.5</td>
</tr>
<tr>
<td>ADG&lt;sup&gt;²&lt;/sup&gt;, lbs</td>
<td>2.65</td>
<td>2.47</td>
</tr>
<tr>
<td>F:G&lt;sup&gt;³&lt;/sup&gt;, lbs</td>
<td>6.79</td>
<td>6.44</td>
</tr>
</tbody>
</table>

<sup>a</sup> Heifers  
<sup>b</sup> Covered Bunks  
<sup>¹</sup> Average Body Weight  
<sup>²</sup> Average Daily Gain  
<sup>³</sup> Feed to Gain
Efficacy of Treating Pathogen Contaminated Food with Trichloromelamine and Ozone

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Introduction

Foodborne diseases are an important public health problem. The actual reporting of foodborne and waterborne diseases in the United States began over 60 years ago when diseases began presenting themselves with high morbidity and mortality. Outbreaks of disease can often be traced back to foodborne or waterborne sources. Surveillance for disease outbreaks is important in preventing and controlling diseases. By investigating outbreaks, control measures in food production can be placed to reduce contamination by foodborne pathogens. Surveillance of outbreaks is also critical in identifying new and emerging pathogens, and it allows epidemiologists to monitor trends so they can improve food safety measures.

In this study, Trichloromelamine (TCM), a sanitizing agent and ozone, a more consumer friendly and less expensive disinfectant, were tested for their antimicrobial effects. Ozone seems to produce fewer carcinogenic by-products than chlorinated products. TCM is typically very effective at killing potential pathogens if the chlorine content is high enough. There have been several studies showing that ozone is also sufficient for killing bacteria. The purpose of this study was to determine how effective these antimicrobials were through the contamination and treatment of beef samples. Results could then help determine the best method for treating meat.

Methodology

Method #1:

Sample Preparation. Three round cores of meat were removed from beef eye of the round with the use of a stainless steel corer. The corer was sterilized in boiling water before and in between each use. All three cores of meat were also sterilized by using tongs and placing each sample, one at a time, in boiling water for 10 seconds each. After sterilization, each core of meat was cut in half with a sterilized knife on a cutting board that had also been sterilized with boiling water (Figure 1). Meat cores were then ready to be inoculated with common foodborne pathogens.

Inoculum Preparation. Fecal material was collected to prepare coliform and E. coli O157:H7 inoculation material.

Figure 1. Beef core preparation. Beef cores sterilized in boiling water were cut in half using sterilized utensils.

¹Ms. Loren Schneider conducted this research for an honors thesis for the Honors College at the UA. She will start her Veterinary degree program at Colorado State University this fall.
Inoculation of Beef Samples. Each beef sample was separately inoculated with 1 ml of solution containing coliforms and *E. coli*. For each meat core, the 1 ml of inoculum was added drop-wise over the inside surface of one half of the core (Figure 2). The drops were spread evenly on the surface of the meat, and for the control sample, the remaining core half was immediately placed on top of the inoculated half to cover the sample. The cores were closed together to provide an anaerobic environment for growth. The other two cores were sprayed with antimicrobials after inoculation and before they were closed together: inoculation followed the same procedure as done with the control sample, but one core was sprayed and soaked in Trichloromelamine (TCM) before being closed. The third meat core was sprayed and soaked in ozone before the core halves were closed together.

**Figure 2. Inoculation of beef.** Prepared inoculum was added drop-wise to the inside of one half of the beef core. Inoculum was spread evenly over the surface of the core half.

Storage of Beef Samples. After each of the meat samples had been inoculated and closed, each core was placed in a sterile Styrofoam tray using tongs sterilized in boiling water. Each tray was placed in an 8” x 12” plastic bag being careful not to let the bag touch the meat samples (Figure 3). The ends of the bag were folded over to close the bag and each sample was stored at 38ºF for five days.

Testing of Microbial Levels on Beef Samples. After storage, trays containing the meat samples were removed from the bags, and sterilized tongs were used to open the core halves. A sterile cotton swab, moistened in sterile deionized water and squeezed of excess liquid, was rolled over the surface of one core half that had been sprayed with ozone (Figure 4). After swabbing, the tip of the swab was broken off into a dilution bottle with sterile deionized water. Swabbing was performed twice on both core halves for ozone. The swabbing procedure was also performed twice on each core half for the control beef sample and for the sample sprayed with TCM. Each sample swab was placed
in separate dilution bottles. Tongs used to open each of the samples were sterilized between each sample. Dilution bottles were inverted multiple times for a homogenous mixture. Ten ml of each solution for each sample was poured on a SimPlate and each SimPlate was incubated at 90°F for 8 hrs.

Method #2:

Sample Preparation. Meat cores were prepared for pathogen inoculation using the same procedure in Method #1. Inoculation of Beef Samples. Each beef sample was separately inoculated with 1 ml of the provided sample of *C. jejuni* or *Salmonella typhimurium*. For each core, 1 ml of inoculum was added to each meat core half according to the same procedure in Method #1. After inoculation, two of the cores were separately sprayed, one with TCM and one with ozone. The control sample was not sprayed with any disinfectants. Again, each of the cores was closed together to provide an anaerobic environment for growth.

**Figure 4.** Swabbing of beef. A sterile cotton swab that had been moistened in sterile deionized water was rolled over the surface of each core half to collect the bacteria.

**Figure 5.** Agar was added and plates were incubated at 90°F for 48 hrs. for total count of bacteria.
Storage of Beef Samples. Meat cores were stored according to the same procedure in Method #1 (Figure 3).

Testing of Microbial Levels on Beef Samples. After storage, trays containing the meat samples were removed, and sterilized tongs were used to transfer the cores to new sterile bags. The sterile tongs were used to open the cores and flip the cores inside out so that the infected area of the meat was exposed. Sterile deionized water was added to each bag containing a meat core. The meat cores were rubbed together in the water to wash any pathogens into solution.

For each of the three samples (control, ozone, and TCM) 0.1 ml of solution was transferred from the bag to an agar plate and spread over the surface with a sterile spreader.

Potency Test for Antimicrobials:

For each use of ozone, a new solution was produced and tested with a meter to check the oxidation-reduction potential. The higher the oxidation-reduction potential of the ozone will provide a stronger sanitizing potential.

Graph 1. Percent prevalence of coliforms that were killed after treatment with either TCM or ozone.

**Decrease in Coliforms After Treatment**

![Decrease in Coliforms After Treatment](image)

Figure #6. SimPlates were observed for *E. coli* and coliform contamination. Pink wells are positive for coliforms. Under UV light, fluorescent wells are positive for *E. coli* contamination.
Trichloromelamine was tested with chlorine test strips by spraying the strips with the solution and comparing the color change to the colors provided on the test vial. Only TCM solutions that had a 200 ppm reading were used for treatment.

Results

Method #1:
Meat sample SimPlate results were read for the control, ozone, and TCM samples (Figure 6). Ozone treatment for coliform and *E. coli* showed little killing of these organisms. TCM treatment decreased coliform count 82.3%, and *E. coli* was a 98.2% decrease (Graph 1 & 2).

Method #2:
Testing of *C. jejuni* inoculum on MHB agar revealed that the inoculum concentration used was over 13,000 bacteria. The ozone decreased the amount of bacteria to 68.5% (Graph 3). With the TCM no bacteria were detected with a 100% decrease in *C. jejuni* pathogens (Graph 3).

Method #3:
Meat sample infected with *Salmonella typhimurium*, ozone resulted in a 61.3% decrease and for the TCM, a 0% decrease was noted. (Graph 4)

Conclusions

With foodborne diseases being such an important health problem, it is necessary to find an effective method for producers to sanitize their products. While disinfecting the products so that no pathogens can be transmitted is the main concern for producers (and the public), it is also preferred that the sanitizing solution is cost efficient and

Graph 2. Percent prevalence of *Escherichia coli* bacteria that were killed after treatment with either TCM or ozone.
Graph 3. Percent prevalence of *Campylobacter jejuni* bacteria that were killed after treatment with either TCM or ozone.

**Decrease in C. jejuni After Treatment**

Graph 4. Percent prevalence of *Salmonella typhimurium* bacteria that were killed after treatment with either TCM or ozone.

**Decrease in S. typhimurium After Treatment**
consumer friendly as well. By comparing the effectiveness of two differing disinfectant solutions, one can determine which product would be better to use for production purposes.

Trichloromelamine has been shown to work well as a food sanitizer. Results from the TCM portion of this study are conflicting. In the first treatment of coliforms and *E. coli*, TCM was effective at decreasing the coliforms by 82% and the *E. coli* bacteria by 98%. TCM was also effective in killing *C. jejuni* since no bacteria were detected after the treatment. However, in the *Salmonella typhimurium* test, the TCM did not decrease the pathogen count at all. TCM may be more effective on certain types of bacteria than others. It appeared to be extremely effective for all other bacteria used aside from the *Salmonella*.

Ozone is another disinfectant that has been shown to be great for use as a decontaminating agent. Results for the ozone portion of this study were also somewhat conflicting. When used to treat *E. coli* and coliforms, the ozone seemed to have no effect on killing the pathogens. When treating *C. jejuni* there was a 68% decrease in the bacteria, and when treating *S. typhimurium* there was a 61% decrease. Although the oxidation-reduction potential of the ozone was always above 700 mV, there was not a huge decrease in the amount of bacteria as was expected. Perhaps, like TCM, ozone may only be effective at killing certain types of bacteria. Unlike other studies, this study has found that ozone was ineffective in killing the common pathogen *E. coli* and coliforms.

Although both results for TCM and for ozone are conflicting and unclear, one might assume that TCM would be more effective at killing foodborne pathogens than ozone. Since there was a sharper decrease in the amount of bacteria than when the ozone was used to treat contamination, TCM may be the better option for producers wanting to disinfect their meat products. However, more studies need to be done to confirm the effectiveness of TCM and ozone since the results were so skewed. Also, further testing of chlorine content in TCM and effectiveness should be looked into more. If there is a correlation between the amount of chlorine in the solution and the bacteria that are killed, there may be an explanation for why not all the bacteria were killed by TCM. In order to ensure safety, the best products for killing pathogens need to be used, and more studies on antimicrobial effectiveness need to be performed.
Soft Tissue Chemical Composition Comparison of Beef Cattle; A Grain-fed, Grass-fed Comparison

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The University of Arizona

As research continues to be published regarding the feeding regimen and carcass composition of beef cattle, two distinct classes of beef have emerged within the market place. Grass-fed beef, as it is called, has gained, and will undoubtedly continue to gain, popularity in the eyes of consumers as the beef of choice, with regards to health benefits. Grain-fed beef, the other dominant class, still maintains a significant hold upon the hearts (and appetites) of consumers because of its palatability. Research has and will continue to be performed in this area of the beef industry and this article will highlight research that has been completed and that which is ongoing at the University of Arizona, looking further into the differences of these classes of beef, as well as, the factors that cause these various changes.

Introduction

Easily seen in consumer trends is a growing desire to consume beef of lower fat content (Daley, 2010). Whether this is scientifically supported or not, consumers have begun to switch to demanding a leaner cut of meat. Since the 1950’s, the majority of beef consumed in the United States has been fed in feedlots for at least a finishing portion of their life (Daley, 2010). In confined animal feeding operations, such as feedlots, high concentrate diets are fed in order to decrease the time housed there, as well as increase carcass quality. This leads to what is termed in this paper as grain-fed beef. As consumers switch to the desired beef with lower quantities of total fat, the traditional beef is found to be less desirable. This switch in consumer preference has led to the development of what is commonly termed and what this paper will refer to as grass-fed beef. This simply means a beef animal that has been fed a lower concentrate, higher roughage-based diet.

Research Plan

(Including concluded and ongoing research)

In an attempt to better understand and publish the characteristics of these two classes of beef a research plan was developed and implemented. With decades of research having already been conducted in grain-fed vs. grass-fed comparisons, it is not necessary to repeat a simple direct comparison. Through all of this research, interesting caveats have been found. For instance, it has been shown that much of the fatty acid profile is a direct product of rumen hydrogenation. This is due largely to the low levels of fat consumed in the diet, but also has been shown to
be a product of rumen pH and its effect upon microbe population within rumen (Bessa, 2000). In fact, Butyrivibrio fibrisolvens, a microbe found in rumen of grass-fed cattle has been shown to elicit a direct effect on the presence of conjugated linoleic acid in fat tissue, which is another reported benefit to grass-fed beef. This particular microbe is extremely sensitive to pH changes. Therefore, as concentrations of starches increase in the diet, which is common in grain-fed diets, the pH of rumen decreases. This has a detrimental effect upon populations B. fibrisolvens, thus accounting for shown differences in amounts of CLAs present in grain-fed vs. grass-fed comparisons (Bessa, 2000).

As a follow up to this research, very little has been done to show if fatty acid profile can be influenced by feed stuffs within the grass-fed realm. For instance, can various grasses with varying protein, carotene, and cellulose concentrations further effect the profile of the end product? This is one of the aspects of the proposed research. To perform this research, 4 groups of beef steers (Groups A, B, C, and D) were acquired and placed upon differing feed regimens all within the same climate parameters. Group A was fed a high concentrate diet in a confined animal feeding operation. This group served as a control; a traditional feeding regimen. Group B was placed upon native pasture and consumed free choice native grasses, largely comprised of Love grasses and Grama grasses. Group C was placed with Group B in the same pasture. (The importance of Group C will be highlighted below.) Finally, Group D was placed upon irrigated pasture, composed primarily of Bermuda grasses for summer ration and barley for winter ration. Number of cattle within these groups was eight. None of the animals were given any form of growth promoting implants. Within the groups highlighted above, breed variations were minimal and believed to have little effect upon results. Steers were also equal in weight and age within groups at beginning of study.

The steers in Groups B and D were used to quantify the effect of varying grasses upon the fatty-acid profile. Both groups remained upon the above mentioned pasture for the duration of feeding time, which was determined by body weight. All animals were weighed every twenty-eight days throughout the study.

Upon harvesting, a portion of the ribeye muscle was collected and will be analyzed using gas-liquid chromatography (GLC) to determine fatty-acid profile. This data will then be quantified and compared to determine if any correlations exist between feedstuffs and resultant profile within the grass-fed realm.

In order to further understand fatty acid profile changes, Group C was withdrawn from the native pasture and moved to the confined feeding operation. They were withdrawn at approximately 650 pounds. Upon moving to the confined animal feeding operation, a tail head biopsy was performed, removing fat tissue to determine fatty acid profile of the native grass diet for grass-fed beef. They were then placed upon the high-concentrate diet. After 45 days of this diet, a second biopsy was performed to determine what changes had occurred within the profile up to that point. Data was also gathered after harvesting to see the end point profile.

Then the three profiles (two biopsies and end point profile) will be analyzed and profile changes will be quantified. This data will then be compared to the data from Group A and Group B, which, in this part of the study, will function as controls. With the data from the three groups, a comparison can be drawn to determine changes in profile and correlate the data with the documented increase in palatability, if one exists, from the higher concentrate diet. The interpretation of data sets will then show a point of profile turnover after being placed in a confined feeding operation to increase palatability, thus catering to traditional taste preferences of consumers.

Yet to be conducted are blind sensory panels, which will be used to determine palatability, flavor intensity, tenderness

<table>
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<tr>
<th>Treatment</th>
<th>Condition</th>
<th>Starting Weight (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>Feedlot for duration of study</td>
<td>445</td>
</tr>
<tr>
<td>Group B</td>
<td>Native grass for duration of study</td>
<td>454</td>
</tr>
<tr>
<td>Group C</td>
<td>Native grass with transition to feedlot at 650 pounds</td>
<td>431</td>
</tr>
<tr>
<td>Group D</td>
<td>Irrigated pasture</td>
<td>442</td>
</tr>
</tbody>
</table>
and color appeal of the four groups or classes of meat product. This information collected regarding consumer preference, will then be compared to the changes found within the fatty acid profile, and more significantly chemical composition of the groups.

The aging of beef has become a strategy for improving the tenderness of beef cuts (Rhee, 2004). The studies supporting the aging of beef to improve tenderness have traditionally been performed on market animals, or as termed in this article, grain-fed. To explore aging and its effects on grass-fed beef all animals harvested were included in an aging study. Forty-eight hours after harvesting, one side of the beef carcass was fabricated into primal cuts. These cuts were then vacuum packaged and stored in the same environmental condition as the other side that had not been fabricated (35 degrees Fahrenheit, 80% relative humidity for 14 days). This provided for a side by side wet aging (vacuum packaged); versus dry aging comparison (see images below). Shear force values, using one half inch core samples and a Warner-Bratzler Shear, were used to determine tenderness of the ribeye muscle. One shear was taken at day zero (48 hours after harvesting) to provide for a starting value. At day 14, the dry aged side was fabricated and a shear value was taken. The wet aged package was also opened and a shear value was taken. As another dimension to this comparison, weights were taken of each individual cut to determine which method of aging was most economical from the standpoint of weight of moisture lost, either to dehydration (dry aging) or purging (wet aging). This data should provide increased knowledge in aging method selection. Lastly, samples were collected to be used in sensory evaluation to determine if consumers have preference for one method of aging over another.

Results

Among the four different treatments that were used significant differences were recorded among those fed either the high concentrate (grain-fed) and those on the low concentrate (grass-fed) diet. Groups B & C (those on native grasses) showed four months of weight losses. Two months of weight loss were seen during the winter of 2010-2011. This loss was likely realized due to the increased nutritional requirement to maintain body temperature during the cold ambient air temperatures. Another month of loss was seen in April during the dry early summer, with the last month of loss occurring in July preceding the summer rains. Valuable to mention is that following the summer rains average daily gains on both groups exceeded three pounds per day. Group D (irrigated pasture) showed one month of weight loss. This was realized in April during the transition time from winter to summer growth on the pastures. Although frame scores were not physically measured, it was visually noticed that frame scores increased throughout the study, indicating that muscle mass was lost while size increased. Group C, once moved to the confined feeding operation and put on a high concentrate diet, realized gains in excess of four pounds per day. Group A, (high concentrate for duration of study) showed average daily gains of 2.6 pounds per day.

With the above being said it is easy to see that the number of days on feed varies significantly among groups. All cattle were started on their feeding regimen at the same, October 2010. Group A was harvested the end of June 2011, showing eight months of time invested and an ending live animal weight averaging 1130 pounds. Group B & D were harvested from December 2011 to February 2012, based upon weight, showing a fifteen month average of time invested and an ending live animal weight averaging 775 pounds for B and 783 for D. Group C remained on grass until August 2011 at which time they weighed approximately 650 pounds. They remained on the high concentrate diet until January 2012 (fifteen months of time invested) and were harvested, with an average weight of 1128 pounds.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Finished Weight (pounds)</th>
<th>Time Invested (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>1130</td>
<td>8</td>
</tr>
<tr>
<td>Group B</td>
<td>775</td>
<td>15</td>
</tr>
<tr>
<td>Group C</td>
<td>783</td>
<td>15</td>
</tr>
<tr>
<td>Group D</td>
<td>1128</td>
<td>15</td>
</tr>
</tbody>
</table>
The data collected from the aging comparison is yet to be analyzed from the standpoint of percent lost to dehydration or purging, and sensory evaluation. However, from the shear force trials data has been interpreted; the shear samples taken 48 post-harvesting averaged 9.2 pounds per half inch core from eight grass-fed animals. A significant decrease was realized in both the wet and dry aging with wet aging shearing at 6.48 pounds and dry aging shearing at 6.54 pounds. As more data is analyzed better conclusions can be drawn between the two methods as to which may be superior economically.

Discussion

With the years of research that has already been conducted in the field of grass-fed vs. grain-fed beef, it is well known and accepted that there exists significant differences in the chemical composition of both categories of beef. This research will look deeper into these differences. Here preliminary research will be conducted to begin to understand the factors of some of these changes, such as the effect of feed stuffs within the grass-fed classification to begin to see just how dynamic this classification can be. Conclusions are also expected as to where and if there is a balance between grain-fed palatability and grass-fed favorability.

Further research will undoubtedly be needed in all of these areas to support and solidify the results expected. This supplementary research will especially be needed with regard to the chemical changes expected within group C. Through this study, generalizations can be drawn as to when profile changes occur, as well as, to what degree they occur. But, further studies will need to be conducted in order to more closely monitor these changes and evaluate to what level they arise and at what day after feeding regimen switch.

Conclusion

Regardless of viewpoint in the grain-fed, grass-fed debate, it is certain that both categories contain compounds that are both beneficial and potentially detrimental to health. Through this research and other similar studies that have been conducted, and yet will be conducted, the exact contents will be more fully documented. As this continues to occur, diets and other contributing factors can continue to be revised in order to ensure a quality and healthy end product that caters to the preferences of the consumer.

Dry Aging

[Image]

Wet Aging (with purge loss)

[Image]

References


Remote Monitoring of Individual Animal Mineral Supplement Intake by Range Cattle

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Intel Corporation, Hillsboro, OR, USA
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Abstract

Individual animal intake and behavior associated with mineral supplementation of cattle on rangelands is largely undocumented. Our objective was to develop instrumentation to remotely obtain such information. We designed and constructed a solar powered high precision load cell and continuous data acquisition system, configured to a standard range mineral feeder. The system was field tested in November 2010 and October 2011 at the V Bar V Ranch in central Arizona. Load cell precision varied with temperature and wind. Wind speed (mph) ranged from 0 to 14 and averaged 9 ± 0.19 in 2010. Corresponding values were 0 to 20 and 7 ± 0.25 respectively, in 2011. Temperature (F) ranged from 19 to 39 and averaged 28 ± 0.9 in 2010. Corresponding values were 30 to 52 and 36 ± 1.1 respectively, in 2011. In predawn hours when ambient conditions were relatively consistent, baseline variation of the load cells was ± 2 g. This value increased to ± 17 g during mid-day. Individual cow identification was accomplished via time-stamped, motion activated digital photography. Feeding bouts were classified by predetermined acute weight change thresholds and matched to a cow by visual inspection of images. Duration of feeding bouts (min) ranged from 1 to 16 and averaged 3 ± 0.4 in 2010, and 1 to 21 and 4 ± 0.4 respectively, in 2011 (P > 0.1). Mineral intake (g/feeding bout) ranged from 0 to 679 and averaged 109 ± 16.0 in 2010, and 0 to 1598 and 226 ± 25.4 respectively, in 2011 (P < 0.05). Measured total daily intake (g/cow) ranged from 0 to 1009 and averaged 190 ± 26.0 in 2010, and 0 to 2177 and 663 ± 108.9 respectively, in 2011 (P < 0.05). Intake rate (g/min) ranged from 1 to 182 and averaged 45 ± 5.2 in 2010, and 1 to 446 and 82 ± 8.0 respectively, in 2011 (P < 0.05). Correlation of the classification protocol was tested between two independent observers. For discrete (n = 5) bouts, r² = 0.95, SE = 5.3 (P < 0.05), and for multiple animal (n = 7) bouts, r² = 0.75, SE = 18.0 (P < 0.05). This system, as tested, is capable of providing individual animal intake of mineral supplement under rangeland management conditions.

Keywords: Individual animal intake, mineral supplement, remote measurement.

Introduction

Mineral supplementation is an essential part of all beef production settings. Being able to provide those necessary minerals in the most efficient manner becomes crucial to ensure optimum production. In intensively managed production settings, this would be through direct incorporation into the formulated diet. In range production settings, this is not possible and therefore managers often choose to provide supplements in a much less precise manner. Due to the physical limitations presented, minerals are often supplied free choice where large quantities of supplement can be transported and left with the herd at one time. This assumes that the mineral will be consumed...
at proper quantities, implying that the animals will limit their intake, although the degree to which they possess this wisdom is debatable (Tait and Fisher, 1996). Animal behavior is also related to intake. The ability to make mineral supplements available to the herd in the proper location in the pasture is important. At what time of the day mineral consumption is likely to occur, for instance, can influence location in the pasture of the supplement based upon known animal behavior patterns (Tait and Fisher, 1996). Therefore, it becomes obvious that our understanding of individual animal mineral supplement consumption must improve in order to provide range livestock managers with the knowledge and tools that they need to efficiently provide minerals to their herd. With the above being said, our objective was to measure individual animal intakes and the associated behavior with that intake (number of feeding bouts, rate of consumption, time of day, etc.) using remote measurements in an extensive rangeland setting.

**Material and Methods**

Animal care was approved by the University of Arizona, Institutional Animal Care and Use Committee (Protocol # 08-131). In order to observe the cattle in rangeland conditions, the V Bar V Ranch in north central Arizona was used to field test the equipment in two different trials, one occurring in November 2010 for 5.5 days and a subsequent trial occurring in October of 2011 for 9.5 days. In 2010 the trial occurred in a 2860 acre pasture with 385 cows. In 2011 the trial was in a 3200 acre pasture with 315 cows. The cattle present in both trials were Bos Taurus or Sanga or crosses of the two. Cattle age ranged from two years old to fourteen years old at various reproductive states but none were lactating. In both cases, the herd at the V Bar V was familiar to the mineral supplement being used, having consumed it in multiple pastures for the time preceding the trial. The supplement was in the form of a loose, granular, commercially produced mineral (Table 1).

In both cases the equipment was placed in areas of known animal traffic to ensure that at least part of those present in the pasture would encounter the mineral. At these areas, a feeding enclosure was created. This was accomplished using two 5 x 10 ft. cattle panels in a wing formation secured by two 6 ft. steel T posts. This would allow for the entrance of only one to two animals at a given time. When two cows were present at the same time, intake was averaged over both cows. To prevent animals from accessing the feeder through the cattle panel bars, a 12 x 48 in. x 0.5 in. plywood was used in 2010 as an additional barrier on one side and a 4 x 16 ft. 4 gauge welded wire livestock panel was used on the other side to protect measurement and solar equipment.

To power the measurement equipment in remote environments, solar technology was utilized. This included a Sunforce 50044 60 W Solar panel kit (adjustable to 49° angle for winter; 19° for summer; Sunforce, Montreal, Quebec, Canada). The voltage was regulated by a 10 A SS-10 Morningstar PWM Solar Controller (Morningstar Corp., Newton, PA). This system supplied a 100 AH deep cycle Lifeline GPL-27T battery allowing 3 day autonomy (Lifeline Batteries Inc., Azusa, CA). The solar controller and battery were housed in a Bison Prefab (Bison Profab, Magnolia, TX) 008014 16 x 16 x 10 in. NEMA 3R Aluminum Pole Mount Solar Battery Enclosure (mounted on 2.5 x 52 in. pipe over 6 ft. T post with wooden wedges). The solar system proved sufficient in output for both trials conducted.

Great care was taken to ensure that measurement equipment would be precise and yet functional in a rangeland, remote measurement setting. We additionally required a system that would not be rejected by the animals supplemented with the mineral. To meet the above criteria, a custom made steel feeder of 3/8 in. thick by 21 in. diameter was mounted on a 3 x 26 in. channel iron square frame with 1.75 in. diameter x 10.5 in. pipe legs (1/8 in. thick walls) welded at a 69° angle from 4 x 5 in. bases secured with 0.5 x 16 in. rebar pins. Three load cells were then mounted on a 14 in. diameter inner circle with 120° between each mounting bolt. The feed pan itself was also custom made of 3/8 in. thick steel, 21 in. in diameter with load cells mounted on a 14 in. diameter inner circle with 120° between each mounting bolt. An old rubber tire, cut to 27 in. diameter x 9.5 in. deep was fitted to the exterior of the inner circle of the feed pan and secured with 1/4 x 0.5 in. cap screws. Load cells were mounted top
and bottom to the feeder base and feed pan with 3/8 x 3/4 in. UNF case hardened bolts with a 3/8 in. flat washer in between the feed pan and each load cell.

To provide for the precision needed in measuring individual animal intakes, which has been documented to be minimal, the load cells had to be highly sensitive (Tait and Fisher, 1996; Cockwill et al., 2000). For this purpose, we employed Interface (Interface, Scottsdale, Arizona) 2420BLX-250 load cells, possessing a 250 lbs. capacity. Each 3 mV/V hermetically sealed stainless steel canister load cell, with Bayonet PT-WIH-10-6P connectors, were mounted in the measurement system as above mentioned using Interface stainless steel bases (to provide precision of measurement while mounting to a non-specification surface). The load cells were powered through the amplifier described below and also had a ground wire connected from the solar regulator to the mineral feeder support frame. Interface CT-179-10 2400/WMC (10 ft.) interconnect cables for each load cell were used to connect the load cells to an Interface model JB104SS stainless steel summing junction box and the junction box was connected to the amplifier described below. Interface matching from the junction box to the load cells provided for standardization to single signal output for zero and span tolerance. This output was processed further by an Imperial (Imperial Instruments, Rushville, Illinois) 12 VDC powered (via the solar regulator positive and negative load connections) TM1-H-WP amplifier/conditioner module with Shunt Cal Resistor. Matching for the cells shipped from Interface occurred at the Imperial facility. The amplifier/conditioner module was modified to contain: a 13,333 OHM cal resistor, a 50 K OHM balance limiter to accommodate ± 22.68 kg of tare adjustment and a gain adjustment covering the range of input times 179 through input times 278. Everything was tested as a complete set and shipped with cables to hook up to an input/output module. A 24 bit Labjack (Labjack, Lakewood, Colorado) UE9-Pro input/output module (with industrial temperature range of -40 to 185°F) was powered by a USB cable from a box PC, converting the analog signal from the amplifier to a digital signal. The Labjack module was hooked to the amplifier with an analog input 0 and ground. A Habey (Habey USA, Walnut, California) BIS 6620-I fan-less Box PC with Z510 Intel Atom Processor (14 to 122°F temperature range) with 1 GB DDR2 SO-DIMM DDR2 added memory & 16GB CF Flash Card was used to store data. The box PC was powered through the positive and negative load connections on the solar regulator. Labview 9.0.1 version software (National Instruments, Austin, TX) recorded the amplified signal weight data and internal solar battery enclosure temperature every 0.25 s for 20 data points for a measurement interval of 5 s followed by a 10 s idle time. Since it was not possible to obtain tare weights reliably, data were recorded every 16 to 17 s to detect changes in mineral weights and to overcome the effects of scale creep and temperature creep. All the electronic components were mounted in the Bison Profab solar battery enclosure.

The system was calibrated in the field with two 50 lb. scale test weights and a 100 g Precision Weight Set (Ginsberg Scientific, Fort Collins, Colorado).

Weather data were collected using publicly available data from the Yavapai County Flood Control District. This remote weather station was located 1.5 miles from the mineral feeder in both 2010 and 2011.

At the V Bar V Ranch, all of the cattle are tagged in the left ear with a unique six digit identification number. They are also branded with this same identification number on the left hip. To capture which animal was consuming mineral at the measurement equipment, a Moultrie I65 Digital Trail Camera, 6 Megapixels, 32 MB Memory with added 16GB SD HC Flash Card (Moultrie Feeders, Alabaster, Alabama) was used. This camera was placed just above and to the rear of the feeder to capture images of which animal was at the feeder at any given time. It was set to capture three pictures per minute when activated by movement at the feeder.

The measurement system generated a significant number of data points. To determine consumption of mineral, data were compared from two different data files, compressed and uncompressed. The compressed file was obtained using GNU Octave 3.2.4 software (GNU Software; http://www.gnu.org/software/octave/) and the software averaged data over the 20 data points obtained in the 5 s weighing interval. Also calculated was a delta value to help identify spikes.
for feeding events.
The compressed file was used solely to help identify the initiation of feeding events and the uncompressed file was actually used to obtain actual mineral intakes for each feeding event. Feeding events were matched to the camera photos and identified by delta values approaching or greater than delta = 1 in the compressed file and by absolute value differences in the uncompressed file scale weights ≥ 20 g.

End points for feeding event were identified by absolute scale differences being below 20 g for at least 3 data points. To minimize noise in scale weights, beginning weights prior to the feeding events were obtained over an average of 10 data points immediately preceding the initiation of the feeding event. Following the cessation of the feeding event (as defined by absolute scale weight differences < 20 grams), the scale was allowed to settle for 10 data points, then the average scale weight was obtained over 10 data points to obtain the ending weight. With few exceptions, this worked for obtaining individual feeding bout mineral intakes. Cattle which fed with large idle times with no other cows present had beginning and ending weights obtained over the total feeding period. In a few instances when cattle were feeding closely together, we were unable to accommodate the 10 data point post feeding settling period before obtaining ending scale weights.

Once obtained, these individual feeding events, as determined by weights, could then be matched to the pictures taken (both pictures and weights had time and date stamps). This allowed for pairing of individual animal identification numbers and individual feeding bouts.

Descriptive statistics and simple regression (Steel and Torrie, 1980) were performed to provide analysis of data collected.

**Results and Discussion**
The intent of this research was not to obtain exact mineral intake for all cows in the pasture, rather to test our ability to obtain individual intake for cows. Due to the sensitivity of the load cells, precision varied with temperature and wind. Wind speed (mph) ranged from 0 to 14 and averaged 9 ± 0.19 in 2010. Corresponding values were 0 to 20 and 7 ± 0.25 respectively, in 2011. Temperature (F) ranged from 19 to 39 and averaged 28 ± 0.9 in 2010. Corresponding values were 30 to 52 and 36 ± 1.1 respectively, in 2011. In pre-dawn hours when ambient conditions were relatively consistent, baseline variation of the load cells was ± 2 g. This value increased to ± 17 g during times when metal expanded at mid-morning, mid-day and mid-afternoon.

Duration of feeding bouts ranged from 1 to 16 min and averaged 3 ± 0.4 min in 2010, and 1 to 21 min and 4 ± 0.4 min respectively, in 2011 (Table 2; P > 0.10). Some cows approached the feeder and were photographed but did not consume any mineral. Repeat visits were made on different days or at different times of the day by four cows in 2010 and three cows in 2011. Feeding periods when mineral was consumed in 2010 included morning (19%) from 729 to 1020 h, late afternoon (46%) from 1506 to 1749 h, and evening (35%) from 1804 to 2208 h. In 2011, the trial was conducted in October instead of November and 86% of the cattle consumed mineral in the early morning from 631 to 857 h, 9% in mid- to late morning from 953 to 1117 h, and 5% in the late afternoon from 1549 to 1718 h. No cattle accessed the feeder in the evening in 2011.

The variability seen in mineral intake and feeding behavior (Table 2) has also been observed in other studies (Tait and Fisher, 1996; Cockwill et al., 2000; Norvell et al., 2011). Mineral intake (g/feeding bout) ranged from 0 to 679 and averaged 109 ± 16.0 in 2010. In 2011, the range increased (P < 0.05) to 0 to 1598 g/feeding bout and averaged 226 ± 25.4. Intake rate (g/min) for each feeding bout ranged from 1 to 182 and averaged 45 ± 5.2 in 2010, increasing (P < 0.05) to 1 to 446 and 82 ± 8.0 in 2011. Measured total daily intake per cow over all feeding bouts ranged from 0 to 1009 g and averaged 190 ± 26.0 g in 2010, increasing (P < 0.05) to 0 to 2177 g and 663 ± 108.9 g in 2011. When expressed as total intake over the course of the two trials, cattle who accessed the feeder consumed an average of 37 ± 5.5 g/d in 2010 and 80 ± 15.3 g/d in 2011. Norvell et al. (2011) reported that cattle consumed mineral at a greater rate during the first 15 d of their trial as opposed to the second 15 d. In 2010, of the 385 cows
that were present in the pasture for our trial, 48 accessed the feeder. In 2011, of the 315 cows present, 28 accessed the feeder.

Correlation of the classification protocol for mineral intake was tested between two independent observers, to test the repeatability of the classification protocol. To further identify repeatability, two different test times were chosen; one during discrete feeding bouts where ample time for scale settling was allowed between bouts and another where multiple bouts occurred very close together which showed greater variability among the two observers. For discrete (n = 5) bouts, r² was 0.95 and the SE was 5.3 (P < 0.05), and for multiple animal (n = 7) bouts, r² was 0.75 and the SE was 18.0 (P < 0.05).

Implications

The intent of this research was to see if a solar powered data acquisition system could be built to determine individual animal mineral intake in an extensive rangeland setting with low power draw (12 VDC) box PC computers and an USB powered input/output module and continuous weight data collection. We accomplished our goal (Figure 1). Individual weight data point precision varied with temperature and wind, but reasonable estimates of mineral intake were obtained. Future research will determine intake with a small herd to obtain additional individual mineral intake and behavior data. With this knowledge, better management decisions can be made, allowing for greater targeted supplementation of the individual animal’s mineral needs.

Literature Cited


Table 1. Composition of Nutrena (Minneapolis, Minnesota) NutreBeef Mineral Supplement.

<table>
<thead>
<tr>
<th>Item</th>
<th>Minimum Guaranteed</th>
<th>Maximum Guaranteed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>13.0%</td>
<td>15.0%</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>6.0%</td>
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<tr>
<td>Salt</td>
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<td>Sodium</td>
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<td>Magnesium</td>
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<tr>
<td>Potassium</td>
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<tr>
<td>Copper</td>
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<td>Selenium</td>
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<tr>
<td>Zinc</td>
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<td>Vitamin A</td>
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<td></td>
</tr>
<tr>
<td>Vitamin E</td>
<td>300 IU/LB</td>
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</table>
Table 2. Feeding behavior, daily intake, and feeding rate for cows consuming free choice mineral in a rangeland setting.

<table>
<thead>
<tr>
<th>Item</th>
<th>Avg.</th>
<th>Minimum Value</th>
<th>Maximum Value</th>
<th>CV %</th>
<th>SE</th>
</tr>
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<tbody>
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<td>Individual feeding bouts</td>
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<td>2010, min</td>
<td>3</td>
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<td>16</td>
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<td>4</td>
<td>1</td>
<td>21</td>
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<td>0.4</td>
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<tr>
<td>Daily Mineral Intake</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2010, g</td>
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<td>2011, g</td>
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<td>2177</td>
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<td>Intake Rate</td>
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<td>2010, g/min</td>
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<td>1</td>
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<tr>
<td>2011, g/min</td>
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<td>1</td>
<td>446</td>
<td>94.5</td>
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</tr>
</tbody>
</table>

a,b Means in columns without a common superscript differ ($P < 0.05$).

CV % is the coefficient of variation, (standard deviation/average)*100

Figure 1. Solar powered high precision data acquisition system for obtaining individual mineral intake on rangeland.
Reproductive Performance of Beef Heifers Supplemented with Stratag or Energii Compared to Heifers Fed an Isocaloric Diet with No Bypass Fat Source

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Department of Animal Sciences
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Introduction

Many producers struggle with getting heifers developed and bred. Recent research has been focused on management practices that may influence and improve reproductive efficiency in yearling heifers. Genetics and nutrition have the greatest effects on age at puberty in beef heifers. Wiltbank et al. (1966) demonstrated that a high level of nutrition decreased the age at onset of puberty. Gasser et al. (2006) reported that increasing dietary energy intake in early-weaned heifers through the feeding of a high-concentrate diet decreased age at puberty regardless of the diet fed. Conception occurring earlier during the first breeding season for a heifer results in positive effects on reproductive performance of that cow for the rest of her lifetime (Lesmeister et al., 1973).

The use of dietary fats in beef heifers have been thoroughly reviewed by Hess et al (2008) and indicated that feeding fat to heifers resulted in increased pregnancy rates, but it raised concerns of differences in response between well developed and underdeveloped heifers. It also indicated that feeding before the breeding season is probably the most effective time to supplement fat to heifers.

Rumen-protected fat has been utilized to meet or exceed energy needs of cattle while minimizing dry matter intake (DMI) reductions and decreased organic matter (OM) digestion associated with fat supplementation (Spicer et al., 1993; Moallem et al., 1997; Filley et al., 2000). Feeding heifers a rumen protected fat source for 60 days before the start of the breeding season resulted in increased pregnancy rates compared to heifers fed only the carrier (Long et al., 2007). Recent research has shifted to feeding fat for a shorter time before breeding and extending this supplementation for a period post insemination.

Heifers fed oilseeds (soybeans or flaxseed based pellets) 9 days before timed artificial insemination (AI) through 18 days post AI resulted in no difference in conception rate to AI (Scholljegerded et al., 2011). Using rumen protected fat sources in lactating postpartum beef cows resulted in no difference in reproduction when supplemented from 10 days before to 30 days post timed AI. There appears to be no research utilizing rumen protected fats that are saturated or unsaturated fed before and after AI.

The period of supplementation before AI should allow the difference in plasma lipids to develop and influence the ovary and possibly the uterus. The post AI supplementation should allow for fatty acids to possibly effect pregnancy loss. In dairy cattle, feeding flaxseed results in improved embryo quality (Thangavelu et al 2007), decreased pregnancy loss (Ambrose et al., 2006) and increased conception rate (Petit et al., 2002, Ambrose et al., 2007). These observations suggest that feeding a rumen-protected fat source prior to and after AI could affect beef heifer conception or recognition of pregnancy with possible different effects of either saturated or unsaturated fatty acid source.

Experimental Design

To evaluate the effects of adding fat to the diet, 120 head of the University of Arizona V Bar V Ranch heifers were blocked by age, breed, weight, and body condition score into one of three groups resulting in 40 heifers per treatment groups. All heifers were pen fed alfalfa hay to gain 2.5 kg per week at 0800 each day. Heifers were individually fed a supplement that is isocaloric and contains the only the carrier (90 % beet pulp and 10 % molasses ~1.0 kg as fed) or either 0.5 kg of the carrier with 200mg of StratG or Energii fed 5 days a week at 1700 hours.

Heifers received the supplement for 3 weeks prior to having an EAZI-BREED CIDR inserted for 7 days. Blood samples were collected every 4 days for 12 days before the CIDR insertion and progesterone concentrations were evaluated to determine the percent of heifers in each group that were cycling at start of the synchronization.
Heifers were detected for estrus every 12 hours after the PGF2α injection when the CIDR was removed and then artificially inseminated 12 after estrus was detected. Estrus detection will be aided with the use of Estrotect heat detection patches (Rockway Inc., Spring Valley, Wisconsin).

Heifers remained on the treatment supplementation regime for 21 days after insemination. A blood sample was collected at the end of the supplementation period.

Pregnancy will be detected at 30 days post AI via transrectal ultrasonography to determine AI conception rate. Heifers will be exposed to a bull for cleanup starting at 5 days post insemination. At 60 days after the bulls are removed pregnancy will be determined via rectal palpation. Serum samples (10 randomly chosen per treatment per time) from before CIDR insertion and at the end of the supplementation will be analyzed for plasma lipid profile via gas chromatography. Therefore we will be able to determine estrus activity rates, conception rates to initial AI, and also timing of mating with bull if initial AI was unsuccessful, along with overall pregnancy rates.

At the writing of this paper, we are currently in the middle of conducting the study so no results can be presented at this time. Some preliminary results should be available by mid-July, 2012 and a full report will be presented at a later date.

**Literature Cited**


Metabolic Implications of Heat Stress

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Summary
Heat stress decreases feed intake and milk production of dairy cows and increases maintenance metabolic costs associated with heat loss mechanisms by 7-25%. Oxidation of carbohydrates by peripheral tissues is also increased as animals switch to increased glucose metabolism and reduced lipid metabolism by peripheral tissues. This is associated with increased insulin sensitivity of peripheral tissues. Milk yield is dramatically reduced due to direct and indirect effects of heat stress. The direct effects are associated with reduced milk protein synthesis as heat shock protein synthesis by mammary epithelial cells is increased and milk secretion is inhibited by local mammary production of an inhibitor induced by the stress. Direct inhibition of milk synthesis by heat stress may make it difficult to develop nutritional strategies to completely recover milk yield during heat stress. Indirect effects of heat stress are associated with increased water and reduced feed intake. Maximal impact of heat stress on milk yield is not detected until 48 hours following the stress. Niacin supplementation has been shown to protect mammary epithelial cells from heat stress but has not resulted in improved milk yield.

Introduction
Heat stress adversely impacts a variety of dairy production parameters including milk yield, growth and reproduction and therefore is a significant financial burden (~$900 million/year for the U.S. dairy industry; St. Pierre et al., 2003). Advances in management (e.g. cooling systems; Collier et al. 2006. VanBaale et al., 2005) and nutritional strategies (West, 2003) have alleviated some of the negative impact of thermal stress on cattle, but production continues to decrease during the summer. Accurately identifying heat-stressed cattle and understanding the biological mechanism(s) by which thermal stress reduces milk synthesis, growth and reproductive indices is critical for developing novel approaches (i.e. genetic, managerial and nutritional) to maintain production or minimize losses during stressful summer months.

Repartitioning of Nutrients in Heat Stressed Dairy Cows
The biological mechanism by which heat stress impacts production and reproduction is partly explained by reduced feed intake, but also includes altered endocrine status, reduction in rumination and nutrient absorption, and increased maintenance requirements (Collier and Beede, 1985; Collier et al., 2005) resulting in a net decrease in nutrient/energy availability for production. Recently, an inhibitor of milk yield produced locally in the mammary gland during periods of stress has also been implicated in reduced milk yield during thermal stress (Silanikove et al 2000, 2006, 2009).

Reduced energy intake during heat stress forces a majority of dairy cows to enter into negative energy balance (NEBAL), regardless the stage of lactation, Baumgard and Rhoads 2007. This NEBAL of the heat-stressed cow is similar but of a lower magnitude to the NEBAL observed in early lactation. The NEBAL occurring in early lactation is associated with increased risk of metabolic disorders and health problems (Drackley, 1999), decreased milk yield and reduced reproductive performance (Lucy et al., 1992). Baumgard and Rhoads, 2007 have pointed out that “It is likely that many of the negative effects of heat stress on production, animal health and reproduction indices are mediated by the reduction in EBAL (similar to the way it is during the transition period). However, it is not clear how much of the reduction in performance (yield, daily gain and reproduction) can be attributed or accounted for by the biological parameters effected by heat stress (i.e. reduced feed intake vs. increased maintenance costs”.

There is substantial evidence indicated that heat stress increases maintenance costs in lactating dairy cows (7-25%, NRC, 2001). However, Fox and Tylutki, 1998 pointed out that due to complexities involved in predicting the upper critical temperatures no universal equation is available to adjust for this increase in maintenance. However, if a heat stress correction is not included in estimating maintenance then EBAL is overestimated and energy status in not accurate estimated, (Baumgard and Rhoads, 2007).
Heat Stress Impacts On Mammary Metabolism

Wheelock et al 2006 and Rhoads et al 2009 used a paired feeding model during heat stress to identify that only 40-50% of the reduction in milk yield could be accounted for by decreased intake. This suggested the possibility that as much as 50% of the reduction of milk yield during thermal stress may be due direct effects of heat stress on mammary milk synthesis or to a switch in post-absorptive nutrient utilization. These investigators did in fact report an alteration of energy metabolism in heat stressed cattle with increased utilization of glucose by peripheral tissues during heat stress and greatly reduced oxidation of lipid.

Silanikove et al 2000, reported finding a rapid modulation of milk secretion that was stress induced. This negative feedback system for the mammary gland consisted of a milk enzymatic system (plasminogen activator (PA), plasminogen (PG), and plasmin (PL)) that acted on β-casein to form a fragment, β-Casein 1-28 (βCN 1-28). This fragment bound to the apical plasma membrane of the lactating mammary epithelial cell and closed potassium channels which subsequently led to inhibition of milk secretion and deterioration of tight junction function, Silanikove et al. 2006. This system was proposed as a pathway to rapidly reduce milk secretion in the face of stresses such as heat stress, dehydration or severe malnutrition which present a threat to survival of the animal Silanikove et al. 2006. These authors also reported that the response of the mammary gland to βCN 1-28 becomes more pronounced under stressful conditions which may be associated with increased receptor localization at the apical surface of the mammary epithelial cell Silanikove et al. 2006. Although its actions are most pronounced under stressful conditions, the βCN 1-28 fragment may also be involved in chronic regulation of milk secretion Silanikove et al 2009. Future research is needed to determine if βCN 1-28 is in fact a stress induced feedback inhibitor of lactation. However, if this pathway is confirmed it would be difficult to dramatically improve milk yield during heat stress through nutritional strategies unless a method to block this inhibition was discovered.

It is well known that heat stress adversely affects cell function primarily by causing denaturation of proteins required for cell function and survival, Collier et al. 2006. Heat shock proteins (Hsp’s) are a class of proteins that protects cells from heat stress by restoring denatured proteins to their correct 3-dimensional structure. However, synthesis of heat shock proteins would compete with milk protein synthesis in lactating mammary epithelial cells. Thus, one might predict a decrease in milk protein concentration during periods of heat stress as mammary epithelial cells switch part of their synthetic machinery to heat shock protein synthesis. This is in fact what we see if we look at the seasonal pattern of milk and protein yield shown in Figure 1. The nadir of milk protein yield corresponds with the highest summer temperatures (June and July) while the nadir of milk yield is actually occurring in September and October when it is actually cooling off. This delay in the milk yield nadir is believed to be due to the carry-over effect from the heat stress that occurred during late pregnancy which is associated with lower birth weights and milk yields in the subsequent lactation, Collier et al. 1982.

Niacin, nicotinic acid is known to be protective against various forms of stress including heat stress and is a possible supplement which induces vasodilatation, therefore transferring the body heat to the peripheral (Di Constanza et al., 1997) and this flushing has been shown to act through prostaglandin D (PGD) and the prostaglandin D2 receptor, (Cheng et al. 2006). Researchers have reported niacin decreases skin temperatures during periods of mild to severe heat stress when supplementing cows with 12, 24, or 36 g of raw niacin for three consecutive 17 day periods (Di Constanza et al., 1997). Muller and co-workers, (1986) detected increases in milk yield of 2.4 kg/day during warm summer months when lactating dairy cows were supplemented with 6 g/d of niacin. Zimbleman et al. 2010 demonstrated that feeding protected niacin, Niashure™ resulted in increased sweating rate and lowered rectal and vaginal temperature. A larger commercial study evaluating impact on milk yield also reported a slight reduction in vaginal temperature but no impact on milk yield (Zimbleman et al. 2008).

Another possible protective mechanism of niacin may occur at the cellular level due to an increase in heat shock protein (Hsp) production. The protective role of Hsp’s during thermal stress are well established, Collier et al. 2007 and Kozawa et al. 2001 demonstrated that prostaglandin D2 increased Hsp 27 production in mammary epithelial cells and osteoblasts however, the Hsp response of other cell types to PGD has not been studied. Bryantsev et al. 2007 reviewed the role of Hsp 27 in heat shock and reported that this protein acts synergistically with Hsp 70 to refold proteins denatured by heat shock.
thereby increasing performance and viability of cells. Collier et al. 2007 reported that prostaglandins of the A but not the E series increased Hsp 70 production in bovine mammary epithelial cells after 8 hrs at 42 ºC in vitro as shown in Figure 2. Furthermore, the increase in Hsp production in response to Prostaglandin A was associated with improved viability of bovine mammary cells in culture, Figure 3. In particular, the ductal structures were much better maintained in cultures containing Prostaglandin A. However, no one has evaluated the role of PGD on Hsp production in the bovine. We have previously evaluated Hsp 70 gene expression in skin biopsies and demonstrated an increase in Hsp 70 gene expression during elevation of skin temperature due to solar radiation (see figure 4). These changes in Hsp 70 gene expression were associated with differences in skin infrared surface temperature (see figure 4).

Although some studies have previously reported an increase in milk yield in cows supplemented with niacin during warm summer months, Muller and co-workers, (1986) we have not yet been able to demonstrate a beneficial effect of supplementing protected niacin on milk yield in lactating dairy cows, Zimbleman et al 2008, 2010 and Rungruang et al 2010. We cannot rule out the possibility that supplementing niacin improves the overall health of dairy animals during warm summer months. However, we have not measured effects on animal health and considerable further work is needed to elucidate the mechanisms for reduced milk yield during heat stress in lactating dairy cows.

References


Conduction Cooling Systems: Improving Production in Dairy Cattle

Robert J. Collier
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Issue
Arizona currently leads the country in production per dairy cow, yet heat stress during the warmest months causes decreases in milk yield, increases in disease incidence and also increases in maintenance costs per cow. Research has shown that compared to winter months, dairy cows in Arizona produced 8.8 pounds less milk per cow per day during the summer months. At the same time, on-farm milk production has the greatest opportunity to affect the carbon footprint of a gallon of milk because dairy operations represent 80 to 95 percent of the dairy industry’s carbon footprint, and 75 percent of its electricity and fuel use. Studies at the William Parker Agricultural Research Complex, part of the University of Arizona College of Agriculture and Life Sciences, have focused on ways to minimize heat gain and maximize heat loss in dairy cattle to maintain or improve yields, while reducing water and electricity costs.

What has been done
In contrast to the traditional overhead electric fan systems and water misting systems that have been the norm in Arizona dairies during the hot months, UA scientists are testing a prototype conduction cooling system with an array of heat exchanger ‘panels’ installed beneath—rather than above—the cows’ bedding area in dairy barns. As well water passes through the flexible polymer-based heat exchangers, the colder temperature of the water cools the cows via conduction by transferring heat from a warm source—the cow—to a colder source—the heat exchanger-cooled bedding material installed above the panels with the colder water flowing through them.

In 2011 we formed a research team to write grants and conduct research in this area. The team consists of Animal Science (John Smith and Bob Collier) and Ag and Biosystems Engineering (Chris Choi) faculty at the UA as well as Dr. Kifle Gebremedhin of the Ag and Biosystems Engineering Faculty of Cornell University and Dr. Joe Harner, of the Agricultural Engineering Faculty of Kansas State University. Dr. Smith is the team leader. This group is currently in negotiations with GEA, the world’s largest dairy equipment supply company to develop a research program to bring a commercially viable conductive cooling system to the world dairy industry. Chris Choi and Bob Collier also obtained funding from the Water, Environmental and Energy Solutions program to begin mathematical modeling of a functional conductive cooling system and to build a test model to verify the computations. The research team is also preparing to write grants for BARD (Bi-national Ag Research and Development) and USDA-AFRI Funding.

Impact
By using conduction cooling alone to cool cows up to 90 degrees F, this same 3,600-cow dairy using 180 fans at 1.2 kilowatt hours per fan and paying $.09 per kilowatt hour would save a projected $26,500 for the summer in energy costs to cool cows—a savings of over 75 percent in electricity costs. The investigators believe that if the water had been chilled by a commercial chiller the electrical costs savings still would have been substantial, and there would have been additional milk yield benefits. Researchers in the UA Department of Animal Sciences and the Department of Agricultural and Biosystems Engineering are collaborating to develop models of cooling systems that could run successfully with different water and air temperatures. Further studies using conduction cooling systems are underway in Arizona, California and Texas in 2011-2012.

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Effects of Adjustable and Stationary Fans Coupled with Misters on Core Body Temperature and Resting Behavior of Lactating Dairy Cows in a Semi-Arid Climate

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Introduction

The ability of dairy cattle to maintain a high level of milk production is dependent on environmental and management factors (Purwanto et al., 1990). Heat stress is caused by factors that reduce the animal's ability to regulate body temperature by interfering with the transfer of heat from the animal to its surrounding environment (Morrison, 1983). Therefore, heat stress is a significant factor preventing dairy cattle from reaching their full genetic potential in terms of milk production and economic efficiency (Buffington et al., 1981; Kadzere et al., 2002).

Consequently, thermal stress has a profound negative impact on the profitability of dairy operations. St-Pierre et al. (2003) estimated that heat stress is responsible for approximately $900 million to $1.5 billion in annual economic losses to the dairy industry in the United States. Economic losses are most prevalent during the hot summer months and most significant in the southern United States where cows experience extended periods of heat stress. Population expansion and resource availability has caused producers to relocate to warmer, dryer climates of the western United States and overlook climatic conditions where dairies are being built (Ortiz et al., 2011). As a result, producers may be unaware of the negative effects of heat stress on cows and will incur significant declines in milk production, reproductive efficiency, and herd health (Ortiz et al., 2011).

Aggressive selection for production traits in dairy cows over the past several decades has improved average milk yield per cow. It has been demonstrated, however, that milk yield is directly correlated to metabolic heat production (Purwanto et al., 1990; Kadzere et al., 2002; West, 2003). Therefore, heat production increases as milk yield increases. As a result, the modern high-producing dairy cow is more susceptible to the detrimental effects of heat stress. In previous decades, it has been widely accepted that a temperature-humidity index (THI) ≥ 72 is the point at which dairy cows become heat-stressed. Recently, Zimbelman et al. (2009) re-evaluated and determined the threshold at which lactating cows enter heat stress to be a THI ≥ 68. This proposed decrease of the heat stress threshold has amplified the importance of cooling cows.

While significant technological advancements in environmental modifications have been made over past decades (Collier et al., 2006), it is necessary for dairy producers to adopt management strategies that effectively and efficiently reduce heat stress. In order to achieve maximal productivity, the response of animals to varying environmental conditions must be understood (Purwanto et al., 1990). Core body temperature (CBT) and resting behavior have proven to be useful tools for analyzing the efficacy of various cooling methods (Hillman et al., 2005; VanBaale et al., 2006). By understanding the effects of environmental conditions on physiology and behavior, better management strategies can be applied to improve performance and maximize profitability.

As ambient temperature increases, CBT must rise to maintain a temperature gradient such that heat energy flows outward to the surface (e.g. skin) and surrounding environment. It is necessary that CBT remain higher than the external temperature, or heat will flow inward, and the cow will act as a “heat sink” (McArthur and Clark, 1988; VanBaale et al., 2006).
As ambient temperature increases and approaches CBT, the ability of cows to dissipate heat is greatly compromised. Therefore, cows are unable to lose heat. To compensate, an increase in evaporative heat loss is necessary as evidenced by increases in respiration and sweating rates. If these mechanisms alone are not sufficient enough to overcome heat gain from metabolism or the environment, then CBT increases (Collier et al., 1981). Johnson et al. (1963) reported that milk yield decreased 4 lbs/d (1.8 kg/d) for every 1°F (0.55°C) increase above daily rectal temperature of 101.5°F (38.6°C). More recently, Igono et al. (1985) reported that cows with mean rectal temperature of 102.4°F (39.1°C) produced 0.3 lbs/d (0.7 kg/d) less milk than cows with a rectal temperature of 101.8°F (38.8°C).

Cows will often stand up when they are heat-stressed. This is a behavioral response to the thermal environment that allows the cow to maximize the effective surface area for evaporative heat loss from the body surfaces (Igono et al., 1987; Hillman, 2009). Therefore, resting behavior can be a useful tool to determine the severity of heat stress.

Furthermore, CBT affects resting behavior of dairy cows. Cows require 12 to 14 h of resting time each day to maintain normal production levels (Grant, 2007). Frazzi and colleagues (2000) reported that cows spent more time lying down during cooler periods of the day. Hillman et al. (2005) determined that cows were more likely to stand up when vaginal temperature approached 102°F (38.9°C). Grant (2007) suggested that each additional hour of resting time corresponds with an increase in milk production of 2 to 3.5 lbs/d (0.9 to 1.6 kg/d).

In this study, the efficacy of the FlipFan® Dairy Cooling System was tested against stationary fans coupled with misters. The FlipFan® system incorporates high-powered fans and misters that rotate along a horizontal truss throughout the day in relation to the sun so that the shaded area of the pen is the target of cooling. This cooling system can also compensate for wind speed and direction by making subtle adjustments to fan angle. This enables cows to benefit from the shade (reduced solar radiation) in addition to the convective and evaporative cooling capabilities of the fans and misters throughout the day. Therefore, it is not necessary for cows to choose between the shade and cooling at certain times of day.

Materials and Methods

Two experiments were conducted on a commercial dairy farm in Buckeye, AZ, in August 2011. Multiparous, lactating Holstein dairy cows (n = 144) were selected for one of two treatments based on days in milk (DIM) and seven-day average milk production. All cows were housed in drylot corrals with a shade structure (4.2 m²/cow) orientated north-to-south located in the center of each pen (Table 1). All shade structures were equipped with one of two cooling systems comprised of fans and high-powered misters installed below the western edge of a corrugated metal roof. Fans for both treatments were spaced at 100 in (2.54 m) center-to-center and operated at 0.5 hp for 16.5 h/d (08:30 h to 01:00 h). Cooling system operating times were limited due to water availability. Two nozzles affixed to the front of the fans sprayed water continuously into the airstream at 220 psi. All pens were also equipped with feedline soakers (Table 2).

The control treatment consisted of stationary fans and high-powered misters that remained in a fixed position facing eastward throughout the day. The second treatment consisted of the FlipFan® Dairy Cooling System (Schaefer Ventilation Equipment, Sauk Rapids, MN), an adjustable fan system with high-powered misters. The FlipFan® system is designed so that the fans adjust their angle throughout the day in relation to the sun and wind, so that the area in the shadow cast by the shaded structure is cooled continuously during daylight hours.

All cows were milked three times daily with times varying between treatments by 1 h. Cows in the control treatment were
milked at 02:00, 10:00, and 18:00 h. Cows in the FlipFan® treatment were milked at 03:00, 11:00, and 19:00 h. High-powered fans and misters were used for cooling the holding pen in both treatment groups.

Data Collection

Ambient temperature and relative humidity were recorded at 15-min intervals for the duration of the study by HOBO® U23 Pro v2 data loggers (Onset Computer Corp., Bourne, MA) placed in solar radiation shields (Onset Computer Corp.) at two locations on the farm. Wind speed and direction was also recorded by a weather station located on site.

Sixty four multiparous, lactating Holstein dairy cows (milk production = 66.5 ± 3.98 lbs/d (30.2 ± 1.81 kg/d) and DIM = 123 ± 58 d) were housed 8 cows/pen, 4 pens/treatment. Vaginal temperature (e.g. CBT) was obtained at 5-min intervals for 6 consecutive days using HOBO® U12 stainless temperature data loggers (Onset Computer Corp.) attached to blank controlled internal drug-releasing devices (CIDR; Pfizer Animal Health, New York, NY). Data loggers were inserted one day prior to the start of data collection to allow adequate time for acclimation.

One hundred forty four multiparous, lactating Holstein dairy cows (milk production = 67.1 ± 5.22 lbs/d (30.5 ± 2.37 kg/d) and DIM = 125 ± 60 d) were housed 18 cows/pen, 4 pens/treatment. Resting behavior was obtained by HOBO® Pendant G data loggers (Onset Computer Corp.) recording angles on three different axes at 30-s intervals for 5 consecutive days. Data loggers were attached to the medial side of the cannon on the hind leg (half were fitted to the right leg and half to the left leg) with vet wrap one day prior to data collection.

Additionally, body condition scores (BCS) and locomotion scores were recorded for all cows. Due to the short duration of the trial, effect on milk production was not analyzed.

Statistical Analysis

Data for both experiments was analyzed using a MIXED procedure in SAS (version 9.2, SAS Institute, Cary, NC). Significance was declared with a P-value < 0.05.

Recorded ambient conditions were pooled to calculate mean hourly ambient temperature and relative humidity. The mean hourly temperature-humidity index (THI) was also calculated using the formula THI = Tdb – (0.55 – 0.55*RH)(Tdb – 58), where Tdb is dry-bulb temperature (°F) and RH is relative humidity (%).

Vaginal temperatures were pooled for each treatment to calculate the mean 24-h CBT and mean hourly CBT. In addition, CBT data was used to determine the duration in which cows maintained a CBT above and below various temperatures.

Resting behavior data was determined by analyzing the angles recorded by Pendant G data loggers attached to the legs of cows. This data was used to determine the average amount of time cows spent standing up versus lying down on a given day. The number of times that cows lay down and the duration of these lying bouts was also determined. A bout was defined as the amount of time a cow remained either standing or lying for at least 30 s. Cows with a locomotion score ≥ 3 or were moved to the hospital pen were eliminated from the final data analysis.

Results

The average THI for the trial was 80.2 and ranged from 76.3 to 84.4 (Figure 1). Under these conditions, cows were subjected to continuous moderate heat stress (Zimbelman et al., 2009).

A significant (P < 0.001) treatment effect was observed in which mean 24-h CBT (Figure 2) of cows in the FlipFan® treatment was lower than cows in the control group 101.93 ± 0.085°F (38.85 ± 0.047°C) vs. 102.32 ± 0.092°F (39.07 ± 0.051°C).

There was also significant (P < 0.0001) time by treatment interaction on hourly CBT (Figure 3). The mean hourly CBT was lower for the FlipFan® treatment at all times except from 00:00 to 02:00 h, although the differences during these times were not significant. Differences in CBT were also not significant at 18:00, 19:00, and 03:00 h. Mean hourly CBT for both treatments was highest at 08:00 h, after which CBT began to drop dramatically. Temperatures at 08:00 h for FlipFan®
and Control were 102.79°F (39.33°C) and 103.44°F (39.72°C), respectively. Mean hourly CBT was lowest for Control at 11:00 h (101.71°F or 38.73°C) and FlipFan® at 12:00 h (101.26°F or 38.48°C). The CBT of cows in both treatments decreased greatly once the cooling systems were turned on at 08:30 h. An immediate increase in CBT was observed after the cooling systems were turned off at 01:00 h. Similar results regarding cooling system operation time were reported by Ortiz et al. (2010), in which CBT was significantly higher for multiparous cows when Korral Kool system operation time was reduced to 21 h/d.

The duration of time CBT remained at various temperature intervals also differed (P < 0.03) between treatments (Figure 4). The CBT for FlipFan® cows remained below than 101.5°F (38.6°C) for more time than the control treatment (334.57 min vs. 174.44 min). Conversely, cows in the control treatment spent more time with CBT above 101.5°F (1265.6 vs. 1105.4 min). Nevertheless, CBT for cows in both treatments remained above 101.5°F for much longer throughout the day than below that temperature.

There was a significant treatment effect on standing and resting time. FlipFan® cows lay down about 1 h more each day than Control cows (Figure 5).

FlipFan® cows had more lying bouts for each day (12.8 vs. 10.7), with each bout representing the instance that a cow lay down for more than 30 s (Figure 6).

**Discussion**

The difference in CBT between the two treatments was observed because the cows in the FlipFan® were able to benefit from the evaporative and convective cooling capabilities in addition to reduced solar heat load for more time each day. The peak in CBT at 08:00 h can be explained since the cooling systems were not turned on until 08:30 h and remained on until well after the heat of the day. It can be clearly observed that CBT increased rapidly from 06:00 to 08:00 h which is consistent with sunrise during the time of year and geographical location. Cows were also inhibited from entering the shade during this time, as they were in head locks for daily inspection. The high solar heat load may play a large role in the dramatic CBT increase during this time period. This clearly demonstrates the importance of shade access and cooling system operating time, especially during the cooler times of day. The general trend of lower CBT following milking times illustrates the effectiveness of holding pen cooling.

It is difficult to explain why a significant difference in CBT was observed between treatments during times when the cooling systems were not operated. One hypothesis is that there may have been an acclimation effect in which cows with lower CBT during warmer times of the day are more likely to maintain a lower CBT without additional support from cooling systems during cooler periods. Cows with higher CBT during the day store more heat that needs to be dissipated at night.

It is expected that cows with lower CBT will spend more time lying down than cows with higher CBT. Cows will stand up when they become too hot in order to increase the effective surface area for insensible heat loss.

The higher number of lying bouts for FlipFan® cows can be explained by the changing angle of the fans and misters. Cows will change their position to benefit from the shade and cooling capabilities of the fans and misters. On the other hand, control cows are forced to choose between shade and the cooling system, and will likely remain in one location for a longer duration of time, resulting in fewer changes in posture (e.g. standing or lying) throughout a given day.

**Conclusions**

The FlipFan® Dairy Cooling System is effective at lowering CBT and increasing resting time of lactating dairy cows. In order to achieve the greatest benefit from this system, it is recommended that it be operate continuously >16.5 h/d, but preferably 24 h/d. The system should be turned on by 06:00 h to prevent such a dramatic rise in CBT during the morning hours. Slight modifications could be made to the FlipFan® system to enable more significant decreases in CBT and increased resting time to more desirable levels. Air velocity may need to be reduced to allow increased contact time of mist
with the cow's skin as well as longer time to evaporate and cool the surroundings. In addition, different nozzles may be installed to increase water droplet size and improve cooling capacity.

Acknowledgements

Without the help and generosity of some very important people, this trial would not have been possible. We greatly appreciate their assistance and cooperation that made this trial a success. First of all, we would like to thank Schaefer Ventilation Equipment for funding this project. We would also like to thank Mike and Nick Terrell for their time and hard work to make sure the cooling systems were operating correctly throughout the duration of the trial. Finally, we would like to thank Larry and Nick Vanderwey of Grand View Dairy for allowing us to use their farm to perform this research.

Table 1. Pen, shade, and stocking density information.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control</th>
<th>FlipFan®</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. Number of Cows/Pen</td>
<td>280</td>
<td>246</td>
</tr>
<tr>
<td>Head Locks/Pen</td>
<td>288</td>
<td>256</td>
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<td>Stocking Density, head locks/cow</td>
<td>1.03</td>
<td>1.04</td>
</tr>
<tr>
<td>Pen Dimensions, ft (m)</td>
<td>250 x 650 (76.2 x 198.1)</td>
<td>250 x 575 (76.2 x 175.3)</td>
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<tr>
<td>Pen Area, ft² (m²)</td>
<td>162,500 (15,095.2)</td>
<td>143,750 (13,357.9)</td>
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<tr>
<td>Pen Area/Cow, ft² (m²)</td>
<td>580.4 (53.9)</td>
<td>584.3 (54.3)</td>
</tr>
<tr>
<td>Shade Structure Dimensions, ft (m)</td>
<td>30 x 425 (9.1 x 129.5)</td>
<td>30 x 375 (9.1 x 114.3)</td>
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<tr>
<td>Shade Structure Area, ft² (m²)</td>
<td>12,750 (1178.5)</td>
<td>11,250 (1040.1)</td>
</tr>
<tr>
<td>Shaded Area/Cow, ft² (m²)</td>
<td>45.5 (4.2)</td>
<td>45.7 (4.2)</td>
</tr>
<tr>
<td>Shade Structure Height, ft (m)</td>
<td>13.5 (4.1)</td>
<td>12 (3.7)</td>
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<tr>
<td>Fan Spacing (center-to-center), in (m)</td>
<td>100 (2.54)</td>
<td>100 (2.54)</td>
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<tr>
<td>Number of Fans/Shade Structure</td>
<td>50</td>
<td>45</td>
</tr>
<tr>
<td>Number of Bays/Shade Structure</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>Number of Fans/Bay</td>
<td>3 (2 in southernmost bay)</td>
<td>3</td>
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Table 2. Feedline soaker operational parameters.

<table>
<thead>
<tr>
<th>Parameter</th>
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<th>FlipFan®</th>
</tr>
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<tbody>
<tr>
<td>Operating Times</td>
<td>23:30 to 00:15 h</td>
<td>00:00 to 00:45 h</td>
</tr>
<tr>
<td></td>
<td>05:30 to 06:15 h</td>
<td>05:30 to 06:15 h</td>
</tr>
<tr>
<td></td>
<td>16:30 to 17:15 h</td>
<td>17:00 to 17:45 h</td>
</tr>
<tr>
<td>Operating Cycle</td>
<td>ON 30 s, OFF 180 s</td>
<td>ON 30 s, OFF 180 s</td>
</tr>
<tr>
<td>Volume/head lock/30-s cycle, gal (L)</td>
<td>0.31 (1.2)</td>
<td>0.31 (1.2)</td>
</tr>
</tbody>
</table>
Figure 1. Average ambient temperature, relative humidity, and temperature-humidity index (THI) by hour. THI calculated from means.
Figure 2. Mean 24-h core body temperature for Control and FlipFan treatments. SEM for Control and FlipFan treatments are 0.092°F (0.051°C) and 0.085°F (0.047°C), respectively. Treatment effect (P < 0.001).

**Mean 24-h Core Body Temperature**

- Control: 102.32°F
- FlipFan: 101.93°F

**Mean 24-h Core Body Temperature**

- Control: 39.07°C
- FlipFan: 38.85°C
Figure 3. Mean hourly core body temperature. Shaded region represents cooling system operating time. Arrows denote milking times for each treatment. Time by treatment effect (P < 0.0001).
Figure 4. Daily time that core body temperature remained above or below various temperatures. Significance between treatments for all temperature intervals (P < 0.03).
Table 3. Daily time core body temperature remained above or below various temperatures.

<table>
<thead>
<tr>
<th>CBT</th>
<th>Control</th>
<th>FlipFan®</th>
<th>P-value</th>
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<tbody>
<tr>
<td>Time, min/d</td>
<td>SEM</td>
<td>Time, min/d</td>
<td>SEM</td>
</tr>
<tr>
<td>&lt;38.6°C (101.5°F)</td>
<td>174.44</td>
<td>334.57</td>
<td>0.0022</td>
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<tr>
<td></td>
<td>37.797</td>
<td>35.339</td>
<td></td>
</tr>
<tr>
<td>&gt;38.6°C (101.5°F)</td>
<td>1265.56</td>
<td>1105.43</td>
<td>0.0022</td>
</tr>
<tr>
<td></td>
<td>37.797</td>
<td>35.339</td>
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<tr>
<td>&gt;38.9°C (102°F)</td>
<td>764.57</td>
<td>594.95</td>
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<tr>
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<td>39.311</td>
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<tr>
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<td>401.37</td>
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<td>31.209</td>
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<td>107.99</td>
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<td>&gt;39.7°C (103.5°F)</td>
<td>53.87</td>
<td>30.80</td>
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<tr>
<td></td>
<td>7.696</td>
<td>7.221</td>
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Figure 5. Daily time spent standing or resting. Treatment effect (P < 0.0001). SEM for Control and FlipFan treatments are 10.07 and 10.14 min, respectively.

Standing vs. Lying Time
Figure 6. Number of times cows lay down throughout one day. SEM for Control and FlipFan treatments are 0.48 and 0.49, respectively. Treatment effect (P = 0.002).

Lying Bouts

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>FlipFan</th>
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<tbody>
<tr>
<td>Bouts/d</td>
<td>10.7</td>
<td>12.8</td>
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</tbody>
</table>

Treatment

References


Chronic Norepinephrine Exposure Desensitizes Fetal Sheep Islets and Enhances Insulin Secretion

Xiaochuan Chen, Dustin T. Yates, Antoni R. Macko, Amy C. Kelly, and Sean W. Limesand
Department of Animal Sciences
The University of Arizona

Placental insufficiency lowers fetal oxygen and glucose concentrations, which chronically elevate fetal plasma norepinephrine (NE) concentrations. Previous studies in uncompromised sheep fetuses designed to isolate NE actions show that chronic exposure to NE suppresses insulin secretion through \( \alpha_2 \)-adrenergic receptors (ARs) and increases plasma glucose. Removing fetuses from the chronic NE exposure results in acute β-cell hyper-responsiveness to glucose with lower mRNA expression of \( \alpha_2 \)-ARs in pancreatic islets. This study is to determine if the compensatory mechanism of NE is dependent on hyperglycemia and persists in fetal sheep after chronic NE exposure. NE was continuously infused into fetal sheep at 1-4 µg/min through 131-137 days of gestational age. Insulin was infused into the ewe to maintain fetal euglycemia during the NE treatment period. In vivo, fetal glucose stimulated insulin secretion (GSIS) was tested with a square-wave hyperglycemic clamp prior to chronic treatments, 1-day, and 5-day after terminating the infusion. After the last GSIS study, in vitro, islets were isolated and incubated with 11.1 mM glucose and various NE concentrations (0, 0.0001, 0.001, 0.01, 0.1, 1, and 10 µM) to determine insulin release. During the 7-day treatment period, NE-infused fetuses had 10 fold greater (P<0.05; n=8) plasma NE concentration than vehicle infused controls (n=7), and plasma insulin concentrations were lower (0.17±0.02 vs 0.43±0.03 ng/ml, P<0.01) than controls. Plasma glucose concentrations were not different between treatment groups. GSIS responsiveness before treatment was similar between groups. However, both 1-day and 5-day after discontinuing the infusion, NE fetuses had 2-fold greater (P<0.05) insulin concentrations than controls at the hyperglycemic steady state conditions. In static incubations, islets from NE fetuses were less (P<0.05) responsiveness to NE inhibition than control islets with the IC50 of 5.40±1.10 vs 2.17±0.90 nM. Islets from NE fetuses also showed greater maximal (P<0.05) insulin secretion than controls (2.12±0.20 vs 1.38±0.15 ng/h/islet, P<0.05). These findings show that chronic NE exposure, not hyperglycemia, leads to hyper insulin secretion coupled with desensitized \( \alpha_2 \)-ARs signaling. Moreover, this compensatory enhancement in fetal β-cell persists for 5-day after removing NE infusion indicating continually β-cell impairment in later life.

Key words: beta cell, glucose stimulated insulin secretion, pancreas
Chronic Mild Pulsatile Hyperglycemia Suppresses Glucose-Stimulated Insulin Secretion and Increases Accumulation of Reactive Oxygen Species in Fetal Sheep Islets

Alice S. Green1, Xiaochuan Chen1, Antoni Macko1, Miranda J. Anderson1, Amy C. Kelly1, Ronald M. Lynch2, and Sean W. Limesand1

1Department of Animal Sciences
2Departments of Pharmacology and Physiology
The University of Arizona

Abstract
Children from diabetic pregnancies have a higher incidence of developing Type 2 diabetes, and fetal exposure to hyperglycemia is a risk factor for islet dysfunction. β-cell responsiveness was examined after a two week exposure to mild sustained hyperglycemia with repeated pulses in fetal sheep. Beginning at 0.84 of term, mild pulsatile hyperglycemia (mPHG, n=5) and pulsatile hyperglycemia ewes (PHG, n=10) received two dextrose infusions: a constant infusion that raised plasma glucose concentrations by 15% or 20% and 45-min boluses at 0800, 1400 and 2000 h each day that raised glucose by 55% or 100%, respectively. Control ewes (n=10) received saline. Fetal glucose-stimulated insulin secretion (GSIS) and glucose potentiated arginine insulin secretion (GPAIS) were lower (P≤0.05) in PHG fetuses with plasma insulin concentrations at 0.86±0.13 and 2.91±0.39 ng/ml compared to controls (1.58±0.25 and 4.51±0.56 ng/ml), and mPHG fetuses were intermediate (1.21±0.08 and 4.25±0.56 ng/ml). In isolated islets, stimulatory glucose concentrations (11.1 mmol/L) increased (P<0.05) insulin secretion (1.6 fold) and glucose oxidation rates (2 fold), but treatments were not different. Islet insulin content was 35% lower in PHG and 35% higher in mPHG compared to controls (P<0.01). Also, isolated islets loaded with CM-H2DCFDA (Invitrogen), a fluorescent ROS probe, had greater ROS accumulation in the presence of 11.1 mmol/l glucose; the ratio of stimulated/basal rates was 1.6±0.2 for PHG islets vs. 0.9±0.1 in control islets (P<0.01). Evidence for islet protein oxidative damage was not observed, but PHG treatment increased oxidative damage to skeletal muscle proteins (P<0.05). These findings indicate that pulsatile hyperglycemia, mimicking that of diabetic mothers, leads to impaired insulin secretion responsiveness and dysregulation of islet ROS production.
Removal of the Fetal Adrenal Medulla at 0.7 Gestation Alters Glucose-insulin Homeostasis at 0.9 Gestation: Role of Norepinephrine in Normal Versus Growth-restricted Fetal Sheep

Antoni R Macko, Dustin T Yates, Xiaochuan Chen, Miranda J Anderson, Amy C Kelly, and Sean W Limesand
Department of Animal Sciences
The University of Arizona

Placental insufficiency causes intrauterine growth restriction (IUGR), and fetal hypoglycemia and hypoxemia which increase plasma norepinephrine (NE) to promote glucose sparing. The fetal adrenal medulla is the primary source of plasma NE. Our objective was to determine whether surgical ablation of the adrenal medulla at 0.7 gestation (G) alters glucose-insulin homeostasis independently of hypoxemia at 0.9 G. Sheep were randomly assigned into four groups by a combination of: control (C) or placental insufficiency-IUGR (I), and by surgical sham (S) or fetal adrenal demedullation (D) at 0.7 G. (n= 5 CS, 3 CD, 3 IS, 3 ID fetuses). At 0.9 G, each fetus underwent two studies (S1 & S2) to assess fetal metabolism. S1 in ambient normoxia, and S2 during acute fetal hypoxemia (CS & CD) or hyperoxemia (IS & ID). Placentome mass was lower in IS vs CS (119±29 v 364±20g p<0.001) and in ID v CD (143±12 v 302±22g, p<0.03). Fetal mass was lower in IS v CS (1.5±0.5 v 3.5±0.2 kg, p<0.005) and in ID v CD (2.1±0.3 v 3.0±0.2 kg, p<0.05). During basal conditions (S1): fetal plasma glucose was lower in IS v CS (10.6±1.1 v 20.2±0.9 mg/dL, p<0.005) and ID v CD (14.8±1.6 v 21.7±2.4 mg/dL, p<0.05). Arterial pO2 was lower in IS v CS (14.7±1.9 v 21.4±0.6 mmHg, p<0.005), and in ID v CD (12.6±1.9 v 19.8±0.7 mmHg, p<0.01). Fetal plasma NE was higher in IS v CS (2575.3±309.2 v 561.2±133 pg/ml, p<0.01) but not different between ID v CD (341.8±216.9 v 219.5±102.4 pg/ml) which were both less than IS (p<0.05). Insulin was lower in IS v CS (0.09±0.03 v 0.47±0.1 ng/ml, p<0.05), but not different between ID v CD. Acute oxygen reversal (S2): Arterial pO2 was raised to 20.4±2.9 and 22.2±2.3 mmHg in IS and ID and reduced to 10.5±0.5 and 11.9±0.5 mmHg CS and CD. Glucose was not affected by hypoxia in CS or CD. Hyperoxia increased glucose in CS to 16.2±1.3 mg/dL. (p<0.05) but had no effect in ID. Acute hypoxia increased NE in CS (2838.9±1216.2 pg/ml, p<0.05) but not in CD fetuses, and reduced insulin concentrations in CS (0.22±0.06 ng/ml, p<0.05) but not in CD. Insulin concentrations were augmented during acute hyperoxemia in IS (0.4±0.25 ng/ml, p<0.05) but not in ID. Together this data supports a model to elucidate the mechanisms by which oxygen and norepinephrine regulate glucose and insulin homeostasis in normal and growth restricted fetuses.
Epinephrine Acutely Suppresses Glucose Oxidation in Rat Islets and Min6 cells

Amy C. Kelly, Dustin T. Yates, Alice S. Green, and Sean W. Limesand
Department of Animal Sciences
The University of Arizona

Glucose-stimulated insulin secretion (GSIS) is suppressed through adrenergic stimulation by epinephrine in pancreatic β cells. Previous work has elucidated a bevy of adrenergic regulatory mechanisms distal to glucose metabolism and ATP production in GSIS, including opening of KATP channels and inhibition of exocytosis. Glucose oxidation may also be an important site for adrenergic regulation of GSIS, but the link between epinephrine and glucose oxidation in β cells is undefined. Our objective was to determine whether epinephrine decreases oxidative metabolism in β cells. A microchamber fixed with a fiber optic oxygen-sensing probe was used to measure oxygen consumption rates in Min6 cells and isolated rat islets. Baseline rates were measured in RPMI media supplemented with 20mM glucose, and then epinephrine was added to a final concentration of 0 nM (vehicle control) or 100nM, followed by 10uM yohimbine (a selective Adrα2A antagonist). To identify glucose oxidation as the primary metabolic pathway affected by epinephrine, oxidation of 14C(U)-labeled glucose was determined in Min6 cells incubated for 90 minutes in KRB+20mM glucose with 0 (vehicle control) or 100nM epinephrine. Epinephrine, but not vehicle, reduced (P<0.01) oxygen consumption rates in rat islets and Min6 cells to 64 ± 6% and 65 ± 1% of baseline, respectively, and yohimbine restored oxygen consumption to rates not different from baseline. In Min6 cells incubated with epinephrine rates of 14C glucose oxidation were reduced 66 ± 4% less (P<0.01) compared to vehicle controls. These results demonstrate that acute epinephrine exposure suppresses glucose oxidation in β cells via the specific adrenergic receptor, Adrα2A, and indicate a new role for adrenergic regulation in GSIS.
Animal Sciences 202: Introduction to Livestock Production  

Dan Kiesling  
Department of Animal Sciences  
The University of Arizona

The spring 2012 semester catalog saw a new course offering in the Department of Animal Sciences, ANS 202: Introduction to Livestock Production. The course focuses on the production and management of beef cattle, goats, sheep and swine covering the principles of animal science, particularly nutrition, reproduction, health and breeding and genetics. The Department saw the need to offer a sophomore level course exposing students to the different management practices of the 4 major meat animal species. Currently, the class is a major requirement for students in the industry option, business/production path. Faculty members anticipate that students will be able to apply course material from ANS 102: Introduction to Animal Sciences (freshman level course) and ANS 202 to their upper division course work.

The course includes weekly homework assignments, article summaries of current issues in animal agriculture, exams and a laboratory section. The laboratory sections offer students the opportunity to travel to local farms and ranches and examine the different production systems in place in southern Arizona. Students are also able to take part in production practices such as processing calves, lambs, piglets and kids. Spring 2012 students were able to examine gastrointestinal and reproductive tracts as well as participate in body condition scoring of cattle.

The class culminates with the completion of a final project in lieu of a final exam. For the 2012 class final project students chose a livestock enterprise and developed an overall plan for the enterprise. Students addressed the type of operation, source of livestock, standards operating procedures, nutrition, breeding, reproduction, marketing and economics. The project was designed to encourage students to take what they learned in the class throughout the semester and apply it to a real life situation.

Responses from the students who took the inaugural class were positive and they stated they would recommend the class to other students. Increased enrollment for the class is one of the goals for the next time the class is offered as well as increased enrollment of students who are on the science/pre-professional path in the major.

Instructor Dan Kiesling would like to thank those who helped make this class possible, Dr. Nathan Long, Drs. John and Elaine Marchello, Mr. and Mrs. Harry Sloan, Wayne, Sherry and Josh Buzzard and the University of Arizona Collegiate Cattle Growers Association.
The Collegiate Cattle Growers Association (CCGA) was established in the fall of 2005 by a group of students who were passionate about the Arizona beef cattle industry. With the closure of the Department's livestock farms, the students saw a need for members to get hands-on experience in livestock production, especially for members who did not come from a production background. Over the years, the cow herd has grown to approximately 25 head and the club has developed a swine herd and formed a partnership with the UA Meats Lab for its weekly meats sale. The club also works with the Arizona Beef Council to promote awareness and support for the Arizona beef industry.

CCGA Enterprises

Livestock

The CCGA is one of the few, if any, collegiate livestock clubs to own and manage their own livestock herds. Student managers oversee the daily management of the herds, including the development of budgets and feeding programs as well as making health and breeding management decisions. The managers are also responsible for the marketing efforts of the offspring. The livestock owned by the club are utilized in departmental courses, by the judging team for workouts and contests and for outreach events.

The cow herd was established in 1996 initially with cows leased from the UA V-V Ranch and over the years, the herd has grown to 24 cows. Primary income is derived from the sale of show calves and replacement heifers. Calves are marketed off the farm at the Arizona National Livestock Show. This past year, the CCGA exhibited the champion replacement heifer that sold at the Arizona National, and sold a Maine-Anjou heifer that found success on the SAILA show circuit as a breed champion many times and as reserve supreme champion heifer once.

The sow herd was established in 2009 and typically ran 2 to 3 sows. The primary income generator for the sow herd was show pigs being marketed off the farm and occasionally at consignment sales. In April 2012, the club made the decision to liquidate the herd and focus their efforts on their other enterprises.

Meat Sales

In the fall of 2009, the club formed a partnership with the UA Meats Lab. The Meats Lab holds a weekly sale and CCGA members provide the labor for the sale. A student manager coordinates with the sales crew, is responsible for packaging and inventorying the product and does the advertising for the sale. This has been a great way for members to experience what happens after the livestock is dropped off at the processing facility and what goes into marketing the end product. The sales have been very successful and have built a large customer base.

CCGA Activities

Homecoming Tailgate

The Department hosts its annual Homecoming Tailgate party on the University of Arizona mall every football season. It’s a great time to welcome back alumni of the Department and the CCGA. Members join in the festivities and have a great time meeting with alumni and celebrating the rich history of the Department of Animal Sciences.
Jackpot Show

The CCGA holds a Southern Arizona International Livestock Association (SAILA) sanctioned jackpot show every February which includes breeding and market cattle, sheep, goats and swine. Members are responsible for procuring sponsorships and donations, advertising, handling registrations and organizing the show. The show is held at the Campus Agricultural Center on Campbell Avenue and Roger Road.

Spring Fling

The University of Arizona Spring Fling is the largest student run carnival in the country and is held the first weekend of April at the Rillito Downs Racetrack. CCGA members use this opportunity as a fundraiser by selling beef kabobs and drinks at a booth at the carnival. This a is a great opportunity for students to show off their cooking skills as well as raise awareness for the beef industry in Arizona.

Annual Banquet

Each year the club hosts a end-of-year banquet to celebrate a year of hard work, recognize members who have done exemplary work for the club and honor a member or members of the community who have contributed greatly to the success of the CCGA. The club has designed several special awards to present to deserving members which include the Club Innovator, a member who has brought a new idea or strategy that has added to the achievements and success of the club; the Club Moneymaker, a member who has contributed significantly to the club's financial standing; the Club Workhorse, a member who has worked the hardest for the club; the Top Gun Male and Female, a new male and female member who have been the most active in the club and who shows promise of being a leader of the club in the future. The club also thanks the out going CCGA officers for their hard work, welcomes in the new officers and recognizes the members of the previous year’s livestock judging team. In addition to the awards presentations an auction is typically held with proceeds going to support club activities.

Other Activities

The club has one standing committee, the Beef Advisory Committee. This committee works with the Arizona Beef Council to put on events that promote and raise awareness of the Arizona beef industry. The committee focuses it's efforts on the UA community and the Tucson area.

For more information about the CCGA, contact:

Dan Kiesling, (520) 621-5810 or kiesling@email.arizona.edu
Livestock Judging Team

Dan Kiesling
Department of Animal Sciences
The University of Arizona

The Livestock Judging Team began competing and representing the University of Arizona in 1925. The team was initially started by the student Agriculture Club and competed at the American Royal in Kansas City, MO and the International in Chicago. Since then, over 320 students have competed on the University of Arizona Livestock Judging Team.

Competing on a judging team helps students to improve their oral communication skills, use critical thinking and decision making, as well as foster a strong work ethic. Students have the opportunity to compete at the most renowned livestock shows in the world as well as visit some of the most elite livestock operations in the country. Networking with producers and students from around the nation gives students invaluable connections for their first job search and beyond.

By competing on the judging team members receive course credit in livestock evaluation (ANS 210, ANS 297B) and can satisfy the communication requirement for an animal sciences degree (ANS 396A and ANS 496B). In addition scholarships are awarded to members for the spring and fall semesters they serve on the team.

The team typically competes in 8 contests a year and follows a calendar year as opposed to an academic year. In the spring season, the team travels to the Arizona National Livestock Show in Phoenix, the National Western Stock Show in Denver, Colorado, the San Antonio Livestock Exposition in San Antonio, Texas and the Houston Livestock Show and Rodeo in Houston, Texas. The fall season includes the Tulsa State Fair in Tulsa, Oklahoma, the State Fair of Texas in Dallas, the American Royal in Kansas City, Missouri and the North American International Livestock Exposition in Louisville, Kentucky where the national championship contest is held.

On December 29th, 2011 in conjunction with the Arizona National Livestock Show in Phoenix the Department of Animal Sciences hosted a reunion for past judging team members. The event garnered nearly 80 attendees
who reminisced about their “glory days” representing the University of Arizona at contests from San Francisco to Ogden, Utah to Houston and places in between. Teams of every decade were represented all the way back to the 1950’s. During the reunion two individual awards were presented to the retiring 2011 team members who had done especially well over the season. The first award was the Don Butler Traveling Trophy, first given in 1952 to the high point member of the team. Former judging team member Don Butler sponsored this trophy in the few years following his time on the team and the trophy was awarded once again in 2011. The award goes to the team member who earned the most points at the five major contests; the Arizona National, National Western, Houston Livestock Show, American Royal and the North American International. The recipient of this award was Zach McFarlane. The second award was the Coach’s award which was presented to Donny Toland, as the team member who had shown the most improvement over the year and exemplified the “model” team member. Past team members enjoyed the reunion and were excited to have the chance to catch up with old friends and meet the current team. Plans are underway for a reunion to be held again in 2012 with the hope of continuing the event annually.

For more information about the Livestock Judging Team or the Judging Team Reunion, contact:
Dan Kiesling, (520) 621-5810 or kiesling@email.arizona.edu

Members of the 2012 team travel to Galveston Bay on their way to the Houston contest. Members of the team are (L-R): Claire Jackson (Tucson, AZ), Josh Moore (Parker, AZ), Jennifer Sherlock (Safford, AZ), Ben Menges (Safford, AZ) and Larissa Gustafson (Owatonna, MN).
Imagine sitting in the starting gate astride a muscular thoroughbred, hearing the bell, then thundering around the track, hooves pounding and mud a-flying.

That’s the visceral visual experience that a team of University of Arizona students captures with the new jockey cam – a smart helmet that streams real-time video and puts viewers right in the saddle.

The new technology, which they’ve launched under the company name of EquiSight, was the brainchild of David P. Matt and Kenleigh Hobby, who met as freshman at the University of Arizona’s one-of-a-kind Race Track Industry Program founded in 1973 within the College of Agriculture and Life Sciences. They shared a passion for horses and snowboarding.

Four years later, the seniors also share a business venture that is changing the way the world views horseracing. It’s called EquiSight.

160,000 YouTube Views

To date EquiSight has filmed more than 100 videos that have attracted 160,000 YouTube views – plus the attention of ESPN, the Ireland Tourism Board, racetracks around the world and venture capital investors.

The two students knew that to graduate they would need a senior capstone project that addressed a pressing issue in the racing industry. They realized “the biggest problem with this sport is it is still stuck in the binocular era,” Hobby said. Other sports use 21st century technology to create high-impact video content. Why not horse racing?

In an era of computers, video games, tablet technology and smart phones, surely they could bring horseracing out of the age of binoculars and into split-second high-def video action. Their goal is to revolutionize the way people experience the horse race – energizing current enthusiasts and engaging the next generation of fans.

“This is the equivalent of seeing the race through the jockeys’ goggles. You simply can’t get any closer to the action than this,” Hobby said.

From Concept to Reality

In less than a year their idea went from concept to tracks across the country – thanks to an array of UA connections. They include a door-opening network of UA alumni in the racing industry, a team of students from the College of Engineering who developed the jockey cam technology, a mentor at the Eller College who provided patent advice and the Arizona Center for Innovation, the business incubator where the co-founders launched EquiSight.

In December of 2011 they presented their interactive multimedia video experience to more than 600 racing and gaming executives at the 38th Annual Symposium on Racing and Gaming in Tucson. In February 2012 they filmed 30 jockey-cam videos at prestigious race tracks and training centers on the East Coast. In March 2012 Wasabi Ventures Portfolio selected EquiSight to receive venture capital support.

“We’ve had unsolicited emails from people all over the world. Owners, trainers, jockeys, race tracks in Australia Canada, Mexico and Argentina,” Matt said. “The Ireland Tourism Board bought 15 seconds of our footage to use for a visit-the-island commercial. Breeder’s Cup and ESPN have used our footage.”

Split-Second Decisions at 35 mph

“Jockeys found this very important. They’re making split second decisions at 35 mph. They can replay and watch
how they ride,” Hobby said, seeing the potential for this technology beyond racing. “We’re working every angle we can.”

Ultimately sports fans could watch a race from the starting gate, switch horses mid stride and do so from anywhere in the world. The jockey cam could be readily adapted for other sports – so baseball fans could watch as the batter swings and hits, then switch to the second-base cam and view the catch.

EquiSight now holds three provisional patents. The company also recently inked an agreement with an engineering design firm to explore the potential application of helmet-cam technology for the military and law enforcement.

**Passion for Horses & Racing**

Matt grew up with horses in Montana. Both his grandfather and father were jockeys. Now his dad is a trainer at Turf Paradise in Phoenix during the racing season and at the family ranch in the off season. A Native American, he sees the potential for combining horse racing with Indian gaming casinos. He owns several horses.

Hobby became “a fan passionate about this beautiful sport” when his family moved to California and discovered the Del Mar Race Track “where the turf meets the surf.” He traveled far and wide to see races. He was scuba instructor and a videographer for ski resorts. Advertisements for the widely respected UA racing industry program brought him to campus. He talked with faculty and sat in on a class. “I realized wow this is something I want to do.” He just bought two race horses that Matt’s dad is training.

**Laser Focused**

Hobby and Matt’s senior project took off like a runaway horse.

Following every lead totally consumed them. Now, with EquiSight fairly well launched, they are now laser focused on earning their diplomas. “We’ve loaded up on classes this summer. This degree is something we need. We’ve been working hard at that.”

By next fall they’ll have found their stride – coursework completed, action plans in place.

Then it’s off to the races.

Learn more about the University of Arizona Race Track Industry Program at http://www.ua-rtip.org/.
Breeding and Farm Management Masters Program

Mark J. Arns
Department of Animal Sciences
The University of Arizona

Two options exist for a Master of Science degree in Animal Sciences at the University of Arizona. The first is a traditional research based degree culminating in a thesis. The second is a non-thesis option with an emphasis on preparing students for professional opportunities in animal agriculture-related businesses.

The non-thesis option includes a professional development project generated through internship or applied, business-related research. The non-thesis option is not designed to prepare students for advancement into a Ph.D. program, but to develop industry leaders that are capable of managing herd operations or communicating scientific discovery to the industry.

A new non-thesis Master of Science option has been created by the department to focus on breeding and farm management. The main goal of this program is to give students reproductive management skills in practical settings. After completion of this program successful students will be able to step in and manage a breeding or farm operation. At this time the program has an equine operation focus but has been designed to be expanded to include dairy and beef operations as faculty availability and student interest warrants.

This program requires students to take their didactic training and apply it in real life production situations, thus learning how to make decisions that they will encounter when they enter the job market. Students are required to maintain a ledger including monitoring expenses and planning a budget, as well as develop standard operating procedures for critical skills which will form a notebook of procedures. The students are expected to complete a competency completion page, which is a skill test, and complete an efficiency evaluation/statement for the breeding season. When possible, students are assigned a project that compares or evaluates the application of new techniques. In this instance the student will prepare a written report and present their findings in their defense.

The program consists of students attending fixed courses over three semesters and participating in an internship over the summer. During their first fall semester students learn basic reproductive management skills including semen collection, evaluation, processing for fresh, cooled and frozen use; mare management including artificial insemination, ultrasound imaging, uterine lavage and treatment, and more. For the spring semester students are on cooperative ranches “full time” when not in class. During the summer students continue to work on cooperative ranches for their internship credit. Towards the end of the summer, as the breeding season slows, and into their final fall semester students will finish classes and paper work, help instruct new students entering the program and prepare to present the results of their professional development project in December.

This program will begin accepting students in the fall of 2012. For admission requirements and application information contact the Department of Animal Sciences (520) 621-7623.
Faculty Bios and Research Interests

Mark Arns  
marns@ag.arizona.edu  
520-626-9538  
Professor and Equine Specialist – Ph.D Texas A&M

Research centers on both applied and basic aspects of equine reproduction, including in vitro maturation of spermatozoa, spermatozoa preservation through cold storage and cryopreservation, the influence of seminal fluids and/or its components in maturation and preservation, and reproductive management of mares and stallions.

Steve W. Barham  
sbarham@ag.arizona.edu  
520-621-9816  
Associate Coordinator in Race Track Industry Program – MBA Portland State

Barham is responsible for coordinating independent study, including promoting independent study activities in the industry, tracking potential projects and assisting in matching students to these various projects. Barham has over 17 years’ of regulatory experience in the pari-mutuel industry having served as Executive Director of the Oregon Racing Commission from 1985 to 2002, giving him real world knowledge of regulation and the role of regulators in the racing industry.

Randy Bogan  
boganr@ohsu.edu  
Assistant Professor – Colorado State University

Dr. Bogan is currently completing his postdoctoral research at the Oregon National Primate Research Center, part of the Oregon Health and Science University. He will join the University of Arizona Department of Animal Sciences in August 2012 initially focusing on researching reproductive physiology with an emphasis on ovarian biology.

Robert J. Collier  
rcollier@ag.arizona.edu  
520-621-7622  
Professor – Ph.D University of Illinois

Research focuses on effect of environment and heat stress in particular to gene function. Areas of specific research interest include nutritional, physiological, endocrine and cellular responses to heat stress. Practical management models and environmental research facilities are utilized to provide environmental conditions facing livestock in Arizona.
Wendy Davis  wdavis@ag.arizona.edu  520-621-5663  
Associate Coordinator in Race Track Industry Program – BS University of Arizona

Davis has a 100% teaching appointment and is responsible for ANS 142 Introduction to the Animal Racing Industry, ANS 340 Race Track Marketing and Media Relations, ANS 370 Form and Function of the Equine Athlete and jointly responsible for ANS 497a The Joe Hirsch Speaker Forum. She currently serves as the advisor for all students in the RTIP option as well as many students from the other three options offered within the department.

Dan Faulkner  dfaulkner@email.arizona.edu  520-626-5573  
Extension Beef Specialist - Ph.D. University of Nebraska

Dr. Faulkner began his position with the University of Arizona July 1, 2012. He joins the Animal Sciences faculty from the University of Illinois where his most current research focus has involved improving efficiency in the beef industry. In his new position Dr. Faulkner’s research program will study the factors that influence cow forage intake, efficiency and longevity under Arizona range conditions in order to assist Arizona beef producers in improving the economic viability and environmental impact of their beef operations.

Vince Guerriero Jr.  guerrier@u.arizona.edu  520-621-7764  
Associate Professor – Ph.D Syracuse University

Dr. Guerriero serves the department in the area of biochemistry with a focus on heat shock proteins in general and heat shock binding proteins in particular. Dr. Guerriero’s laboratory has discovered a novel Hsp70 inhibitory protein called HspBP1. In vitro studies have revealed that HspBP1 binds to and inhibits Hsp70 by removal of bound nucleotide. Further studies have shown that HspBP1 is elevated in a number of tumors. Current research is focused on the function of extracellular HspBP1 in cancer cell growth.

Daniel Kiesling  kiesling@email.arizona.edu  520-621-5810  
Lecturer - B.S. Michigan State University

Dan Kiesling serves as livestock judging coach, lecturer and student advisor. Dan is currently finishing up an MS degree in Animal Science from Iowa State University with an emphasis in beef cattle nutrition. His research project is byproduct supplementation of pasture reared finishing cattle and its effects on live animal and carcass performance and fatty acid profiles.

Sean Limesand  limesand@ag.arizona.edu  520-626-8903  
Associate Professor – Ph.D Colorado State University

Research focuses on fetal development and growth, understanding how aberrant fetal nutrient and/or endocrine factors lead to postnatal complication or the fetal origins of adult disease. Seeks to identify mechanisms that alter pancreatic structure, physiology and metabolism in intrauterine growth restricted offspring to provide treatment strategies.
John A. Marchello  
**Professor – Ph.D Colorado State University**

Dr. Marchello has been a member of the University of Arizona Animal Sciences faculty since 1965. He serves as a Professor of Meat Science and Muscle Biology and his courses focus on food safety issues, meat animal evaluation, carcasses and meat cuts. He also manages the UA Meat Science Center, which is a USDA inspected meat processing facility. His research interests include Meat Science and Muscle Biology, as well as safety issues regarding meat animals and other food items.

Benjamin Renquist  
**Assistant Professor - Ph.D University of California, Davis**

Dr. Renquist’s research has 3 foci. 1) Development of a single dose injectable sterilant by employing GnRH-toxin conjugates to ablate gonadotropes which produce hormones that stimulate both egg and sperm maturation. 2) Measurement of the metabolic rate of embryonic fish to predict future growth rate by employing an assay to sort aquaculturally important species (tilapia and trout) by metabolic rate and monitoring the subsequent growth rate. 3) The Renquist lab will focus research on the metabolic changes that occur during times of stress that can either induce or suppress feed intake to better understand how stress mediates changes in food consumption.

F. Douglas Reed  
**Director of the Race Track Industry Program – MBA University of Arizona**

Reed has extensive experience as a racing official, track manager and racing and gaming industry consultant. He has been affiliated with the RTIP for 12 years and is responsible for all aspects of the racing program, including administration, instruction, promotion and fundraising. He is also director of the RTIP’s annual Symposium on Racing & Gaming, the world’s largest pari-mutuel racing conference.

Dave Schafer  
**Resident Director of V-Bar-V Ranch - Ph.D Colorado State University**

Research at the V-Bar-V addresses environmental, wildlife and domestic livestock issues applicable to Arizona and the Southwest. The historic V Bar V is a 57-pasture grazing allotment totaling 77,000 acres that runs about 30 miles east from Camp Verde along the Mogollon Rim. Research involves an applied approach to problem-solving, rather than laboratory studies in basic science. Current studies focus on three main areas: cow herd management; range and watershed activities, and wildlife interactions, particularly with elk.

John Smith  
**Extension Dairy Specialist - Ph.D University of Missouri**

Dr. Smith’s research interests include cow comfort, heat stress, milking parlor performance, special needs facilities and management of expanding dairies. He is nationally and internationally recognized for his work in housing and management systems for dairy cows and is considered a world expert in the area of cooling dairy cows and dairy facilities construction. Dr. Smith works throughout the United States and internationally assisting producers with the development of efficient dairy operations.
William A. Schurg  bschurg@ag.arizona.edu  520-621-3601
Professor and Equine Specialist – Ph.D Oregon State University

Dr. Schurg is responsible for the introductory and nutrition courses in the equine sciences program within the Animal Sciences Department at the UA. Dr. Schurg also contributes to the Animal Industry, Principles of Nutrition and Applied Animal Nutrition courses each year with guest lectures. Dr. Schurg’s research focuses on the nutritional and exertional factors affecting athletic ability of equine animals.

Laura Walker  llwalker@cals.arizona.edu  520-318-7023
Instructional Specialist Coordinator and Equine Center Manager - M.Ag. Texas A&M

Laura Walker has been involved in the horse industry for over 20 years through her education, work experience and instructional experience. Walker manages the Equine Center overseeing daily operations, breeding, horse care, and training.

Jim Sprinkle  sprinkle@ag.arizona.edu  928-474-4160
Area Extension Agent in Animal Sciences – Ph.D Texas A&M

Jim Sprinkle is headquartered in Payson and covers primarily Yavapai and Gila counties but also works statewide in cooperation with other extension agents. Most of his work deals with range monitoring, range issues with agencies, range beef cow production and range nutrition. His current research is in the area of beef cattle trace mineral nutrition.