LARGE ANIMAL PROCEEDINGS

June 5–7, 2022

2022 ANNUAL CONFERENCE

College of Veterinary Medicine
Kansas State University

Conference Contact Information:

Kansas State University College of Veterinary Medicine
Office of Continuing Education and Events
213 Trotter, 1710 Denison
Manhattan, KS 66506
785.532.4528
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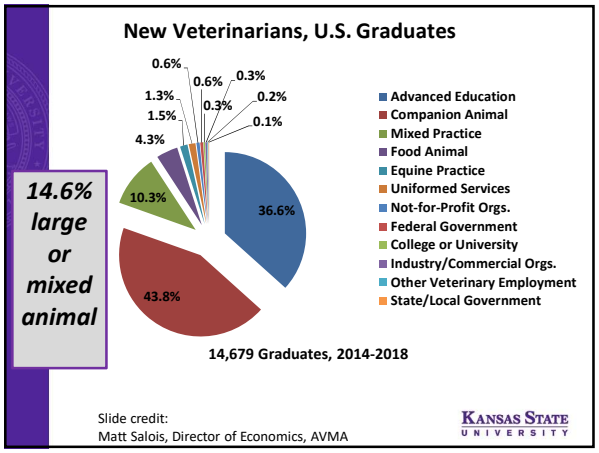
LARGE ANIMAL PROCEEDINGS
June 5–7, 2022

Available Resources to Augment Rural Veterinary Practice

Dr. Brad White, Kansas State University


Rural, mixed animal practice issues
Brad White, DVM, MS
Beef Cattle Institute
Kansas State University


New Veterinarians, U.S. Graduates
14.6% large or mixed animal
0.6%
0.6%
0.3%
1.3%
0.3%
0.2%
1.5%
0.1%
4.3%
10.3%
36.6%
43.8%
Advanced Education
Companion Animal
Mixed Practice
Food Animal
Equine Practice
Uniformed Services
Not-for-Profit Orgs.
Federal Government
College or University
Industry/Commercial Orgs.
Other Veterinary Employment
State/Local Government
14,679 Graduates, 2014-2018
Slide credit:
Matt Salois, Director of Economics, AVMA
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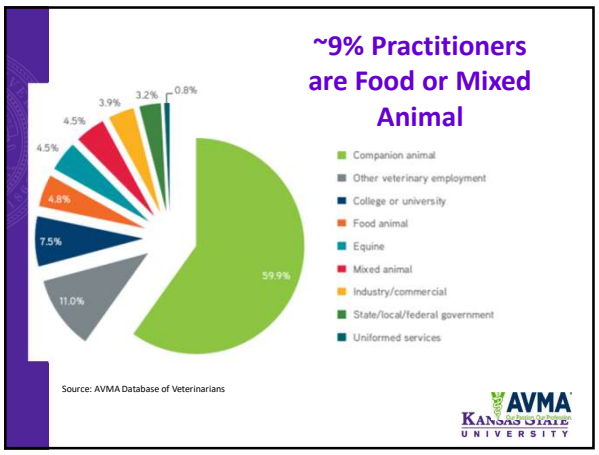
~9% Practitioners are Food or Mixed Animal
0.8%
3.2%
3.9%
4.5%
4.5%
4.8%
7.5%
11.0%
59.9%
Companion animal
Other veterinary employment
College or university
Food animal
Equine
Mixed animal
Industry/commercial
State/local/federal government
Uniformed services
Source: AVMA Database of Veterinarians
AVMA
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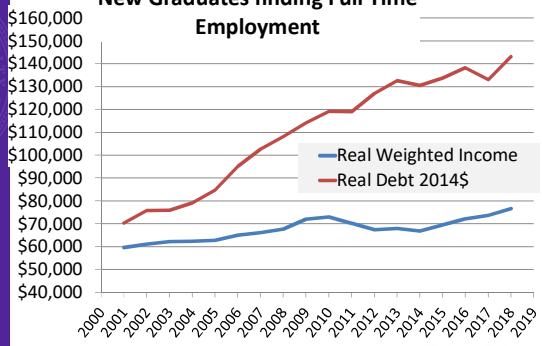
Debt and Income: New Graduates finding Full Time Employment



Slide credit:
Matt Salois, Director of Economics, AVMA

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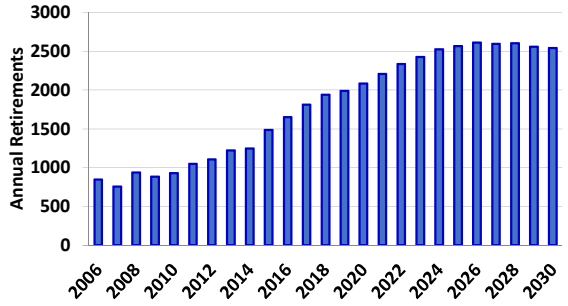
Retirements will accelerate in the next 5 – 10 years

Source: AVMA Census of Veterinarians; AVMA Economic Calculation

Estimated Number of Veterinarians Retirements (2006 – 2030)



Graduate Demand

AVMA:

- 2021 unemployment rate = 0.7%
- 2021: YoY 13% industry growth
- 17%-35% projected employment growth over 10 yrs
- 2.5 offers/graduate
- 3.1 jobs/job seeker

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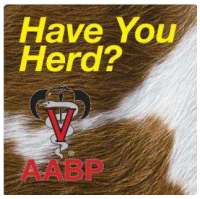
AMERICAN ASSOCIATION of BOVINE PRACTITIONERS

Veterinary Practice Sustainability Committee

- Next generation practice analysis workshops
- Monthly newsletters
- Podcast



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Rural practice issues

- Producer expectations
- Student training
- Job satisfaction
- Veterinary compensation
- Turnover in practice

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Rural Veterinary Workforce Development

KANSAS STATE UNIVERSITY College of Agriculture

KANSAS FARM BUREAU The Voice of Agriculture

KANSAS LIVESTOCK ASSOCIATION

LMA

KVMA

Kansas Department of Agriculture

Workforce team:

KSU Veterinary Med: Bonnie Rush, Brad White

KSU College of Ag: Mike Day, Ken Odde

KS Veterinary Medical Assoc: Megan Kilgore

KS Dept. of Agriculture: Mike Beam, Kelsey Olson

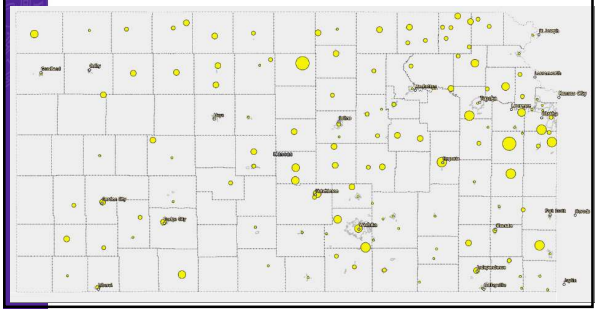
Kansas Farm Bureau: Nancy Brown

Kansas Livestock Association: Matt Teagarden

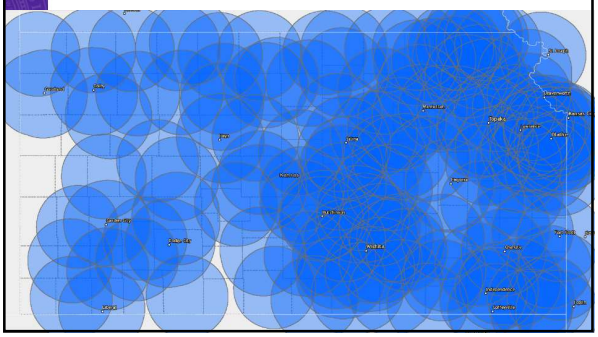
Livestock Marketing Association: Joe Barbour

Number of practicing large animal vets in KS

- 446 large /mixed animal / mobile



30 mile radius from each large animal practice



Rural Veterinarian Producer Survey

Kristen Smith

Survey goal

Identify level of shortage as perceived by producer

Identify specific areas or types of services needed

Survey responses

- Survey posted online and promoted
- 202 usable responses

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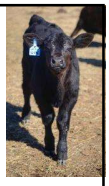

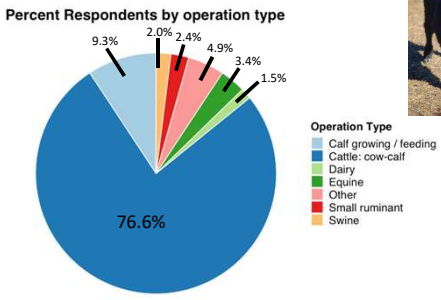

87.3% of respondents in operation > 10 years

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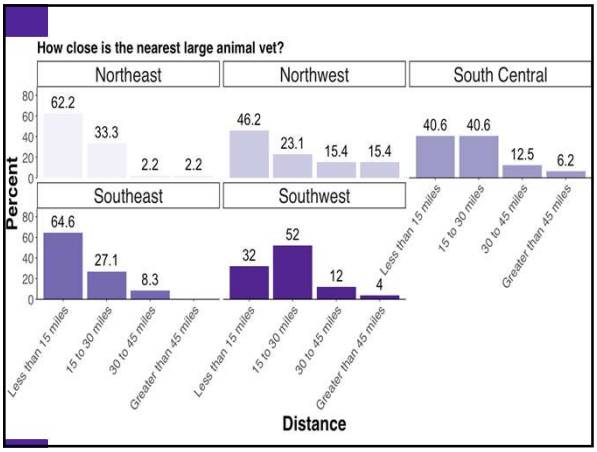
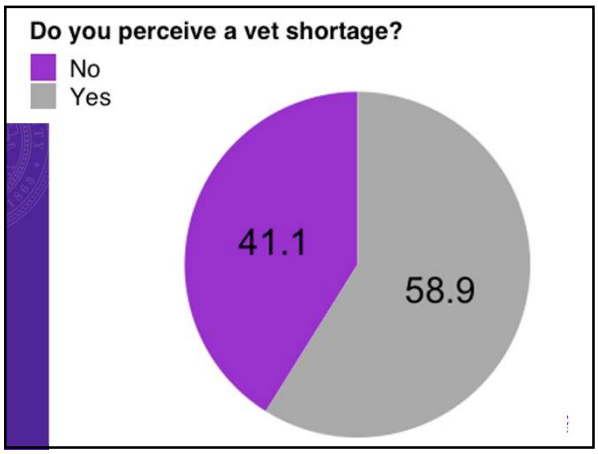
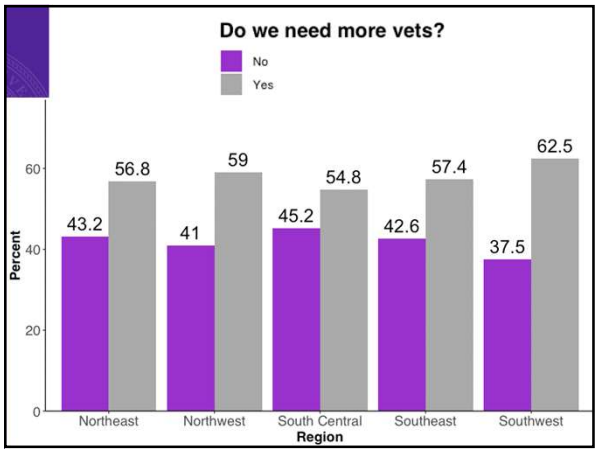
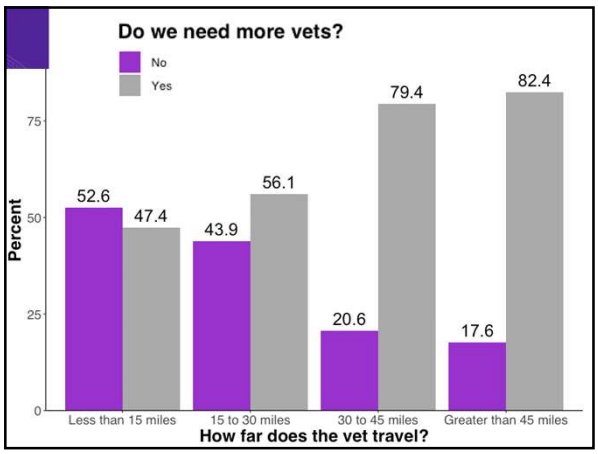



Do you perceive a vet shortage?
No
Yes
41.1
58.9


Do we need more vets?
No
Yes
Percent
0
20
40
60
43.2
56.8
41
59
45.2
54.8
42.6
57.4
37.5
62.5
Northeast
Northwest
South Central
Southeast
Southwest
Region


Do we need more vets?
No
Yes
Percent
0
25
50
75
52.6
47.4
43.9
56.1
20.6
79.4
17.6
82.4
Less than 15 miles
15 to 30 miles
30 to 45 miles
Greater than 45 miles
How far does the vet travel?

Services listed in survey

1. Herd production records
2. Herd financial analysis
3. Marketing plans for animals
4. Balancing rations
5. Evaluation of feed / mineral costs
6. Genetic decisions
7. Designing reproductive programs (estrus synchronization)
8. Implementing reproductive programs (estrus synchronization / AI)
9. Performing regulatory procedures (health certificates, required testing)
10. Design working / processing facilities
11. Designing a preconditioning program
12. Designing an immunization program for adults
13. Vaccinating animals
14. Designing a treatment protocol
15. Designing a biosecurity program
16. Selecting / managing replacement animals
17. Performing emergency individual animal treatments (sick animals)
18. Visiting farm to evaluate herd emergency or disease outbreak
19. Performing pregnancy testing by rectal palpation on cows
20. Performing pregnancy testing by ultrasound on cows
21. Performing breeding soundness exams on bulls
22. None

Overall results

Top 5 Current Services Utilized

- Performing emergency individual animal treatments (sick animals) (n = 157)
- Performing pregnancy testing by rectal palpation on cows (n = 125)
- Performing breeding soundness exams on bulls (n = 119)
- Performing regulatory procedures (health certificates, required testing) (n = 117)
- Vaccinating animals (n = 115)

Overall results

Top 5 Services Unavailable

- Performing emergency individual animal treatments (sick animals) (n = 23)
- Balancing Rations (n = 16)
- Evaluation of feedstuffs/mineral costs (n = 14)
- Designing reproductive programs (estrus synchronization) (n = 13)
- Designing a biosecurity program (n = 12)

Conclusions

- Most respondents cow-calf with monthly/quarterly veterinary interactions
- 58.9% respondents indicated veterinary shortage
  - Higher percent indicated shortage if < 3 vets within 45 miles or vets have to travel > 30 miles to operation

Top 5 Current Services Utilized	Top 5 Services Unavailable
• Emergency treatments (n = 157)	• Emergency treatments (n = 23)
• Preg test (palpate) (n = 125)	• Balancing Rations (n = 16)
• Bull BSE (n = 119)	• Feed/mineral costs (n = 14)

Rural practice issues

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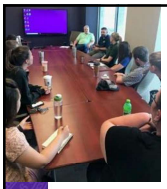

KSU CVM Rural veterinary educational programs

- Food Animal Veterinary Certificate (FAVC)
- Veterinary Training Program for Rural Kansas (VTPRK)
- SPARK grant: Summer program for Aspiring Rural Kansas Veterinarians

KSU CVM
Food Animal Veterinary Certificate

- Certificate based on existing and new courses
  - Incorporate program through all 4 years
- Communicate student/graduate food animal interest internally and externally
- **Educational objectives**
  - Produce entry level workforce for food animal practice
  - Prepare graduates for success in food animal practice

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FAVC *Overview*

- *Course work:*
  - Core courses (4 hours) must take all
  - Elective courses: 10 hours (pre-clinical and clinical)
- *Core Experiences*
  - Involvement extracurricular
  - Procedure logs
  - Proficiency at core clinical skills
  - Capstone experience seminar presentation

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Veterinary Training Program
VTPRK
For Rural Kansas

- FAVC (14 credits)
- Attend Continuing Education
- Monthly Meetings
- Summer Tour of KS Ag Production
- Capstone Experience Presentation

Veterinary Training Program
VTPRK
For Rural Kansas

- 80 recipients: 98% have/are fulfilling
- Beyond 4 years: 94% practice in a qualifying county / 77% in practice of origin

Veterinary Training Program
VTPRK
For Rural Kansas

Current VTPRK students

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- Career satisfaction impacts:
  - New associate **recruitment**
  - Current associate **retention**

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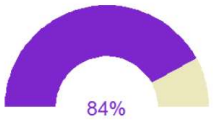
Career Satisfaction Summary



- Most new graduates satisfied with career (84%)
  - How to increase satisfaction: time away from work
- Only 67% felt financially healthy
  - Recognize the role of current student debt
- **Adequate recognition** is critical
  - Job and career satisfaction and financial health

2021 Gilliam et al Bovine Practitioner Proceedings

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Rural practice issues

- Producer expectations
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- Turnover in practice

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BOVINE PRACTITIONER | VOL 55 | NO 2 | 2021

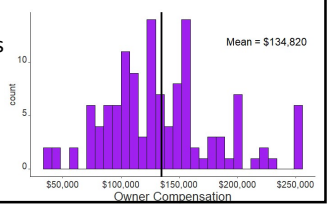
PEER REVIEWED

Factors influencing administrative personnel and veterinarian turnover and compensation packages in rural mixed-animal practices over a 5-year period

Gabryelle N. Gilliam[1], MS; **Brad J. White**[1], DVM, MS; **Charles C. Dodd**[2], DVM, PhD

- Associations with compensation:
  - Frequency of meetings
  - Turnover (DVM and administrative)
  - Marketing Plan

Owner Compensation



Rural practice issues

Producer expectations

Student training

Job satisfaction

Veterinary compensation

Turnover in practice

- Key associations:
  - Veterinarians with ownership
    - Higher with 1 DVM owner
  - Number Admin left
    - Higher turnover if 4 left compared to 0

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Rural practice issues

Producer expectations

Student training

Job satisfaction

Veterinary compensation

Turnover in practice

- Rural vet shortage
  - Specific services?
- Satisfaction
  - Relationships and feedback
- Marketing plans / staff meetings
  - Job vs. business
- Turnover is challenging
  - Culture

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LARGE ANIMAL PROCEEDINGS
June 5–7, 2022

Ruminant Ectoparasite Control

Dr. Brian Herrin, Kansas State University

Large Animal Ectoparasite Control
June Conference 2022
Brian Herrin DVM, PhD, DACVM (Parasitology)

Insecticide Resistance

- As a measurable decrease in the efficacy of a compound against parasite species and stages that were previously susceptible.

Insecticide Tolerance

- In contrast to resistance, tolerance is a natural tendency rather than a result of selection pressure.

- Tolerance is often used to describe natural differences between different species or between life stages of organisms.

–For example ticks are naturally more tolerant of imidacloprid than fleas

Refugia

- Portion of the parasite population that is not exposed to the chemical.
- A reservoir of pesticide-susceptible genes because there is no selection pressure on parasites that are unexposed to the chemical(s).
  - Managing refugia has been used strategically to help delay progression of resistance.
    - Population ("pool" of genetic material) that is susceptible and can mate with resistant population
    - Population ("pool" of genetic material) must be able to immigrate into the treated area

Common Reasons for Perceived Product Failure

- Lack of understanding of product performance attributes
  - Speed of kill, duration of adulticide activity, repellency, unrealistic efficacy expectations
- Inadequate control measures
  - Not treating all pets, visitor pets, misadministration, no treating regularly, etc.
- Lack of knowledge concerning parasite biology and epidemiology

Integrated Pest Management

- Uses a variety of systems to control pest populations & delay development of resistance.
  - Establishment of injury and treatment thresholds
    - Maintaining refugia
  - Monitoring of pest populations
  - Chemical control (rotations?, combinations?, mosaics)
    - Insecticides
    - IGRs
  - Biological control
  - Mechanical control
  - Resistance monitoring

- Lice - Pediculosis - Livestock
    - Sucking Lice- feed on blood, therefore systemic and topical products are very effective
    - Biting Lice- feed on skin/hair debris, therefore topical products are more effective
    - Life Cycle
        - Lice are very host specific
        - Entire life cycle on host
        - Adult--> Egg --> Nymph --> Adult (3-4 weeks)
        - Transmission by direct contact (carriers that remain persistently infested)
    - Predisposing Causes
        - Neglect
        - Poor nutrition, poor condition, poor grooming, overcrowding, filth, cold, debilitation
        - Seasonal; worse in winter
        - Usually more a problem in young animals
    - Treatment, Management and Control
        - Correct underlying causes (Crowding, debilitation, nutrition, etc.)
        - Treatment does not work on eggs (nits). Therefore repeat treatments are often needed after eggs hatch, but before the next generation becomes reproductively active ~3-4 weeks.
        - Macrocyclic lactones
            - Viable lice can be found for 1 week after treatment with avermectins - do not mix cattle for 1 week.
            - Label - Single doses of avermectins are generally 100%, however - may be best to give two treatments 3 - 4 weeks apart.
        - Insecticide sprays, pour-ons and dusts
            - Permethrin, Coumaphos, Cyfluthrin, Phosmet, Fenthion
            - Generally 2 applications at 2 - 3 weeks intervals; read and follow labels

Fly Control-

- Effective fly control depends on the fly species of interest.
    - On-animal focus
        - Horn Fly
        - Face Fly
    - Environmental/management focus
        - Stable fly
        - House fly
- Feeding Sites
    - House fly

        - Tears, saliva, nasal discharge, blood (from wounds/insects), serum, feces, filth
    - Stable fly
        - Female and males feed on blood;
        - Only on host when feeding
    - Horn fly
        - Cattle are feeding and resting site
    - Face fly
        - Tears, saliva, nasal discharge, blood (from wounds/insects) & serum
- Oviposition sites
    - House fly
        - Moist (>90%) decaying organic matter
    - Stable fly
        - Moist decaying vegetable matter
    - Horn fly
        - Fresh manure (< 3 min. post-defecation)
            - Environmental control challenging to accomplish
    - Face fly
        - Fresh dung (5 hr to 24hr) post defecation
            - Environmental control challenging to accomplish
- Resting sites
    - House fly
        - Fences, buildings, trees, and shrubs; **often in the sun**
    - Stable fly
        - Shaded sites usually low to ground; indoors
    - Horn fly
        - Cattle are feeding and resting site
    - Face fly
        - Shaded vegetation; overwinter in attics

- Control
    - Sanitation – The "KEY" to fly control
        - House Fly/ Stable Fly -
            - If sanitation isn't maintain then chemical control may be useless.
        - Face Fly/ Horn Fly - Not practical since these flies use fresh feces

- Environmental Control
    - Physical - screen windows & doors in dairies
    - Residual surface sprays - (only helps for a short time)
        - <u>Apply to resting sites</u> such as ceilings, panels and walls.
        - (Fenthion, Diazinon, Permethrin, Cyfluthrin, Spinosad etc..)
    - Baits (HOUSE FLY ONLY)

        - Insecticide impregnated material that kills flies when they land and feed on bait.
    - Traps
        - House flies
            - Ultraviolet light traps
            - Attractant (sugar and pheromone) based traps
        - Stable flies
            - **t**ranslucent or semi-translucent plastics
    - Biological control – very tiny **parasitoid** wasps – wasp larvae eat fly pupae
        - Tiny wasps (2 – 4 mm)- obligate parasites of flies.
        - Must use correct wasp species.
        - Best if used May – June
- Control- On Animal
    - Ear tags impregnated with pyrethroids or organophosphates. Control up to 5 months (Horn flies and Face flies)
        - 2 tags/animal
        - Organophosphate: diazinon, diazinon + chlorpyriphos, fenthion, coumaphos + diazinon, etc
        - Pyrethroids: permethrin, cypermethrin, cyfluthrin, fenvalerate
        - Avermectins (abamectin)
    - Topical residual insecticides
        - Treat late May when fly counts reach 50 flies/animal

- Topical Avermectins
    - Short duration of action typically 7 days, may get some benefit for up to 28 days
    - Pour-on formulations of
        - ivermectin (28 days)
        - eprinomectin (7days)
        - moxidectin (7 days)
        - doramectin (7 days)
- Recommendations to combat resistance to ear tags:
    - Do not tag before fly season starts
    - Use tags in conjunction with other control measures
    - Rotate tags 1 year Pyrethroid – 2 years Organophosphate (OP)

Tick species of interest – Livestock

- Asian Longhorned Tick- *Haemaphysalis longicornis*
    - INVASIVE and newly introduced
        - Likely here for good
    - Infests cattle in HIGH numbers
        - Several reports of cattle being exsanguinated due to the high tick burden
    - Tick-borne pathogns
        - In its native range, can transmit *Theileria orientalis*

        - Has not been reported to transmit pathogens in the US yet, BUT
        - *T. orientalis* Ikada (pathogenic strain) has recently been reported in the US (in KS) as well
- Lone Star Ticks- *Amblyomma americanum*
    - Adults in spring and summer (February-June)
    - Nymphs in summer and fall (May – September)
    - Larvae in early fall (Aug-Sept)
    - Tick borne infections
        - None to cattle?

- American dog ticks, wood ticks- *Dermacentor variabilis* & *Dermacentor andersoni*
    - Throughout most of United States
        - *D. andersoni* overlaps into regions where *D. variabilis* is not found
    - Adults in warmer months (spring to summer)
    - Tick borne infections
        - *Anaplasma marginale*

- Gulf Coast ticks- *Amblyomma maculatum*
    - Southeastern and southcentral United States
    - Tick borne infections
        - Gotch Ear- inflammatory damage to ear cartilage

- Spinose Ear Tick- *Otobius megnini*
    - Only larvae and nymphs are parasitic
    - Prefer to attach in the ears

- Winter Tick- *Dermacentor albipictus*
    - Thousands of these ticks may infest deer, moose, cattle and horses in the fall and winter, resulting in severe anemia, alopecia and death due to exposure in winter.
    - In Kansas we find adults on horses as early as late October to mid November
        - In northern regions nymphs do not molt to adults until November or as late as January.
    - Adults drop off in winter or early spring to lay eggs.
- Rhipicephalus spp.
    - Rhipicephalus annulatus - (formerly Boophilus annulatus) "Texas Cattle Fever Tick“
    - Rhipicephalus microplus - (formerly B. microplus) “Southern Cattle Tick”.
    - 1-host inornate ticks
    - Officially eradicated from U.S. in 1943
    - Tick transmit Texas Cattle Fever (Babesia bigemina and Babesia bovis), Anaplasmosis
- Control of Ticks on Cattle
    - Where possible eliminate shrubs and other woody vegetation.

        - Provides habitat for both rodents and ticks and tick climbing sites.
    - Pasture burning
        - Results have been variable. Regular prescribed burning has been shown to reduce D. variabilis and A. americanum, but not A maculatum.
    - There are no acaricides registered for treating grazing land.
    - Killing of ticks on cattle can be accomplished with repeated whole body treatments at 3 to 4 week intervals
        - Permethrin (various formulations such as Ectiban, Atraban, Permectrin, Expar etc.)
        - Coumaphos: (Co-Ral: Bayer)
        - Amitraz (Taktic) not registered for use on horses – currently not available
            - Always read and follow label directions
    - Gulf Coast or Spinose Ear ticks
        - spray ears directly!!!
        - acaracide impregnated ear tags (one tag per ear)

- Scabies - Livestock
    - Five genera of mites in cattle
        - Psoroptes sp.; Sarcoptes sp.; Chorioptes sp.; Psorergates sp.; Demodex sp
    - Upon detection cases of scabies in cattle, sheep or goats should be reported to the State Veterinarian (Kansas).
        - The most important and legally reportable in all states is Psoroptes communis bovis.
        - Note many state regulations say “cattle scabies” is legally reportable without differentiating between mite species.

- Sarcoptic scabies
    - Sarcoptes scabiei has become extremely rare in the United States in both cattle and sheep.
- Chorioptic Scabies
    - Chorioptic mites live on the surface of the skin.
- Treatment - Scabies
    - Highly contagious, in Kansas it is recommended (Required) that all cases of scabies mites in sheep, goats and cattle be reported to state veterinarian.
    - State authorities may require immediate quarantine of infected herds and institute control measures.
    - Approved treatments for scabies mites are:
        - Ivermectin, Doramectin, Eprinomectin, Moxidectin
        - Amitraz dip; twice at 7-10 day intervals
        - Coumaphos dip; twice at 10-14 day intervals
        - Permethrin dip; twice at 14 day intervals

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Internal Parasite Control for Ruminants

Dr. Jeba Chelladurai , Kansas State University

Notes

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Necropsy Tips and Techniques

Dr. Dave Sjeklocha, Merck Animal Health

Necropsy Tips and Techniques – Dave Sjeklocha, DVM

Necropsy is a tool that is probably underutilized in beef cattle practice. They can be time-consuming and many of our producers don't see the value in a necropsy, especially with the added expense of laboratory diagnosis. However, our clients can relate to many of our procedures in necropsy such as the physical effort it requires, the sharp tools we use and it can also be an excellent learning opportunity. Clients are not impressed if it takes 15 minutes to simply cut the skin before we open the animal up, or if we do a “peekaboo” necropsy or if we have a poor attitude about the thoroughness of our necropsy. On the other hand, if we can do a necropsy efficiently, if our tools are sharp, if we are thorough and if we have the ability to explain what we are seeing to the customer our clients will be impressed.

Sharp Tools - the importance of sharp tools cannot be overstated. If we have a sharp knife the client is impressed, it makes our job easier to do the necropsy, and we are more likely to be thorough simply because it is easier to be thorough if our tools are sharp. The tools I use include in Estwing campers axe, an Eicher 7 inch straight knife, an Eicher 6 inch curved knife, a medium sharpening steel and a fine/course whetstone. I also protect my hands by wearing a cut resistant glove covered by a @XL kitchen glove. Other tools I have seen used include a cordless reciprocating saw (to cut the ribs), and a utility knife or carpet knife for cutting the skin instead of using your regular necropsy knife.

Which brand of knife is best? As stated earlier, I use Eicher. I have seen other brands such as Victorinox Dexter, Flussel, Havalon, etc. I have done thousands of necropsies with my Eicher knives and I have yet to wear them out. I do well with Eicher knives but I can't tell you if Victorinox or any of the other brands are better, simply because I really have not used them. So my advice is to simply find one you like and use it.

Part of the reason why my knives have lasted as long as they have is because I am constantly sharpening them. That may sound counter intuitive, but the actuality is that I very seldom take my knives to a stone. Throughout the necropsy I stop and use my medium steel to keep the edge on my knife. I have tried fine steels, but I believe the edge is too fine at that point and is actually easier to dull. When I do use a stone, it is a very common two-sided stone that I purchase at Ace Hardware stores. I do not use oil or water on my stones. The stone is made for the initial sharpening of the knife. Once you have it sharp, the steel can be used to maintain the edge and keep it sharp. We are often taught that when we use a stone we need to keep the edge of the knife add a 15 to 30 degree angle for proper sharpening. For many years, I work very hard to try to maintain that 15 to 30 degree angle. Then, I learned that if I held my knife at an angle that felt like I was trying to shave the top off of the stone, the 15 to 30 degree angle took care of itself. It is very important when using a stone to sharpen the full length of the blade, and to apply the same number of strokes on each side of the blade.

Steels should never be used as the primary sharpening tool. They will fine tune an edge after a good edge is put on the knife with a stone. When using a steel, the steel should not “jump” as the knife comes off. It should be stroked gently and carefully. Steels will wear out over time, so they will need to be replaced. The same rules apply to the steel as they do to the stone: go the full length of the blade, same number of strokes per side of the blade. If you stop and stroke the steel multiple times throughout the necropsy it will keep your knife sharp and make the job a lot easier.

Sharpening Gadgets - I have never really cared for sharpening gadgets. They seem to wear out quickly and the folks who like to use gadgets are always looking for the next new gadget, indicating that they were never satisfied with the gadget they had.

As we start the actual necropsy, we want to be sure to get as much history as we can on the animal and then do a thorough examination of the animal before we cut. in beef cattle, the left side of the animal should be down in all cases, so we are always taking the same approach to the necropsy. As we examine the animal we should note if predators or any other wildlife have disturbed the animal, as this may affect our diagnostic capabilities.

Rendering services truly appreciate it if we can save the hide. I make my first cut starting at about the level of the umbilicus and cut forward between the front legs, up the ventral side of the neck all the way to the mandibular synthesis. Once that is complete, I extend to cut caudally from the umbilicus to the point where my hand comes in contact with the stifle. at this point, I will usually stop, stand up straight, and stroke the steel a few times. Then, I will reflect the foreleg and hide by placing the animal's hoof on my left shoulder and use it too raise the shoulder as I undermine the scapula and the hide. once the scapula is undermined, I can use my left hand to push the leg up and over while I continue to undermine the scapula and the hide.

Once that leg is reflected, I will continue undermining the skin following the incision I made from the umbilicus back to the stifle. Then I stand behind the animal and lift the right hind leg and place it against my left thigh. This allows access to the coxo-femoral joint. Then I can disarticulate the coxo-femoral joint using my thigh to keep the legs apart, and as the joint is disarticulated I can use my left hand to lift on the animals right hind leg and use my right foot to hold down the animal’s left hind leg as I open the joint. At this point, I stop again and use the steel on my knife a few strokes.

I then make a cut through the abdominal musculature along the caudal edge of the rib cage and then extend that cut caudally along the skin incision on the ventral surface of the animal. I can then grasp the abdominal musculature and reflect it out of my way. Once the abdominal musculature is reflected, I prefer to open the rib cage. This is where I use my axe. When using an ax, one should make the first cut through the ribs as close to the spine as possible from the caudal edge of the ribs anteriorly. The second cut should be along the costrochondral junction. It is very important to make these cuts with your axe at an angle that allows you to cut from the back to the front of the rib as opposed to cutting straight down on the rib (lateral to medial). After making the two rib cuts, I use my knife to cut a 6-8 inch hole between the ribs near the caudal edge of the rib cage. This allows me to use the hole as a handle while I lift the rib cage and cut the diaphragm, allowing me to reflect the rib cage anteriorly so the thoracic organs can be exposed. When reflected anteriorly, the rib cage can be used as a table to store diagnostic specimens until you are ready to bag them for the diagnostic lab.

From here, I like to remove the tongue, trachea and esophagus by making a cut along the lingual surface of the right mandible. I can then reach through that cut and roll the tongue out ventrally. I make a stab incision through the tongue so I can put my finger in that hole and use it as a handle as I continue to cut the tongue out and work caudally toward the hyoid apparatus. I find the cartilaginous joints of the hyoid apparatus and cut through those and then continue cutting caudally, removing the esophagus and trachea. I typically stop cutting at the thoracic inlet. At this point I examine the tongue for any lesions, then I incise the full length of the esophagus and check it for any lesions. Then I incise the full length of the trachea and check it for lesions. At this point, I examine the thoracic organs. I cut the lungs loose

dorsally and ventrally and then cut along the anterior surface of the diaphragm so I can reflect the thoracic organs anteriorly and see both sides of the lungs. Please note, part of my goal is to keep all the organs attached to the body so they don't fall out on the ground when the rendering service picks up the animal. I will then examine the heart by making cuts to check the heart valves and to also check for lesions such as *Histophilus somni* in the left papillary muscles.

Then, I will begin my examination of the abdominal organs. I prefer to lift the rumen and abomasum so they are hanging out of the abdominal cavity ventrally. Then when I open those organs up the contents will not drain inside the abdominal cavity. This makes it much easier to examine the rumen and the abomasum. Once the rumen and the abomasum have been examined I will make multiple cuts through the liver to check for abscesses, flukes etc. I will then make multiple longitudinal cuts through various sections of the small and large intestines.

If the brain needs to be removed, it can be done with the axe. I like to start by making a cut from the lateral canthus of the “up” eye to the lateral canthus of the “down” eye. Then I make a cut from the lateral canthus of the “up” eye dorsally, passing just in front of the ear base and over the top of the head, just behind the poll. Once these cuts are made, the back of the axe can be used as a hammer to tap on the skull flap you have just created and open up the skull. The brain can then be easily removed for examination.

Digital photography can be very helpful, since everyone has a camera on their phone today. You can teach basic necropsy techniques to your clients and they can take pictures of the pathology they are seeing and send them to you to help with diagnosis. It is important to keep in mind that in order for photography to be successful the organ being photographed must be laid on a contrasting surface. For example the organ of interest is a section of lung, it should not be laid on top of the lung for photography. Instead, the lung section should be placed on the ground or perhaps on the side of the animal’s head for background contrast. Also, image quality is best if the photograph is taken in the shade as opposed to direct sunlight.

These are some useful techniques that I have developed as I did necropsies in the many years I was in the feedyard. If you have confidence in your techniques, your clients will have more confidence in you. I cannot overstate how important it is to have sharp tools. If the tools are sharp, you will do a better job on your necropsy, it will be less work for you to do a necropsy and your client would be much more satisfied.

LARGE ANIMAL PROCEEDINGS

June 5–7, 2022

Animal Welfare and the Future of Audits

Dr. Dave Sjeklocha, Merck Animal Health

Animal Welfare and the Future of Audits – Dave Sjeklocha, DVM

Beef quality assurance started out as a violative residue program. In 1982, the federal government initiated this program as a result of seeing too many violative residues in our meat supply. At that time, 1.82% of all beef carcasses had a violative residue. The beef industry, in their efforts to keep the federal government from developing more regulations, decided to take this measure into their own hands and the Beef Quality Assurance program was developed. The success of the beef quality assurance program has resulted in violate if residues being reduced to .00014% in fed cattle (2011). But as the beef industry evaluated violative residues, the industry also noticed that there were many quality defects in our beef, the most common being injection site lesions. In addressing injection site lesions the program brought to light how much damage is done to meet by injecting pharmaceuticals and biologicals. Research has shown that an injection given to a calf at 50 days old is still present and has actually grown with the calf throughout its entire life. By virtue of these findings, producers were encouraged to stop injecting pharmaceuticals and biologicals into the hip and round and instead, move the injection sites to the neck region. In addition, producers were encouraged to avoid intramuscular injections as much as possible and pharmaceutical and biological companies were asked to develop less reactive products. Today, there are very few products used in cattle that are labeled to be administered intramuscularly.

So the Beef Quality Assurance program started out as solely a residue avoidance program, then it developed into a program that was not only focused on residues but also on injection site lesions. From there it was determined the quality audits should be performed on a regular basis in order to measure the progress that was being made through Beef Quality Assurance. So we now have quality audits for both fed cattle and non-fed cattle. As the beef quality assurance program has expanded and developed, animal welfare has become a major portion. We now have animal welfare assessments for the cow-calf segment, the stocker segment, in the feedlots segment. There has also been developed a certified feedyard animal welfare audit.

As we consider animal welfare, we must understand exactly what animal welfare means. There is a difference between animal rights and animal welfare. However, animal rights groups are constantly working to blur that difference. Animal welfare allows the use of animals for food, clothing, entertainment and experimentation as long as humane guidelines are followed. Animal rights, on the other hand, means that animals are not ours to use for food, clothing, entertainment or experimentation. The ultimate goal the animal rights movement is to stop the way we use animals for agriculture, as pets, for rodeo, in zoos, in circuses, and in research.

First, let's consider the BQA animal welfare assessments. There are assessments for feedyards, stocker operations and cow calf operations, as well as a transportation assessment. All of these assessments have similar metrics, but they are not audits. They can, however, serve as a template for audits. In my experience, attitude towards animal welfare can have a very positive or very negative effect on the progress of animal care.

One component of the feedyard welfare assessment is cattle handling. The metrix in cattle handling require that the electric prod be used on less than 10% of the cattle being observed, cattle falling to their belly or side as they exit the chute should be less than 2%, cattle stumbling or tripping as they exit the chute should be less than 10%, cattle vocalizing while in the chute should be less than 5% and cattle that jump or run from the chute when released should be less than 25%. Also if an animal is miscaught in the chute and the processing crew does not immediately release or readjust the catch before

processing the animal, that is considered unacceptable and the processing crew fails the assessment due to one animal. Vocalization is only measured before any processing procedures are administered. So, if a calf vocalizes when an injection is given or an eartag is placed, it doesn't count against the processing crew. If the calf is caught correctly in the chute and starts to vocalize immediately, then that counts against the crew. As a general rule, I have found that if vocalization is a problem during an assessment, it is usually due to the hydraulic pressure of the squeeze chute being excessive. When working with processing crews and using the feedyard welfare assessment, many processors think it is impossible to work cattle and use the electric prod on less than 10%. However, if they are willing to learn and willing to change their ways, they can do a much better job of handling cattle and the 10% mark is very easy to achieve. As Albert Einstein said, “The definition of insanity is doing the same thing over and over again and expecting different results.”

The scope of assessments is very broad. It not only looks at cattle handling, but it also considers food safety, feed quality, water quality, equipment maintenance and antibiotic stewardship.

Our consumers want to know where their food comes from, if it is being raised humanely, if it is safe to consume, and if antibiotics are being used correctly. In 2017, San Francisco enacted an ordinance addressing antibiotic use. Grocery store chains of 25 or more stores were required to verify antibiotic use in any of the meats in their store for the life of the animal represented in their meat case. So, in order to sell beef to consumers in San Francisco, these stores had to produce an antibiotic use history for the meat in their meat case. This meant that each segment of the industry (cow calf, stocker, feed lot,) had to share with the grocery store the reasons they use antibiotics, the volume of antibiotics used, and the capacity or size of their operation. This begs the question, how many farms, ranches, or feedlots could actually provide that information?

The Humane Society of the United states (HSUS) has given the beef industry a road map of the issues that they hope to address. Their list includes dehorning without pain management, castrating bulls without pain management, abrupt weaning, pregnant heifers in the feedlot, our marketing system, and the transportation of cattle.

Dehorning - Approximately 7% of beef cattle have horns. So there has been some progress made to the point where this issue can be managed if we desire. However, nearly all dairy cattle have horns. Videos from animal rights groups commonly include hot iron dehorning or disbudding of calves. While certainly not commonplace, it is slowly but surely becoming more common for dairy and beef operations to include some form of pain management when doing these procedures.

Castration - Much like the Horning, pain management it is not common with castration. However, more and more producers are starting to use some pain management when they castrate their calves.

Abrupt weaning - Animal rights groups are also very concerned about how we wean our calves. They refer to it as abrupt weaning and believe that we should be letting our calves stay on the cows until the cows naturally wean them.

Pregnant heifers - Pregnant heifers can be a major problem in feedyard. They are most definitely an animal welfare concern and we should be working as an industry to reduce the number of pregnant heifers that go to the feedyard.

Marketing - our marketing system is also an issue that animal rights groups would like to exploit. Hauling hundreds to thousands of calves into a central location for the purpose of selling the cattle provides an excellent opportunity for disease transmission and, in some cases, animal abuse. Once the cattle are sold, many are often loaded on trucks and hauled great distances to their new owner's operation or feedyard.

Transportation - Transportation of cattle is also a big concern for animal rights groups. Long hauls without access to feed or water along with the morbidity and mortality associated with long hauls provide plenty of fodder for animal rights groups.

As we look to the future of animal welfare, we see that the industry is already trying to address many of these issues. The Professional Animal Auditors Certification Organization (PAACO) is an organization that has developed standards for what an audit tool should look like. If a company or organization would like to have their audit tool certified, PAACO will make sure that the tool meets the requirements to be certified. PAACO is made up of animal scientists and veterinarians from all of the major protein groups: chicken, turkey, swine, beef, dairy, sheep, goats, and eggs. PAACO has certified audits in the US as well as internationally. In recent years, PAACO has certified a fur farm audit and has been asked to certify an audit for the BLM Mustang management program. PAACO also trains auditors so producers can rest assured that the person auditing their operation has the experience and understanding to conduct an audit.

We will undoubtedly see more audit tools developed. There are already several audit tools being utilized at the packer level and also at the feedyard level. Clearly, we can see that this will develop further into the stocker, cow calf, livestock auction, in transportation levels. These audits will have a far broader scope than simply animal welfare. Indeed, these audits will include animal welfare and pain management, but will also address antibiotic stewardship, food safety, and even community outreach.

So, we can see that Quality Assurance has been the root for the development of these audits. We need to make sure that these audits are producer-driven and that the end user (consumer) is the focus. Doing so will help to ensure safe, wholesome food. All segments of the beef industry will be included or affected in some way. Veterinarians should begin the discussion with their clients now about the future of animal welfare audits and help them to understand what will be required of them. This should be looked upon as an opportunity, not a problem.

LARGE ANIMAL PROCEEDINGS
June 5–7, 2022

Managing High Risk Cattle

Dr. Dave Sjeklocha, Merck Animal Health

BRD Management and High-Risk Cattle – Dave Sjeklocha, DVM

In spite of years of research showing that preconditioning is a valuable tool in keeping calves healthy, there are still a lot of cattle that are not preconditioned before being sold. In my opinion, preconditioning entails much more than two rounds of vaccinations. Truly preconditioned cattle will receive two rounds of vaccinations including a five-way modified live viral vaccine, a Pasteurella/ Mannheimia vaccine, seven-way clostridial and an Histophilus somni vaccine. They will also be dewormed, weaned for at least 45 days, bunk broke and tank broke.

Why aren't more cattle preconditioned? One reason might be that 93% of the herds in the US have less than 100 head. These producers simply can't invest large amounts of money into weaning, handling and feeding facilities. Also, many of these herds have no defined calving season or breeding season and the marketing plans for many of these herds simply include a need for cash for things like Christmas shopping, school shopping, vacation or a major appliance. These cattle are often removed from the dam and taken directly to the livestock auction where they are sold. And another reason why more cattle are not preconditioned is simply because there are people who are willing to buy these calves non-preconditioned.

Typically, these non-preconditioned cattle would be considered high-risk. A one-word definition for high-risk cattle would be “mismanaged.” A classic description of high-risk cattle might include: weighing 600 pounds or less, from a livestock auction, with an unknown vaccination history, commingled or multiple farms of origin, and being hauled a long distance. However, cattle that are weighing 750 pounds have been backgrounded 60 days, received the appropriate two rounds of vaccinations, have been bunk broke and tank broke, and hauled 500 miles could be an example of high risk cattle if, for example, the truck breaks down and it takes 16 hours longer than it should have to get the cattle into the feed yard.

In order to deal with high-risk cattle, preparation is key. The first step is to get a history on the cattle. This history is often very sketchy, and may include an unknown vaccination history, may include a sale barn origin and we may know that the cattle have been commingled.

Before the cattle arrive, be sure to check the unloading facilities and make sure that they will not cause any injuries to the cattle as they unload. Make sure that the cattle have good traction in the facilities and that the scales are in working order. We also want to make sure that the receiving pen has clean, dry bedding so the cattle have a comfortable place to rest once they are off the truck. The water tanks should have clean fresh water available and the bunks should have some long stemmed hay with some mill ration in them.

Go through the cattle processing facility and make sure that there is nothing that will cause any injuries to the cattle as they are being processed, check all the noise reduction equipment such as rubber bumpers on metal gates, etc. And also go through the squeeze chute make sure that it is safe for both the animals and the workers, it is operable and is well lubricated.

Product inventories should also be checked to make sure that all the appropriate vaccines, parasiticides, ear tags, implants, disinfectants, and any antibiotics are on hand. Of course, along with this, make sure the proper tools to administer the above named products are available. This would include syringes,

taggers, parasiticide applicators, implant guns and trays, hypodermic needles, and encouragement devices.

Once the cattle arrive, the truck should be examined. Did the truck arrive on time? Is it covered in snow or ice? Is the truck clean? Is there evidence that the truck's exhaust blew directly into the trailer? What are the driver's habits? Does he turn slowly and brake softly? If not, the cattle on this load were subjected to this driver's behavior for the entire trip. As the cattle are unloaded, they should be observed closely and the handling of the cattle should be quiet. It is very important at this time to establish trust with these cattle. Make sure there is a good count and check the cattle for any misfits or any injuries at arrival. Be sure, if the cattle are weighed on the ground, to not overcrowd the scale.

The importance of establishing trust cannot be overstated. Remember that these cattle have been handled through a livestock auction, loaded on a truck, taken to a collection center, sorted and commingled more at the collection center, loaded on another truck, and then hauled long distances. So, their level of trust of humans is going to be very low when they arrive at the feed yard or ranch.

Once the cattle are unloaded, weighed, and the count is agreed upon, they should be moved to the receiving pen quietly and gently. As stated earlier, the receiving pen should already have fresh bedding in it, the water tanks should be full of fresh, clean water, and the bunks should have long stemmed hay and perhaps some mill ration on top of it.

Shrink can help to decide the level of risk that the cattle represent. To figure shrink, the following formula can be used: [(Pay weight – Arrival weight)/Pay weight]x100. If the shrink is 6% or higher, cellular fluid has been lost.

Livestock auction backtags can also help determine risk level. On every back tag, at the top, there is a number/letter code. The 2-digit number represents the state of origin, and the letter code represents the livestock auction in that state. So, using this information can help to determine how many states the load may have come from and how many different livestock auctions are represented.

Another clue about the risk of the cattle would include ear tags. Ear tags indicate that there has been some level of management of these cattle before they arrived. Dr. John Richeson at West Texas A & M University has collected data on cattle that arrive at the research feedyard with ear tags and has found a significant reduction in morbidity and mortality in these calves that have ear tags at arrival.

Checking the stools on cattle can also help to determine risk. Many cattle will have loose, runny stools, and that should be expected. Loose, runny stools indicate some level of stress, but it also may indicate that the calf has tanked up on water. Seeing a few stools that are blood-tinged is very common. Most of the time, calves will get over blood-tinged stools on their own. If the stools have frank hemorrhage, that's when there is a problem. "Stacked" stools indicates mild dehydration. Calves with stacked stools can usually correct this dehydration if they can find water. Stools that appear to be pelleted indicates a more severe dehydration in the cattle and they will have to be watched more closely and more effort should be put into helping them find the water tank.

After the cattle rest for a few hours or overnight, we should start to process them. Remember, their trust must still be earned. Cattle handling should be low stress, with no yelling or whistling, electric prod use kept to a minimum (less than 10%), and efforts should be made to get them into the alleyway and

out of the squeeze chute in as short time as possible. Time is a major stressor, so the longer the cattle are in the tub, the alleyway and the squeeze chute, the more stress is put on them.

If possible, the vaccines should be administered subcutaneously. Even though a shorter needle is used for a subcutaneous injection, the needle still needs to be angled as it is inserted. Even a 5/8 inch needle can reach the muscle if the needle is not angled. Protect the vaccines from sunlight and keep them cool. Vaccines should only be mixed as needed and should not be shaken to mix them up. Proper mixing includes swirling the bottle or rolling it on a flat surface.

The decision to use metaphylaxis should be taken seriously. Use antibiotics that are labeled for the control of BRD. Metaphylaxis is not a tool to be used so we can forget about the cattle while we finish harvesting corn or to lower the purchase price of cattle. If a post metaphylactic interval is to be used, the management of the operation must be committed. If the cattle are high enough risk to require metaphylaxis, then stressful procedures like castration and dehorning should be delayed.

Once the cattle are processed and taken to their home pen, workers should go through the cattle every day even if there is a post metaphylactic interval. The workers should encourage the cattle to go to the bunk and should also help the cattle find the water tank by cleaning and draining the tank every time they go into the pan. Keep in mind that many of these cattle have never seen a horse, or if they have they may have had a very bad experience with a horse. So, acclimating these cattle to a horse must be done quietly and gently.

It is very important to know as much about the cattle as possible before they arrive. Being prepared, with feed, water, bedding, vaccines, etc. will help with the success of management in high-risk cattle. It is very important to earn their trust and keep their trust when they arrive.

LARGE ANIMAL PROCEEDINGS
June 5–7, 2022

Systems Models to Identify Management Strategies to Improve Economic and Sustainability of Beef Cow–Calf Operations

Dr. Phillip Lancaster, Kansas State University

Systems Models to Identify Management Strategies to Improve Economic and Sustainability of Beef Cow-Calf Operations

Phillip Lancaster, Robert Larson, and Dustin Aherin

Cow-calf operations are complex systems involving many factors that affect productivity and profitability. Also, achieving maximum animal performance may not result in maximum profit. Forage species and productivity, cattle genetics, calving season and distribution, stocking rate, weaning age, winter and supplemental feed resources, and cattle prices relative to input costs are just a few of the factors that can impact the profitability of a cow-calf operation. In addition to these 10 main factors, many of these factors interact with each other resulting in a complex web of ways the profitability of a cow-calf operation could be impacted. A better understanding of this web of factors would improve management strategies for cow-calf operations.

Sustainability of beef cattle production has come under scrutiny in recent years, and the industry needs to make progress in improving sustainability. Environmental sustainability and methane emissions are the primary concern at the current time. The cow-calf sector of the industry produces 60 to 70% of the greenhouse gas emissions (9, 10); thus, improvements in this sector would make a large impact on the environmental sustainability of beef production as a whole.

In order to make improvements in profitability and environmental sustainability of cow-calf operations, a better understanding of the interaction of factors is needed. However, field research to evaluate all the possible combinations of factors impacting cow-calf operations is nearly impossible and not practical. Systems models provide an effective method to evaluate multiple factors and their interactions simultaneously. Recently the Beef Cattle Institute developed a stochastic, dynamic cow herd simulation model (BCSM) that will allow us to determine the most likely factors impacting profitability and environmental sustainability of cow-calf operations. The objective of the study was to determine the importance of four factors on the profitability and sustainability of cow-calf production using a sensitivity analysis in the BCSM.

The BCSM represents a cow-calf production system in the Kansas Flint Hills simulating individual animals on a daily time-step. The model computes animal age, weight, body condition score, lactation, nutrient requirements, nutrient availability, reproductive status, morbidity and mortality. The current version of the model computes the feed required for a cow to achieve a BCS of 5 at calving; thus, little variation in reproduction is expected and the variation among cows and herds is evident in the feed consumed and the feed costs.

The BCSM simulates a herd of 100 breeding females exposed to a bull for 63 days. Calves are weaned on the date which the oldest calf is 220 days old. All open cows are sold at weaning and cows 13 years old at weaning are culled. Heifers are kept to replace culled females. The genetic base of the cow herd is Angus using genetic information from the American Angus Association, calf and cull cow prices are from Livestock Marketing Information Center, and pasture rent is from the Kansas Bluestem Pasture Survey.

Cows grazed pasture starting May 1 and were removed from pasture when residual forage reached 50% of forage yield, which represents forage utilization for a moderate stocking rate. Cows are supplemented when forage digestibility is less than 50% TDN, and an energy supplement is provided during the grazing season if a cow decreases to BCS 4. The winter feed ration is fed from the end of grazing in the fall to the start of grazing the next production year.

Comparison with Standard Performance Data

In the first analysis, we evaluated combinations of mature cow weight and peak milk yield on BCSM outputs, and compared these results to field data from Cow Herd Appraisal Performance Software (CHAPS) program in North Dakota. Cow herds ranging in mature body weight from 1,000 to 1,700 lb and ranging in peak milk yield from 15 to 30 lb were simulated. The BCSM compared very well with CHAPS data where the mean age of cows in the herd was very similar (Figure 1). The BCSM estimated slightly greater percentage of open cows, percentage of pregnancy losses, and calf mortality than was reported in the CHAPS dataset. The average cow age is a function of pregnancy losses

However, the BCSM estimated slightly lesser calf birth weight and significantly lesser calf weaning weight than CHAPS data even though weaning age was similar. The lesser birth weight and weaning weight

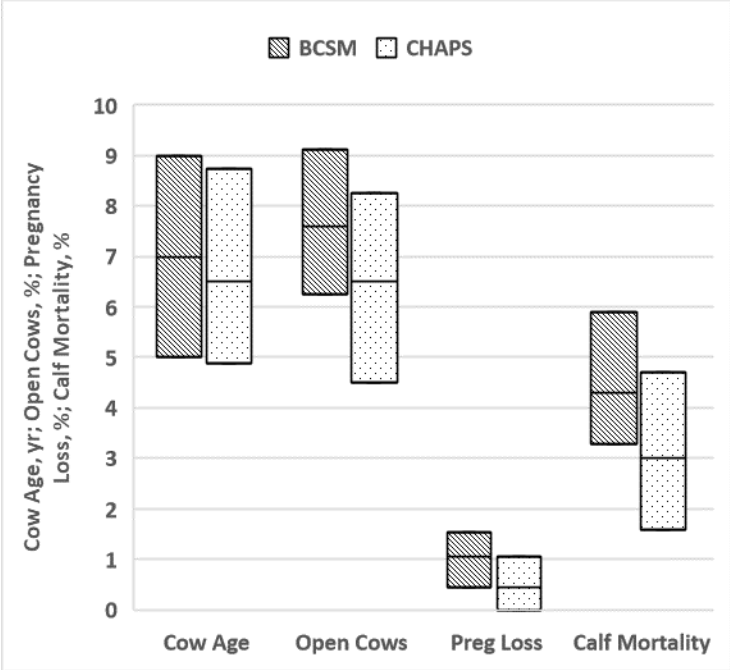

Figure 1. Median and interquartile range for cow age, open cows, pregnancy loss, and calf mortality of simulated herds in the BCSM and CHAPS field data.

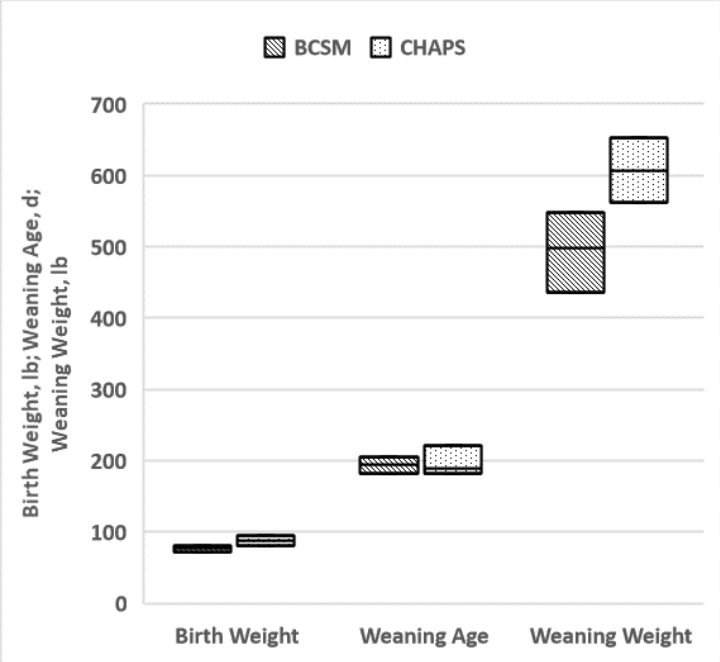

Figure 2. Median and interquartile range for calf birth weight, weaning age, and 205-d weaning weight of simulated herds in the BCSM and CHAPS

could be due to differences in growth potential and/or nutrition. In the BCSM simulation, creep feed was not provided to nursing calves, but the use of creep feed is not recorded in the CHAPS dataset. Additionally, the growth equations used in the BCSM were developed using data from postweaning calves and may not accurately estimate the average daily gain of preweaning calves based on some preliminary data analysis from the Beef Cattle Institute.

Overall, the BCSM adequately simulated a cow-calf production system when compared with field data. There are improvements that could be made to the model, but the BCSM appears to be an effective tool to evaluate factors impacting productivity and profitability of cow-calf production.

Evaluation of 4 Improvement Strategies

For the second analysis, we evaluated the impact of 4 strategies to improve profitability and sustainability of cow-calf production systems: 1) decreasing maintenance energy requirements of the cow herd, 2) decreasing the postpartum interval, 3) increasing the digestibility of the pasture forage, and 4) increasing the forage yield per acre. Outputs important to reproductive efficiency (percentage cycling in first 21 d of the breeding season, postpartum interval, pregnancy percentage, percentage calving in the first 21 d of the calving season), productivity (weaning weight of calves, pounds of calf weaned per cow exposed), profitability (revenue, purchased feed cost, total variable cost, returns), and sustainability (feed consumed per pound of calf weaned). The primary driver of methane emissions is feed intake and thus feed consumed per pound of calf weaned is a good proxy for the methane emissions intensity of the production system. The BCSM was ran for 1,000 simulations of a 100-cow herd over a 15 year time span of 2004 to 2018. The output values represent the average of a herd.

The mean, standard deviation, minimum and maximum values for the model outputs are presented in Table 1. The mean percentage of cows cycling in first 21 days of the breeding season, pregnancy percentage, and percentage of cows calving in first 21 days of the calving season were 88.11, 92.96, and 59.40%, respectively, which agree with the experimental results of Rutter and Randel (1984), Doornbox et al. (1984), Richards et al. (1986), and Vizcarra et al. (1998).

Average calf weaning weight was 457 lb, which lesser than current weaning weights. Additionally, pounds of calf weaned per cow exposed is less than data from the Texas Standard Performance Analysis program. As discussed above, we believe the growth equations developed using data from postweaning calves does not accurate estimate the average daily gain of preweaning calves resulting in less than expected calf weaning weights. Regardless of the mean weaning weight, the variation in weaning weight is correct, which is the critical piece for this analysis.

Cows required 928 lb of supplement and 4075 lb of winter feed on average, which agree with data from the Kansas Farm Management Association. The mean feed intake per pound weaned was 26.49 lb/lb. Feed intake per pound of calf weaned is a good measure of efficiency and sustainability. The primary driver of methane emissions is feed intake, and thus, feed intake per pound of calf weaned is a good proxy for the methane emissions intensity (i.e., kilograms of methane per kilogram of beef produced). The Kansas Farm Management Association reports similar economic values as the BCSM with revenue of $773.04 ($708.12 for BCSM), feed cost of

$290.07 ($385.44 for BCSM), and total variable cost of $749.26 ($667.82 for BCSM) per cow from 2015 to 2019.

Table 1. Descriptive statistics for model outputs of a 100-cow herd				
Output	Mean	Std Dev	Min	Max
Cycling in first 21 days, %	88.11	3.93	71.41	96.23
Postpartum interval, d	59.2	3.8	45.7	70.3
Pregnancy percentage, %	92.96	0.95	88.92	95.68
Calved in first 21 days, %	59.40	2.74	47.75	65.71
Actual calf weaning weight, lb	457.7	10.1	428.6	493.4
Grazing days per acre, d	25.9	1.0	23.0	29.1
Lb weaned per cow exposed, lb	379.7	10.1	348.2	416.3
Supplement used, lb/cow	928.4	229.5	323.3	1600.0
Winter feed used, lb/cow	4075.3	258.1	3275.1	4926.2
Total purchased feed, lb/cow	5003.7	135.9	4593.4	5406.6
Feed intake per lb weaned, lb/lb	26.49	0.70	24.46	28.78
Revenue, $/cow	708.12	12.36	675.94	754.60
Purchased feed cost, $/cow	385.44	22.56	320.99	470.54
Replacement heifer cost, $/cow	110.09	6.45	91.09	131.77
Total variable cost, $/cow	667.82	25.23	592.83	762.38
Returns, $/cow	40.30	29.00	-76.57	130.20

In the analysis of the importance of each strategy to productivity, economic, and sustainability outputs, postpartum interval (PPI) had a strong influence on reproductive measures of percentage cycling in first 21 days of breeding season, pregnancy percentage, and percentage calved in first 21 days of calving season (Table 2). In contrast, maintenance energy requirement, forage digestibility, and forage production per acre had no effect on reproductive outputs. Calf weaning weight was most influenced by maintenance energy requirement and forage digestibility because both decreasing maintenance energy requirement and increasing forage digestibility increased the amount of energy available for gain.

The influence on grazing days per acre was interesting and not completely expected. Increasing the forage production had a strong influence on increasing the grazing days per acre, which makes sense, but increasing forage digestibility had a moderate influence on decreasing the grazing days per acre. The reason for this is that forage of greater digestibility will pass through the rumen quicker allowing the cow to eat more forage per day, and this is reflected in the feed intake equation used in the model. Therefore, the cows consume the available forage quicker shortening the grazing season. There is a tradeoff when grazing a more digestible forage in that on one hand calves are consuming more energy for gain and grow faster, but cows consume more forage depleting the forage supply quicker.

A very important metric for overall cow herd productivity is pounds of calf weaned per cow exposed, which was influenced by maintenance energy requirement, forage digestibility, and PPI. Decreasing maintenance energy requirement and increasing forage digestibility had moderate influences on the numerator because they increased calf weaning weight. Decreasing PPI had a moderate influence on the denominator by increasing the number of cows that conceived. A combination of strategies may have the strongest influence on pounds of calf weaned per cow exposed.

Table 2. Standardized correlation coefficients between strategies and model outputs

Output	MAINT	ForageTDN	PPI	ForageYield
Cycling in first 21 days	0.06	-0.02	-0.96	0.03
Pregnancy percentage	0.03	-0.03	-0.59	0.05
Calved in first 21 days	0.06	0.00	-0.77	0.03
Actual calf weaning weight	-0.66	0.58	0.14	-0.07
Grazing days per acre	0.11	-0.39	0.07	0.84
Lb weaned per cow exposed	-0.53	0.47	-0.31	-0.04
Supplement used	0.71	-0.58	0.07	0.22
Winter feed used	-0.47	0.44	-0.12	-0.65
Total purchased feed	0.31	-0.15	-0.11	-0.86
Feed intake per lb weaned	0.65	-0.50	0.20	0.13
Revenue, $/cow	-0.51	0.45	-0.14	-0.04
Purchased feed cost, $/cow	0.24	-0.15	-0.06	-0.32
Replacement heifer cost, $/cow	-0.22	0.20	0.37	-0.06
Total variable cost, $/cow	0.15	-0.09	0.04	-0.31
Returns, $/cow	-0.36	0.27	-0.09	0.26

MAINT = net energy for maintenance requirement; ForageTDN = digestibility (TDN) of pasture forage; PPI = postpartum interval; ForageYield = yield of forage per acre
Values near zero indicate low importance, ± 0.10 to 0.30 indicates weak importance, ± 0.30 to 0.50 indicates moderate importance; and ± 0.50 to 1.00 indicates strong importance of the strategy to the output.

Decreasing maintenance energy requirement and increasing forage digestibility had strong influences in decreasing the amount of supplement used during the grazing season, and moderate influences on increasing the amount of winter feed used because both strategies resulted in cows consuming more forage per day decreasing the grazing season. However, increasing forage production had strong influence on decreasing winter feed used and total purchased feed because of the strong influence on increasing grazing day per acre. Feed intake per pound of calf weaned was most influenced by decreasing maintenance energy requirement and increasing forage digestibility because these strategies increased calf weaning weight indicating that increasing the

output of the cow-calf production system is likely to have a large impact on sustainability and methane emissions intensity.

Greater revenue was moderately influenced by decreasing maintenance energy requirement and increasing forage digestibility because of the effect on calf weaning weight, whereas PPI and forage production had little influence. Purchased feed cost was only weakly influenced by increasing forage production even though total purchased feed was strongly influenced by forage production indicating that feed price has a large influence on feed cost even relative to the amount of feed used. Increasing forage production had a moderate influence, decreasing maintenance energy requirement had a weak influence, and forage digestibility and PPI had little influence on decreasing total variable costs. Decreasing maintenance energy requirement had a moderate influence, and forage digestibility and forage production had a weak influence on increase returns.

In conclusion, cow-calf production systems can be accurately simulated through mathematical models, which can be an effective tool to evaluate potential management strategies to improve profitability and sustainability of cow-calf production. Of the four strategies evaluated in this analysis, decreasing maintenance energy requirements of the cow herd had the largest overall impact on our key metrics of returns (i.e., profitability) and feed intake per pound of calf weaned (i.e., sustainability). However, increasing the digestibility of forage was also an important strategy to both of our key metrics, and increasing the forage yield per acre was important to decreasing winter feed cost and increasing returns. A combination of strategies may have the largest overall effect.

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LARGE ANIMAL PROCEEDINGS
June 5–7, 2022

Revisiting Antimicrobial Resistance in BRD pathogens

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Revisiting Antimicrobial Resistance in BRD pathogens

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The BRD – AMR Backstory

In 2013, the Kansas State Veterinary Diagnostic Laboratory received an increasing number of requests for assistance in interpreting Bovine Respiratory Disease (BRD) antimicrobial susceptibility test (AST) reports. In most of these consultations, the submitting veterinarian was seeking assistance because they had encountered a BRD isolate that was resistant to multiple antimicrobials. Based on this (anecdotal) observation, this author conducted a search of BRD submissions to KSVDL in calendar years 2009 – 2013. There was a notable increase in antimicrobial resistance over this time period, particulary in *Mannheimia haemolytica* isolates. Additionally, many of the recovered isolates were resistant to multiple classes of antimicrobials. While the levels of antimicrobial resistance (AMR) seen in *M. haemolytica* were not seen in *Histophilus somni* or *Pasteurella multocida*, resistance levels approaching 50% of isolates were seen in some antimicrobials for the latter two pathogens. The observed AMR in BRD pathogens was concerning and deserved to be monitored in the future.

Interpreting Diagnostic Laboratory Data

While cumulative summaries of AST data can provide some insight into regional resistance patterns, there are limitations to the data summarized here. The primary limitation is that the case history for these submissions is largely unknown. There may be differences in AMR patterns between production classes (cow-calf vs. feedlot) that are not distinguishable with this dataset. Additionally, the isolates in this dataset were all recovered from animals that developed BRD. Extrapolations regarding resistance in the overall populations of BRD pathogens is inappropriate.

Lastly, the treatment histories of submitted cases are unknown. Previously published reports by Snyder et al (2017) and Magstadt et al (2018) demonstrated significant alterations in the recovery of antimicrobial resistant BRD pathogens prior to and following exposure to antimicrobials. Unfortunately, coordinated surveillance programs for monitoring antimicrobial resistance in BRD pathogens in the United States do not currently exist. Diagnostic laboratory data is the most suitable alternative at this time; however, data presented here should be interpreted with considerations for these limitations.

BRD-AMR today (2018-2021)

Data Extraction Methods

Data were retrospectively extracted from cases submitted to the Kansas State Veterinary Diagnostic Laboratory from January 1, 2018 through December 31, 2021. All diagnostic submissions that met the following criteria were eligible for inclusion in the final dataset:

- Host species = Bovine

- Specimen = Lung, Lung swab or Bronchoalveolar lavage (upper respiratory tract specimens, i.e. nasal swabs, deep nasopharyngeal swabs were excluded, as were specimens from outside the respiratory tract)
- Aerobic culture positive for:
    - *Mannheimia haemolytica*
    - *Histophilus somni*
    - *Pasteurella multocida*
    - *Bibersteinia trehalosi*
- Antimicrobial susceptibility test results available

Consistent with current recommendations for developing cumulative antimicrobial susceptibility test summaries, when multiple isolates were recovered within a calendar year that were associated with the same production system, only AST results from the first isolate (in chronological order) were retained (CLSI, 2022).

The following antimicrobials with approved breakpoints for BRD were included in this analysis:

- Ceftiofur
- Enrofloxacin (fluoroquinolone class representative)
- Florfenicol
- Oxytetracycline
- Penicillin
- Spectinomycin
- Tulathromycin (macrolide class representative)

Breakpoints are not approved for *Histophilus somni* for danofloxacin, therefore, *Mannheimia haemolytica* breakpoints of 0.25/0.5/1 ug/mL were used for fluoroquinolone class correlations. There are no veterinary-approved breakpoints for any antimicrobial for *Bibersteinia trehalosi,* therefore, *M. haemolytica* breakpoints were used for this bacterial agent.

Due to a change the range of antimicrobial concentrations on AST testing panels during the summary period, only interpretive criteria (“S”, “I”, “R”) were summarized.

AMR in Mannheimia haemolytica

After removing isolates recovered from the same premise (within a calendar year), AST results for 257 *Mannheimia haemolytica* isolates were available. One additional isolate was excluded due to incomplete AST results, leaving 256 *M. haemolytica* in the final dataset (isolate recovery by year is detailed in Table 1). Antimicrobial resistance to multiple classes of drugs occurred relatively frequently in *M. haemolytica* isolates recovered in diagnostic cases with 41% of isolates classified as MDR (resistant to ≥3 drug classes) and 10% of isolates classified as XDR (resistant to ≥6 drug classes). These results are consistent with reports of integrative-conjugative resistance elements (ICE) in BRD pathogens [Michael, 2012; Clawson, 2016].

Within class correlation of in vitro susceptibility was very high for both the fluoroquinolones and macrolides at ≥90% for all two-way drug comparisons.

AMR in Histophilus somni

After removing isolates recovered from the same premise (within a calendar year), AST results for 161 *Histophilus somni* isolates were included in the final dataset (isolate recovery by year is detailed in Table 1). Although the overall number of isolates is not substantially lower for *H. somni* in 2018 in the final dataset, there were considerably more isolates that did not demonstrate sufficient growth to report AST results (data not shown). This is likely due to a change in the approved AST testing medium for this organism.

Resistance to at least 1 antimicrobial class was commonly reported in *H. somni*, as only 30% of isolates were reported to be pan-susceptible to all 7 antimicrobial classes. Multi-drug resistance in *H. somni* was relatively common with 25% of isolates expressing resistance to 3 or more classes of drugs; however, the XDR phenotype was not seen in any *H. somni* isolates recovered from BRD cases.

Within class correlation of in vitro susceptibility was very high for most comparisons. Correlation between danofloxacin and enrofloxacin was >90%, while tilmicosin – tulathromycin and gamithromycin – tulathromycin were >80%. Antimicrobial susceptibility test result correlations for tildipirosin – tulathromycin were much lower (Table 2). Test results of "susceptible" to tildipirosin and "resistant" to tulathromycin were seen in 15% of isolates and results of "resistant" to tildipirosin and "susceptible" to tulathromycin were reported in 4.5% of cases. Overall correlation of AST interpretation for these 2 macrolides was approximately 70%.

AMR in Pasteurella multocida

After removing isolates recovered from the same premise (within a calendar year), AST results for 157 *Pasteurella multocida* isolates were included in the final dataset (isolate recovery by year is detailed in Table 1). Antimicrobial resistance is uncommon is *P. multocida* isolates recovered from field cases of BRD with over 70% of isolates reported as phenotypically susceptible to all 7 classes of antimicrobials. When resistance was reported, it was most commonly seen in spectinomycin (34/157 isolates), oxytetracycline (32/157 isolates), and/or macrolides (24/157 isolates). Only 8% of isolates were reported as MDR and no XDR isolates of *P. multocida* were recovered during the period of 2018 – 2021.

Within class correlation of in vitro susceptibility was very high for both the fluoroquinolones and macrolides at ≥90% for all two-way drug comparisons.

AMR in Bibersteinia trehalosi

After removing isolates recovered from the same premise (within a calendar year), AST results for only 34 *Bibersteinia trehalosi* isolates were included in the final dataset (isolate recovery by year is detailed in Table 1). Phenotypic resistance in *B. trehalosi* (using interpretive criteria for *M. haemolytica*) was seen at very high levels. All 34 isolates displayed phenotypic resistance to at least 1 antimicrobial, i.e. there were no pan-susceptible *B. trehalosi* isolates recovered from BRD cases from 2018 – 2021. Over 80% of isolates were MDR and approximately 1 in 4 isolates were XDR. Two *B. trehalosi* isolates displayed phenotypic resistance to ceftiofur, using *M. haemolytica* interpretive criteria. Resistance to ceftiofur was not seen in any other BRD pathogens during this time period.

These findings are not an endorsement of *B. trehalosi* as a primary BRD pathogen. Indeed, this agent is recovered from BRD field cases much less frequently than other pathogens. However, this phenotype

does raise concern, at minimum, about the ability of *B. trehalosi* to harbor antimicrobial resistance genes which could be subsequently passed to other BRD pathogens.

Table 1. Number of BRD isolates included in the final dataset by year of recovery

	2018	2019	2020	2021
M. haemolytica	**74**	**79**	**65**	**39**
H. somni	**30**	**38**	**47**	**46**
P. multocida	**47**	**46**	**34**	**30**
B. trehalosi	**13**	**7**	**6**	**8**

Table 2. Correlation between tildipirosin and tulathromycin in vitro AST results for *Histophilus somni*. Percent of all isolates (n=161) in each classification for 2018-2021.

Tulathromycin	**Resistant**	15.2%	0.8%	12.1%
	Intermediate	7.6%	0.8%	3.0%
	Susceptible	56.1%	0%	4.5%
		Susceptible	**Intermediate**	**Resistant**
		Tildipirosin		

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LARGE ANIMAL PROCEEDINGS
June 5–7, 2022

Diagnostic Stewardship & Detection of Subclinical Ketosis in Dairy Cows

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Diagnostic stewardship & detection of subclinical ketosis in dairy cows

Conrad S. Schelkopf

Diagnostic Stewardship

The term 'Diagnostic Stewardship' falls under the larger umbrella of Antimicrobial Stewardship where it serves to address the importance of proper usage and technique of microbiological tests to aid in the diagnosis and treatment of infectious diseases. The true definition of diagnostic stewardship "… involves modifying the process of ordering, performing, and reporting diagnostic tests to improve the treatment of infections and other conditions" (Morgan et al., 2017). Ordering refers to the pre-analytical process such as sample collection and/or shipment. Components such as applying aseptic technique, using the appropriate collection container and then properly handling the sample prior to and during shipment are frequently underappreciated components of the diagnostic testing process. Depending on the test type, the performing or analytical aspect of the process may be out of the hands of the practitioner, however, if the diagnostic modality utilized is a point-of-care test the practitioner assumes the burden. Finally, the diagnostic laboratory and the practitioner are responsible for the reporting or the post-analytical aspect. Correctly inputting results derived from the test, as well as, applying appropriate reference intervals, when applicable, gives the practitioner the best chance of properly interpreting the results and providing the best treatment option.

While diagnostic stewardship was intended to promote better diagnostic protocol related to antimicrobial stewardship, it can be applied more broadly to include the proper use and interpretation of any diagnostic test found within a veterinary practice. From this standpoint, diagnostic stewardship is somewhat of a misnomer and the phrase 'diagnostic test appropriateness' may better suit this concept (Dyar et al., 2019).

Applying Diagnostic Stewardship in a Practice Setting

The hallmark of diagnostic stewardship, from a practitioner's standpoint, is limiting unnecessary diagnostic testing while correctly interpreting test results. Diagnostic stewardship will allow the practitioner to derive the quickest and most accurate diagnosis for the patient, leading to the application of the most appropriate and cost-effective treatment. When applied correctly in a practice setting, diagnostic stewardship leads to fewer false positive test results (Morgan et al., 2017). This is a function of only utilizing a test with a respectable sensitive and specificity for a particular disease in a patient that has a high pretest probability of having that same disease. This contradicts a shotgun approach or method of exhaustion when concerning the utilization of diagnostic tests. Often the shotgun method, which involves performing multiple test simultaneously in hope of getting a quick diagnosis without the burden of a long case work up, will complicate the diagnostic process and slow down the application of proper treatment. Overall, diagnostic stewardship will improve clinical care and provide fewer mis/overdiagnoses (Morgan et al., 2017).

The outcome of implementing diagnostic stewardship within the practice does come with its limitations. The most significant one includes missed or delayed diagnosis by being over conservative in the diagnostic approach. This sets the stage for patients which truly have an illness to go untreated. Depending on the practice's protocol, diagnostic stewardship can also restrict the veterinarian if certain additional tests cannot be performed prior to a positive result on ones previously performed (Morgan et al., 2017).

Diagnostic Stewardship Simplified

Putting diagnostic stewardship to work requires a conscious effort to address three key criteria during every case work up. These criteria include: (1) right test, (2) right patient, and (3) right time (Messacar et al., 2017). The 'right test' pertains to the selection of the most appropriate test for the clinical setting. Intrinsic properties affecting test appropriateness include the test's sensitivity and specificity. When the prevalence of a particular disease is known, test sensitivity and specificity can be used to determine positive and negative predictive values allowing the practitioner to better assess the reliability of a positive or negative test result. Other key considerations related to the selection of the optimum test include laboratory availability for ones that require submission to a diagnostic lab. For point-of-care diagnostics, the ability to easily operate and apply the test within the practice setting is an important consideration. Regardless of the type of test, relative cost and clinical impact affecting patient treatment are key factors in determining the selection of an appropriate test.

Determining the 'right patient' for a specific diagnostic test can be challenging and lies largely in the hands of the veterinarian. Deciding how a test result will modify clinical care drives the patient aspect of diagnostic stewardship. Tests which are not reliable in a population of patients should be prioritized lower compared to ones that are known to provide more reputable results. When determining the usefulness of a test for a particular patient, pretest probability of disease should be highly considered. Patients who are more likely to have the disease for which the diagnostic test is detecting provide more confidence in that test's results. Additionally, published research and empirical outcomes within the clinic setting, along with feasibility of test application help drive the appropriateness of a test for a certain patient.

The 'right time' component aids in the consideration for timely delivery of results that can positively impact the clinical care of the patient. Key considerations include whether the diagnostic test must be sent in to a laboratory or can be performed in-house or in the field. Time from sample collection to arrival at the laboratory, individual versus pooled samples, and run time can influence the utility of a particular test. Finally, the speed of which results can be returned to the veterinarian for appropriate assistance in treatment selection ultimately guide the selection of an appropriate diagnostic test.

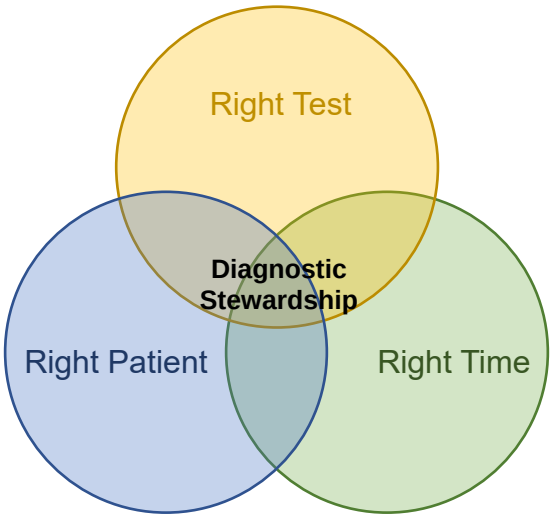

Figure 1: Interconnected components of diagnostic stewardship.

Although each of the three components of diagnostic stewardship outlined above are addressed individually, it would be improper to view them as stand-alone components. Right test, right patient and right time are interconnected and all play an equally important role in guiding veterinarians in providing the highest quality of care to their patients with the diagnostics at their disposal (Figure 1).

Comparison of Three Diagnostic Tools for Detection of Ketosis in Early Lactation Dairy Cows

Background

Ketosis is a metabolic disease observed in early lactation, high producing dairy cows characterized by a negative energy balance (Enjalbert et al., 2001). The on-farm prevalence of ketosis ranges greatly across dairy operations. Subclinical ketosis prevalence can range anywhere from 8.9% to 34%, whereas clinical ketosis ranges from 2% to 15% (Duffield, 2000). Ketosis status is characterized by an increase in serum, milk and urine ketone bodies (acetoacetate (AcAc), acetone and beta-hydroxybutyrate (BHB)), by-products of fatty acid metabolism. There is a lack of a definitive diagnostic cutoff for ketosis in the literature (McArt et al., 2011; Oetzel, 2004). Published research studies have cutoff values varying from 1.0 mmol/L to 1.4 mmol/L for subclinical ketosis. Values above 3.0 mmol/L more frequently represent a clinical ketosis cutoff. Rapid diagnosis of ketosis is imperative for implementing proper treatment protocols and managing economic losses associated with reduced milk production and reproductive performance, increased culling rates, treatment costs and predisposition to other diseases. It is estimated the total cost per case of subclinical ketosis on an operation is nearly $300 (McArt et al., 2015). The demand for rapid and accurate diagnostic tools is evident.

The objective of this study was to perform a side-by-side comparison of cow-side diagnostic tools used widely in the dairy industry and then determine the utility of each tool given specific dairy operation ketosis prevalence. A secondary component of the current study focused on the application of a new diagnostic tool (Electronic Nose) for ketosis detection.

Study Methods

Primiparous and multiparous dairy cows (n= 60) were sampled up to three times within the first eight days of lactation between May – August 2021. The tools utilized in this study were: (1) Electronic Nose (Enose) analysis of milk volatile compounds (Cyranose 320, Sensigent, California, USA), (2)

Table 1: Diagnostic Tool Specification Comparison

	Cobas BHBA Assay	Precision Xtra	Ketone Strips	Enose
Application:	Laboratory	Cow-side	Cow-side	Cow-side
Sample Collection:	Minimally Invasive	Minimally Invasive	Non-Invasive	Non-Invasive
Sample Required:	Serum	Whole Blood	Urine	Milk or Urine
Ketone Detected:	BHB	BHB	AcAc	???
Time to Results:	24-48 hr	10 s	15 s	30 s
Results Reported as:	mg/dL	mmol/L	Semi-Quantitative Scale	Positive or Negative
Instrument Cost:	NA	$27.50	NA	$11,000
Cost per Test:	$12.00	$1.80-$7.50	$0.14	$0

handheld ketone meter detecting BHB in whole blood (Precision Xtra, Abbott Laboratories, Illinois, USA), and (3) urine ketone test strip detecting AcAc (ReliOn, Wal-Mart Stores, Inc., Arkansas, USA). Diagnostic tool's individual specifications are outlined in table 1. Each test modality was compared to a gold standard serum BHB assay for accurate ketosis detection. Each tool's performance was modeled over a range of ketosis prevalence that could be encountered in field settings.

Whole blood (n=172), milk (n=96), and urine (n=160) samples were collected prior to morning milking, then transported to the laboratory for same-day analysis on the designated diagnostic tool. Serum (n=172) samples were submitted for BHB analysis. Each modality was compared against the BHB assay (gold standard) to determine test sensitivity and specificity. These values were used to model positive predictive value (PPV) and negative predictive value (NPV) across a range of subclinical ketosis prevalence at the herd level (10-35%). Ketosis positive was defined *a priori* as BHB concentrations ≥ 10 mg/dL. All diagnostic tool cutoffs utilized in this study are outlined in table 2.

Table 2. Diagnostic Tool Test Negative/Positive Criteria

	Negative	Positive
Cobas BHB Assay (Reference Test)	< 10 mg/dL	≥ 10 mg/dL
Precision Xtra	< 1.0 mmol/L (< 10 mg/dL)	≥ 1.0 mmol/L (≥ 10 mg/dL)
Urine Ketone Strips	Negative, Slight	Small, Moderate, Large
Enose	Negative	Positive

Results

The urine test strips provided the highest specificity (99.2%) and inversely the lowest sensitivity (58.6%), while the Enose displayed a similar low sensitivity (58.8%) and was poorly specific (44.3%) (Table 3). The handheld ketone meter provided the highest sensitivity (93.8%) among the tools along with a specificity of 92.9%. In the modeling component of the study, when ketosis prevalence was low (10%) the urine test strips produced the highest PPV (89.5%), and the handheld ketone meter had the highest NPV (99.3%) (Table 3). With a hypothetical ketosis prevalence of 35%, the same trend among devices was observed with the highest PPV recorded at 97.6% (urine test strips) and the highest NPV at 96.5% (handheld ketone meter).

Table 3: Diagnostic Tool Ketosis Detection Performance Comparison

				Prevalence 10%		Prevalence 35%	
Diagnostic Tools	**n**	**Sensitivity**	**Specificity**	**PPV**	**NPV**	**PPV**	**NPV**
Precision Xtra	172	94%	93%	59%	99%	88%	97%
Ketone Test Strips	160	59%	99%	90%	96%	98%	82%
Enose	96	59%	44%	11%	91%	36%	67%

Discussion

Urine test strips and the handheld ketone meter are adequate cow-side ketosis detection tools. For timely herd-level interventions, a high-test sensitivity will minimize false negative results; thus, the handheld ketone meter is the optimal tool for this use while still providing a reasonable specificity. Further optimization of the Enose is needed before deployment as a field diagnostic tool.

Conclusion

When applied correctly, diagnostic stewardship will aid in the efficient selection of an appropriate test which ultimately results in improved treatment selection. Right test, right patient, and right time helps emphasize the interrelated components attributing to the implemention of diagnostic stewardship in the clinical setting. Clinical research is a helpful resource in guiding the selection of an appropriate test and determining the one best fit for your patient. Diagnostic technology is constantly evolving, staying current with the available menu of testing options will improve the overall veterinary care that you provide to your clients and patients.

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LARGE ANIMAL PROCEEDINGS
June 5–7, 2022

Deep Digital Sepsis in Cattle

Dr. Bryan Weaver, Kansas State University

Notes

LARGE ANIMAL PROCEEDINGS
June 5–7, 2022

Surgery of the Bovine Distal Limb

Dr. Bryan Weaver, Kansas State University

Notes

LARGE ANIMAL PROCEEDINGS
June 5–7, 2022

Utilizing Cover Crops for Cow–Calf Producers

Dr. Jaymelynn Farney, K-State Research and Extension, Kansas State University

Utilizing cover crops for cow-calf herds

Jaymelynn Farney
Beef Systems Specialist
Kansas State University

K-STATE Research and Extension

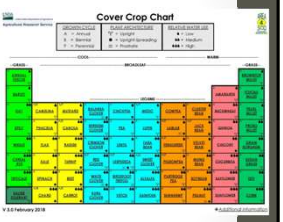
Integrated Crop-Livestock Systems

- "Encourage sustainable farming and generate positive interactions between crops and livestock with environmental and economic benefits" Allen et al., 2007
- Benefits:
  - Reduce risk of raising single product
  - Increase water infiltration
  - Resist soil erosion
  - Build soil organic carbon
  - Manure from livestock increases within-farm nutrient cycling = less synthetic fertilizers

Summarized by Maughan, 2009

Introduction

- Incorporating cattle into cover crops quicker economic return on investment in seed (Franzluebbers et al., 2007; Drewnoski et al., 2018)
- Selecting plant species difficult with all the options
- Operations have specific goals
  - No one-size fits all plans



Type and common annuals

Fall/Winter

- Grasses
  - Rye, barley, oat, triticale, wheat, ryegrass
- Broadleafs
  - Brassicas, buckwheat
- Legumes
  - Winter pea, clovers, vetch

Summer

- Grasses
  - Sorghums, sudans, millets, corn, teff
- Broadleafs
  - Sunflowers, buckwheat
- Legumes
  - Sunn hemp, forage soybeans, cowpeas

Issues with cattle grazing crops

- Compaction??
- Water
- Fencing
- Toxicities

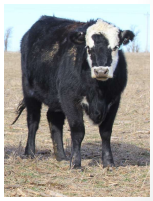
HOW DO WE USE ANNUAL FORAGES FOR CATTLE?

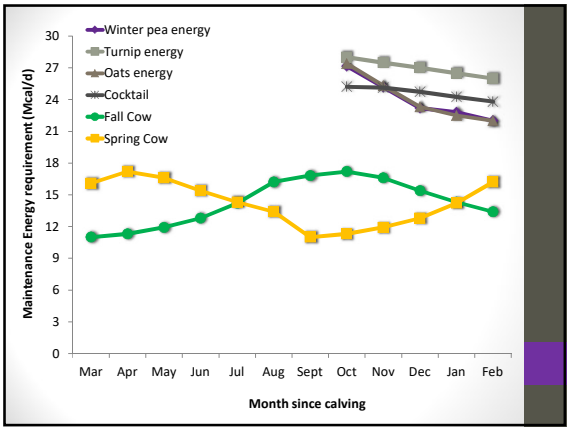
Know purpose - Cattle

- **Are gains a priority**
  - **Might need to include supplement**
- **Is maximizing land a priority**
- **What class of animal maximizes the acreage**

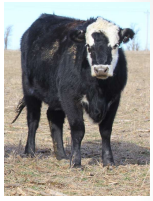
Winter Annuals and Cows

- Cow requirements, especially if dry, pregnant is much, much lower than what is offered by the winter annuals





Winter Annuals and Cows



- Issues
  - Too much body condition
  - Inefficiency in production system
  - Loss of potential revenue
- Practices to manage for this:
  - Short term (limit) grazing on high quality forage
  - Combination paddock

Short term grazing

- Allow cows a couple of hours/d to graze high protein, high energy forage at least 3x/week
  - This is also know as limit grazing wheat pasture
- Oklahoma State University study
  - Allowed cows to graze wheat pasture for 4 hours 3x/week (Fall-calving herd)
  - Rest of the time cows where on native hay
  - From calving to weaning cows on this system performed exceptional

Combination paddock

- Portion of pasture is corn/milo stalks or perennial pasture the other portion is cereal grain or brassica
  - Planting corners of circles with high quality forage
  - Fencing both types of forage
  - Flying on brassicas or cereal grains into residue??
- Cattle will consume a combination of residue and high quality forage
- Cows maintain appropriate body condition
- Removes the need for supplemental protein on residues

How much high quality pasture need??

- Really for spring cows don't need anything other than corn stalks for 1st month of grazing
- If only want to fence once – determine was maximal acreage is needed for the highest nutrient requirement period and multiply by days (90 d)
  - Cow needs 1.14 ac of cocktail and 1.93 ac of stalks
- Fall cows for 90 d
  - Cow needs 1.51 ac of cocktail and 2.18 ac of stalks

Weaned Calves

- Most of the time, we still are offering too much protein (much higher than requirements)
- Need another source of dry forage/feed
- Maximize gain potential want to make protein to energy ratio optimal
- Maximize gain = maximum dry matter intake

Value of winter cover crops - stockers

- Nebraska data showed that calf gains are VERY variable with cover crop mixtures
- Over 10 studies
  - ADG ranged from 0.8 lb/d up to 2.3 lb/d
  - Same cocktail in back-to-back years
    - 2.3 lb/d one year and 1.3 lb/d next year

Calf gains on cereal grains

Cereal type	Cattle Type	Gain	Location
Oat	Heifer	1.96	North Dakota
Barley	Heifer	1.96	North Dakota
Barley	Heifer	1.75-1.96	South Dakota
Barley	Steers	3.0	Canada
Oat	Steers	2-3.5	Canada
Rye	Steers	2.25-2.6	Canada
Triticale	Steers	1.7-2.4	Canada
Wheat	Steers	1.87	Canada
Oat-Ryegrass	Steers	3.06	Alabama
Oat-Rye-Ryegrass	Steers	2.78	Alabama
Rye-Ryegrass	Steers	2.50	Alabama
Ryegrass	Calves	1.96	Florida
Ryegrass-triticale	Calves	1.68	Florida

Grazing Weaned Calves Data - Eric Mousel

	CP	Cost/T DM	Performance ADG	COG
Turnip + Radish + Rape	18%	$46.00	1.37	$0.26
Oats	20	$57.33	2.55	$0.18
Millet	14	$26.39	2.57	$0.08
70% Turnip | 30% Oats	18	$47.70	1.56	$0.24
30% Turnip | 70% Oats	18	$53.93	2.23	$0.19
70% Turnip | 30% Millet	16	$40.11	1.78	$0.18
30% Turnip | 70% Millet	15	$32.27	2.36	$0.11
50% Turnip | 50% Oats	18	$51.66	2.26	$0.18
50% Turnip | 50% Millet	16	$36.19	2.31	$0.12

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Dual purpose wheat and compaction

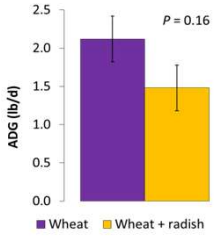


Figure 4: Calf average daily gain on dual-purpose wheat with or without radish (averaged over two years)
Farney and Sassenrath, unpublished

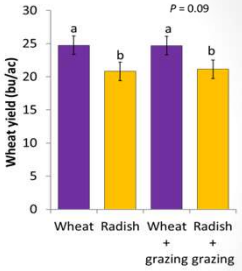


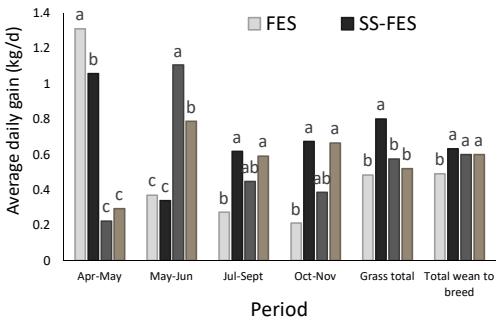
Figure 5: Dual-purpose wheat yield averaged over two years with or without radish and with or without grazing.. ^{ab} Letters with different superscripts differ $P < 0.05$.
Farney and Sassenrath, unpublished

Grazing systems with covers

Warm-season systems

- Years 2 of 3
- Fescue
  - 2 pastures – stocked 1 ac/hd – March to November
- Sorghum-sudan Fescue
  - 2 pastures rotationally grazed in 3 paddocks
  - Stocked 0.67 ac/hd – March to July (“mowing fescue”)
  - Drilled 25 lb/ac sorghum-sudan May 26
  - Stocked 1 ac/hd – July to November
- Crabgrass
  - 3 pastures rotationally grazed in 2 paddocks stocked 1 ac/hd
- Bermudagrass
  - 3 pastures rotationally grazed in 2 paddocks stocked at 0.8 ac/hd

Results - 2020

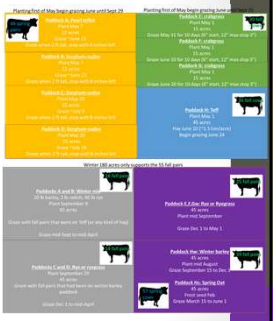


Results - 2021

	Pasture type					
Item	FES	BERM	CRAB	SS-FES	SEM	P-value
Initial weight (April), lb	490	489	490	431	19	0.07
July weight, lb	622	630	623	554	19	0.01
Gain/acre April-July, lb	132	140	132	122	8	0.55
ADG, April-July, lb/d	1.48	1.58	1.49	1.37	0.10	0.55
September weight, lb	699	695	737	696	20	0.41
Gain/acre July-September, lb	76	65	114	90	13	0.13
ADG July-September, lb/d	1.21	1.04	1.81	1.43	0.22	0.13

On-going project

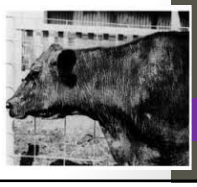
- On-farm project converting 160 acres of cropland into a year-long annual forage grazing system
  - Summer 2020 start
    - Teff, sorghum-sudan, crabgrass
    - Supported 110 cows May – mid-September
      - 46 spring pairs and 65 fall cows
- Capture stocking rate, water runoff, and cow performance data during this transition



What are issues with using annual forages

Potential problems

- Bloat
- Glucosinolates
- Grass tetany
- Nitrates
- Polioencephalomalcia (PEM)
- Prussic acid
- Sweet clover
- Just simply poisonous…



Poisonous plants

- Hairy vetch
  - Mortality 50-100% for affected animals
  - Not all animals affected
  - Black pigmented most commonly affected
  - "Allergic" reaction
  - Death due to kidney failure
  - Risky to graze at any stage of plant maturity

Dermatitis on hairy vetch pasture

Poisonous Plants

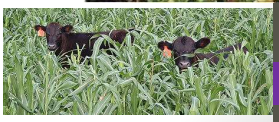
- Amaranth
  - Pigweed cousin
  - Death due to nitrate toxicity
  - Kidney failure issues
  - "True weed" – hard to control in pasture and crop ground
    - Glyphosate resistant…
- Some amaranth species for grain production can be good cattle feed
- Before using for cattle feed make sure you know the species

Green amaranth
BAD

Grain amaranth
Seed possibly ok to feed

Concerning Popular Plants

- These plants cause metabolic issues that need to be addressed….
  - Brassicas
  - Small grains
  - Legumes
  - Summer grasses



Brassicas

Issue	Management to resolve

• High moisture, low fiber
  • Loose stool
	• Supply a dry feedstuff
	  • Stalks
	  • Hay

• Glucosinolates
  • Decrease mineral absorption
  • Iodine – thyroid issues
  • Low in Cu, Mn, Zn
  • Eye and feet issues
	• Provide chelated/highly absorbable and palatable mineral
	• Offer mineral in daily feed supplement

• PEM, anemia, emphysema	• Brassicas <75% of total diet
• Nitrate ??? • Brassicas are nitrate accumulators and will test high in nitrate	• Allow plant to mature (usually decreases nitrate further in season) • Slow introduction to plant

Small Grains

- Barley, oats, rye, ryegrass, wheat, triticale
  - Grass tetany – fall, winter, spring
    - Manage with magnesium mineral ~8-12% Mg
    - Graze non-lactating cattle
    - Include legumes @ ~30% of pasture
  - Bloat
    - Dry forage
    - Ionophores
    - Bloat blocks

Legumes

- Clovers, alfalfa, lablab, cowpea, sunhemp, mungbean, soybean, medics
- #1 issue – bloat
  - Non-bloating legumes: lespedeza, birdsfoot trefoil, sainfoin
- Clovers – sweet clover poisoning; coumarin
  - Sweet clover, yellow clover, and white clovers
  - Red clover – low coumarin
  - Moldy hay most common culprit

Summer Grasses

- Sorghum, sudans, millets, corn
- Prussic acid
  - Sudan grass < sorghum-sudan < sorghum
  - No prussic acid: corn, pearl or foxtail millet
  - Graze when plants are taller than 18 inches
    - Might have new regrowth within 5 days so a rotational grazing system is best in summer to graze sorghums and millets

Summer Grasses

- Sorghum, sudans, millets, corn
- Nitrates
  - Can have ↑ nitrate
  - Manage for nitrate
    - Allow plant to mature
    - Harvest at higher cutting height if making hay

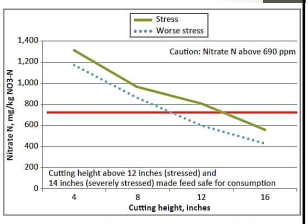


Figure 1. Holman, J. 2010. Effect of cutting height on nitrate-N level in forage sorghum that was either stressed or severely drought-stressed within the same field near Garden City, Kansas, in 2010.

Sorghum Grazing Considerations

- Rotational grazing best option
  - Start grazing sorghum when > 24 inches tall
  - Graze until 8 inches left
  - Grazing time per paddock should be less than 10 days – optimal a couple days
  - Rest time ~25 days should give 24 inches
  - Estimated stocking rate 5-6 AU/acre

Sudangrass and millet grazing considerations

- Rotational grazing still best option
  - Start grazing 18 inches tall
  - Stop grazing 8 inches tall
  - Grazing days 7-10 days
  - Rest period of ~21 days
  - Estimated stocking rate 4-5 AU/acre

Additional information

- MF3244 – Forage Crops Grazing Management: Toxic Plants
  - www.bookstore.ksre.edu/pubs/MF3244
- Beef Tips May 2015
  - http://www.asi.k-state.edu/about/newsletters/beeftipsMay2015.pdf
  - *"Sorghums and millets for summer forage"*
  - *"Estimating the amount of forage available for grazing in summer annuals"*
- Android and iPhone mobile app – Grazing Mgmt Toxic Crops

Additional Tools

- Tool to help determine cover crops that work in your area and to meet your operations goals

  http://mcccdev.anr.msu.edu/covercroptool.php

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620-820-6125

Thanks!!

Questions

LARGE ANIMAL PROCEEDINGS

June 5–7, 2022

Receiving Cattle Nutrition and Management

Dr. Blaine Johnson, Kansas State University

Receiving calf nutrition: A veterinarian's perspective.

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Abstract

Mitigating digestive mortalities begins when new cattle arrive to the feeding facility. The proportion of U.S. feedlot mortalities attributable to digestive diseases has been reported to account for 19.5% to 28.4% of all mortalities. Veterinarians provide a key role in the health and husbandry of cattle feeding operations. It is important to not overlook certain aspects of cattle feeding such as water, rest, and food for newly received cattle. Water plays a crucial role in an animal's physiology/homeostasis. Rest from a stressful event, such as transportation, should be address prior to processing. A general industry recommendation for rest after transportation is one hour of rest for every hour of transportation. Food in the form of good quality long stem hay must be provided at arrival along with fresh water. The next phase is transitioning cattle to a high grain diet. The transition period typically lasts around 28-45 days, which coincides with the highest risk period for bovine respiratory disease (BRD). Proper management during the transition phase relies on bunk management, reading the cattle, monitoring the weather, and proper communication within personnel working with and/or feeding the cattle. Failure in one or more of these areas will likely result in undesirable returns.

Key words: Feedlot, Health, Nutrition

Introduction:

There are roughly 30-32 million beef cattle in the United States and approximately 15 million are placed on feed throughout the United States annually[5]. Cattle are typically raised on pasture as calves and

finished out in confined feeding facilities on grain-based diets to optimize gain and growth for human consumption. Getting cattle from a forage-based diet to a finishing grain diet involves many factors (ex. animal's nutritional status, location/travel, disease burden, weather) and disruption in the process can lead to unintended health consequences for the animal and cattle feeder. Meyer and Bryant (2017)[2] reported that digestive disease accounted for 19.5%-28.4% of all feedlot mortalities, the majority of which were feedlot bloat. The transition period also coincides with the greatest risk for bovine respiratory disease (BRD). The major metabolic disease of concern during transition is typically acidosis (grain overload or overload) and subacute acidosis (sub-acute ruminal acidosis, SARA). Acidosis or sub-acute acidosis is a condition where cattle consume a large amount of highly fermentable carbohydrates, and the rumen microbial population metabolizes those carbohydrates to volatile fatty acids and create the by-product of lactic-acid. When cattle's ruminal pH drops below 5.2 (Acidosis), the animal is at a high risk for the cascade of disease events. The objective of this presentation is to identify areas where veterinarians can help producers optimally transition newly received cattle to finishing diets while avoiding detrimental health consequences.

Receiving cattle:

Receiving cattle to a feeding operation should address three major animal needs: water, feed, and rest[4].Water is often one of the most overlooked nutrients for living creatures. Providing adequate, clean, fresh, and cool water should be one of the first priorities for cattle feeders. Cattle will typically enter receiving pens and travel the parameter to familiarize with their new surroundings. For cattle that are unfamiliar to an automatic waterer, producers often keep an open float to simulate the sound of running water to gain animal's attention is a common practice. Cattle can drink three time their normal DMI during normal conditions and can drink up to five times their DMI during heat stress periods[4]. Things to consider as a veterinarian: are the waters easy to access?, i.e., can sorter cattle reach the water? How often are waters cleaned at the feeding operation? During heat periods, how many linear

inches are available for cattle access water, and what is the flow rate; can the supply keep up with demand? Cattle will typically increase their water consumption after their first eating period. This can cause a large demand on the water system of a facility. Cattle may have access to water, but the flow cannot keep up with demand causing water deprivation to some of the cattle population. In situations where cattle refuse to eat offered feed, especially when previous feed call have been consumed, the waterer should be investigated for stray voltage. Cattle will often act scared and reluctant to the water. Caution should be used when investigating stray voltage on automatic waters. The author recommends using a voltage meter or shutting off the electricity to the water. Voltage meter can detect stray voltage in the water without risking harm from electrical shock. If stray voltage is detected, shut off power to the water and have a professional determine the root of cause and fix the issue.

A rest period from transport also needs to be established. While in transport cattle lack the opportunity to lay down and rest as part of their normal behavior. Therefore, cattle producers should incorporate an ideal environment of rest to accommodate newly received cattle. Ideal environments should include dry, clean areas for cattle to lay down. During inclement weather proper bedding material should be available for animals. An industry rule of thumb is one hour of rest for each hour of transport[6]. Animals being transported are deprived of both food and water for potentially long periods of time. Allowing access to food in the form of long-stem hay is necessary for both animal and rumen microbial needs. Currently there are many options available to deliver hay to pens either on the slab or in bunk. Cattle can also benefit by delivery of starter (low-energy) rations top-dressing hay in the bunks. Top dressing can help train cattle that have not had complete rations or known as “bunk broke cattle”.

Starting on Feed:

Cattle being started on feed should be offered good quality long-stemmed hay along with their starter ration for the first 3-5 days or until cattle are consuming the starter ration at approximately 1% of their

BW on a DM basis. Hay can be discontinued when all cattle are coming to the bunk and eating starter diet. Literature supports an established goal of getting cattle to eat 1.5% of BW by two weeks on feed to minimize loss in performance and minimize health detriments[4]. Alfalfa mixed hay can also be offered in the beginning, but caution should be addressed due to a potential risk of frothy bloat development. This can be mitigated by limiting total hay offered for consumption to < 1.5% of BW. Adequate bunk space should be provided and will range depending on manager and type of cattle. Younger cattle typically are given more bunk space to avoid crowding and encourage eat behavior. Typical bunk space for calves can range from 12-18 linear inches per animal (30.5-46 cm). Older or larger cattle that are bunk broke are typically fed with 8-12 linear inches of bunk space per animal (20.3 to 30.5cm).

Equally important, some general knowledge of feed stuff should be exercised. Ration balancing is beyond the scope of this presentation, and one should seek further educational material if interest is desired. Rations are built to meet and/or exceed an animal's nutritional needs which are based on the cattle's predicted gain and dry matter intake. The typical components that comprise a ration (total mixed ration, TMR) are carbohydrate, protein, roughage/fiber, and supplements. Grains typically make up the carbohydrate portion of a ration. In the Midwest, corn is the most common source grain/carbohydrate used in feedlot rations. Wheat, barley, and sorghum are also used in feed lot rations as carbohydrate sources depending on location of the feeding operation. The cereal grains will commonly go through some sort of processing method to increase the utilization and efficiency. Depending on the grain type and processing method, the overall energy content can vary, which can influence risk of ruminal acidosis.

In the past urea was commonly used as a protein source due to its efficiency of providing nitrogen to ability to be broken down in the rumen. The advent or ethanol has brought co-products/by-products to feedlot rations as the primary source of protein in diets. The crude protein of rations is typically 13% or higher of the DMI for calves and can be reduced to around 11-12% for more mature

cattle. Crude Protein is comprised of ruminally degradable protein RDP and rumen non-degradable (undegradeable) protein (RUP). Protein is necessary for proper microbial growth for a healthy rumen population (RDP) and for individual animal growth (RUP).

The forage component of rations is typically some type of hay. Calves may require more good quality grass hay compared to older animals and can be transitioned over time to a lower quality forage such as corn stover. Silage can be used as both an energy source and a forage source. Silage used with calves should be cautioned. Calves are typically reluctant to silage especially if no prior exposure due to its taste.

The supplements of a ration are commonly formulated to comprise approximately 2% of the total DM. Supplements, at least for this presentation, include vitamins (A, D, and E), minerals (macro and micro minerals), and drugs added will be formulated in this portion of the ration.

For optimal consumption the ration should be formulated around 75% total DM. Using a higher DM creates a ration that's too dry for optimal consumption and can create sorting issues. Rations below 70% DM can run the risk of spoilage and creating potential refusals. Water can be added to a ration to create the optimal as-fed DM content. In my experience, order of placement in the mixer can also impact quality of delivered ration. Typically grains and supplements are added first, followed by forage, and finally distiller's grains. This allows the higher energy portions of the rations to be mixed longer and the weight and consistency of the distiller's grains will help bind all particles together. Ultimately creating a more uniform distribution at delivery and decrease in sorting (in my experience).

Step-Up Diets: Transition phase and Bunk reading

The transition phase is the period of getting cattle from their starter ration (number one ration) (50-65% Concentrate) to their finisher ration (80-90% Concentrate). Moving cattle too fast increases the risk of acidosis or sub-acute ruminal acidosis (SARA). This can set cattle up for disturbances in feed intake across the feeding period leading to poor performance. A good understanding of bunk management is key to stepping cattle up appropriately while minimizing health impacts on performance. Bunk management practices have been developed by scoring bunks by the amount of feed remaining in the bunk at feed call to keep cattle at consistent intakes. It is best practice to call feed (read the bunk) at the same time each day. Feed intake is typically managed by bunk reading. The South Dakota Bunk reading system was developed on a 0 to 4 scoring scale. A bunk scoring a 0 (also considered a slick bunk) have no feed remaining with visual lick marks on the bunk. Some systems have a 0.5 category or "crumbles", meaning that there are crumbs left in the bunk, but most feed has been consumed and bunk bottom can be easily visualized. A bunk score of one indicates a small amount but uniform layer of feed across the length of the bunk line. A bunk score of two refers to 25-50% of previous feed delivery remaining. Bunk score of three indicates that greater than 50% of previous feed offering remaining and bunk score of four translates to virtually untouched. As indicated previously, a bunk score of four would lead one to investigate potential water issues especially if cattle have history of adequate feed consumption. Previous literature showed that cattle with properly managed intake had greater DMI which translated to greater ADG and gain to feed ratios[3]. Additionally, data showed that cattle on the South Dakota bunk management had a 10% lower feed to gain ratio, which increased profits USD $19.33 per animal (in 1993) keeping all factors equal between to feeding operations. Whereas, the author reported that an increase of 10% F:G decreased returns USD $26 per animal[3]. Lastly, when increasing feed delivered, any increase in the amount of feed called should be kept to 0.5 lbs per animal or less and consistently consumed for a minimum of two days before the next increase.

Feed delivery: Timing and Frequency

Cattle are creatures of habit and by feeding them consistently at the same time every day will accommodate their nature. Inconsistencies of feed delivery timing can lead to inconsistencies of DMI. Swings in DMI leads to an increased the risk of SARA/overload by overloading the rumen with rapidly fermentable carbohydrates. For the transition phase there are two common methods adapting cattle to finisher diet: the step-up, and two-ration-blend methods. The step-up method feeds one ration at a time and transitions by decreasing the amount of fiber and increasing the amount of grain. Typically, rations are changed every 4-7 days from cattle's beginning ration to their final ration. The two-ration blend method uses only two rations (the first and final ration) throughout the transition period. Cattle are fed a proportion of each ration and the proportion is adjusted to get cattle on the final finishing ration. The two-ration blend method cuts down on the number of rations the mill must make every day, which helps gain some logistical efficiency. Regardless of type of transition, if cattle are getting fed at the same time each day, they will adapt to their feeding situation. The number of times feed is delivered can vary for many reasons. As an industry, cattle are typically fed twice a day. This allows for cattle to get two fresh meals a day and a more consistent feed intake, which should allow for better performance. Some operations feed three times a day to capitalize on consistent feed intake through multiple feed delivers. However not every feeding operation has the capability to feed cattle twice a day and will resort to a once a day feeding schedule. When considering a once a day feeding schedule two major considerations need attention. 1) Can the amount of feed properly fit in the feeding bunk and is there enough bunk space for cattle to eat? Over filling feed bunks will encourage wastage of feed. Inadequate bunk space could limit number of cattle at the bunk when fresh feed is delivered, and potentially cause DMI issues. 2) Will the manager still maintain appropriate feed bunk management? Many cases where feeding once-a-day has gotten cattle producers in feeding detriments have been during times of increased workload on their end (such as harvest or planting season). From personal experience, cattle on a hot finishing diet fed once a day have an increased risk of bloat and pen death potential when not managed

appropriately. High heat periods will stress cattle and throw off timing of feed consumption due to thermoregulation. Typically, cattle will thermoregulate late in the evening/early morning and consume most of their diets just prior to dawn. The swings in consumption can lead to opportunities for high loads of highly fermentable carbohydrates, leading to risk of SARA or acidosis/overload. Good managers will foresee these events and begin to acclimate their cattle either by slowly changing the timing of feed delivery or decreasing the energy content or amount delivered of the ration.

Fecal Scoring:

Once an understanding of feed delivery and intake management have been demonstrated, the whole process can be evaluated from the back end of the animal. Care takers are monitoring cattle very closely for BRD during the transition period. Training personnel to look at fecal scores is also beneficial on overall pen health. Walking through cattle and evaluating the consistency and color of feces provides real time data for veterinarians, nutritionist, producers, and care takers. Fecal scoring systems have been established to evaluate the consistency of feces from animal consuming feeds. Large amounts of undigested carbohydrates can make their way to the lower gastrointestinal tract causing localize disturbances and giving a viscus-gray bubbly appearance on the pen floor. Fecal scoring systems are commonly based on a 1 to 5 scale[1]. When large amounts of cattle are scoring 2 or less, increasing feed delivery should discouraged. A fecal score of three generally accepted as a healthy gastrointestinal system of adequate plan of nutrition intake. Fecal scores of 5 (rarely seen in feedyards), indicate the potential of low levels of protein in diets, more common in range cattle when forage has gone dormant. Other things to consider when evaluating pen feces would be the appearance and frequency of blood, mucosal plugs, and odors. Finding large amounts of blood could indicate other disease problems within the pen. Top differentials that should come to mind when blood if found in feces would be coccidiosis, injury (temperature prob trauma), bovine viral diarrhea virus BVD, and salmonellosis. Proper early identification of these metabolic problems can help mitigate pen-wide issues.

Summary and Conclusions:

Success in cattle feeding relies on getting cattle properly started on feed and transitioned to grain diets by providing good welfare practices, husbandry, and adequate nutrition. Goals for all cattle producers are first to adequately get cattle to eat by providing rest, and optimal feed. The second goal should be to transition cattle to a finishing (high-concentrate) diet while keeping DMI as consistent as possible in an appropriate timeframe. Pushing cattle too hard or fast can cause undesired consequences for both the producer and animal. It is just as important to understand your cattle as much as the nutrition being provided to gain optimal success.

Citations:

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