

Investing in Your Future – Calf Health

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Paradigm Shift – Heifer Raising

Traditional Thinking

- Calves are an expense – they won't pay for themselves until somewhere in the 2nd lactation
- I need to raise them as cheaply as possible
- If I run short on heifers – I can always buy extra animals
- As long as I keep them alive and get them pregnant – they will “catch up” in the lactating herd eventually



Paradigm Shift – Heifer Raising

Reality

- Calves are an investment
- Early growth and disease incidence have a significant impact on future productivity
- Need to manage heifer inventory and focus on nutrition
- Heifer survival rate has been shown to be a key indicator of net farm income and total profitability of dairies (Zoetis Dairy Financial Drivers study)
- The key is not only heifer survival – but quality

Current Trends

- 1) Beef on dairy calves have been a blessing and a curse
- 2) Many farms have restricted the “incoming” heifer pipeline by their breeding decisions
- 3) Purchasing dairy replacement heifers has become more difficult
- 4) This has restricted the ability of some dairies to make culling decisions
- 5) Many farms still fail to calve heifers at 85% of mature body weight

Calf Health

- Calf health continues to be a problem on some farms
- Obviously high mortality rates limit the number of heifers available for breeding
- Calves treated for BRD have a 500-1,200 lb decrease in 1st lactation milk
- Multiple studies have shown that scours is a significant risk factor for the development of pneumonia
- Need to focus on weaning big, healthy calves with “good lungs”

Disease Incidence – Dairy Calves

	1991	1996	2002	2007	2014
Pre-weaned calf mortality	8.4%	10.8%	10.5%	7.8%	6.4%
% of deaths caused by diarrhea	52.2%	60.5%	62.1%	56.5%	56.4%
% of deaths caused by pneumonia	21.3%	24.5%	21.3%	22.5%	24.0%
Weaned calf mortality	2.2%	2.4%	2.8%	1.8%	1.9%

Data from USDA NAHMS surveys

Neonatal Calves

- Overall focus should be on management – NOT products or interventions
- The vast majority of disease and/or calf health problems stem from improper calf management
- There is no magic bullet to overcome a poor colostrum program or bad housing/hygiene
- Key focus should be in 3 areas: first-day calf care, nutrition and weaning



Day 1 Calf Care: Where Calves Get Their Healthy Start

- ✓Needs to be a focus on dairy farms
- ✓Clean, well-ventilated maternity barn with a separate area for calving
- ✓Dip navel immediately and tag calf
- ✓Harvest colostrum ASAP post-calving in the maternity barn



Colostrum Management

A good colostrum management program – ensuring that all calves get an adequate volume of quality colostrum within the first 2-4 hours - is the single most important aspect of neonatal calf management.

Best Practices

- Test colostrum (Brix) and if not immediately fed – need to have plan for rapid cooling and proper storage
- Calves fed 4L of colostrum within 2 hours of birth
- Monitor [total protein] periodically
- Need stable (well trained) maternity barn staff with a plan in place for heavier times of the year



New Standards for Passive Transfer

Category	Serum [IgG] (g/L)	Total Protein (g/dL)	%Brix	% of Calves	2014 NAHMS % of calves
Excellent	<25.0	>6.2	>9.4%	>40	35.5
Good	18.0-24.9	5.8-6.1	8.9-9.3	~30	25.7
Fair	10.0-17.9	5.1-5.7	8.1-8.8	~20	26.8
Poor	<10.0	<5.1	<8.1	<10	12.0



Post Day 1 Colostrum Use

- Research shows that the continued use of colostrum (or CR) past day 1 can help prevent scours^{1,2} and may help increase growth rates¹
- Colostrum can also be used as a “treatment” to help resolve diarrhea^{3,4}
- More research is needed to define “how much” and “for how long” transition colostrum should be fed


1 Charmorro MF, Cernicchiaro N, Haines MH Evaluation of the effects of colostrum replacer supplementation of the milk replacer ration on the occurrence of disease, antibiotic therapy, and performance of pre-weaned dairy calves *J Dairy Sci* 2016;100:1378-1387

2 Kargar S. et al. Extended colostrum feeding for 2 weeks improves growth performance and reduces the susceptibility to diarrhea and pneumonia in neonatal Holstein dairy calves *J Dairy Sci* 2020;103:8130-8142

3 Carter HSM, Steele MA, Costa JHC, Renaud DL. Evaluating the effectiveness of colostrum as a therapy for diarrhea in preweaned calves *J Dairy Sci* 2022;105:9982-9994

4 Chung J, Rayburn MC, Chigerwe M, Randomized controlled clinical trial on the effect of oral immunoglobulin supplementation on neonatal dairy calves with diarrhea *J Vet Int Med* 2019;33:1807-1813

The Benefits of Increased Milk Nutrition

- Nutrition has been shown to be a critical piece of the puzzle in helping to prevent calf disease
 - Studies have shown that higher planes of nutrition reduce the incidences of BOTH diarrhea and pneumonia
 - Calves should be fed “more” early – so they are in good body condition to handle diarrhea if it should happen
 - Better nutrition also helps modulate immune function in calves
- 

Nutrition and Disease

- In a challenge model of Cryptosporidiosis in calves – those on a higher plane of nutrition got better “faster” than those on conventional nutrition
- On day 5 calves were inoculated with *C. parvum* (1×10^6 oocysts) with an esophageal feeder
- Health score, fecal score, rectal temp, [TP], PCV, WBC count, body weight, [NEFA]
- A quantitative Crypto oocyst count was done on feces from each calf once diarrhea started

Nutrition and Disease

- After a pathogen challenge – calves on a higher plane of nutrition:
 - maintained hydration
 - had faster resolution of diarrhea
 - grew faster
 - converted feed with greater efficiency


Nutrition and Disease

- Another study compared calves on LPN and HPN with a *Salmonella* Typhimurium challenge model
- Calves on HPN had:
 - Higher % of neutrophils producing an oxidative burst on days 1-5 post-challenge
 - Greater intensity of oxidative burst post-challenge
 - Some increase in secretion of TNF α from whole blood cultures stimulated with LPS in HPN calves
 - LPN calves had higher [haptoglobin]

Ballou et al. J Dairy Sci 2015; 98:1972-1982

Article

A High Plane of Nutrition Is Associated with a Lower Risk for Neonatal Calf Diarrhea on Bavarian Dairy Farms

Ingrid Lorenz ^{1,*} , Regina Huber ² and Florian M. Trefz ³

- Study took place in Bavaria – with 14 veterinarians employed by the Bavarian Animal Health Service making farms visits
 - Risk factors were compared between herds with “frequent diarrhea” (n = 59) and control herds that had not treated more than 10% of calves for diarrhea in the preceding year (n = 18)

Results

- Farms that fed higher volumes of milk – particularly during the first week of life had lower risk of diarrhea
- Both increased frequency of feeding and increased volume of milk/meal were associated with in ↓ diarrhea

Table 4. Variables entered into a multivariate regression model with p-values from univariate regression.

Variable	p-Value
Calving pen cleaned after every calving	0.14
Newborn calves with dams longer than 3 h	0.08
3 L of colostrum at first feeding	0.08
3 or more liters of colostrum at second feeding	0.01
Ad libitum feeding during first week of life	0.00

Milk and Future Production

- Several studies now have indicated that increased nutrient intake during the first 8 weeks of life will increase milk yield in first lactation
 - Increases have ranged from 1,000 to 3,000 lbs
- The increase in milk production seems to be consistent regardless of body weight
- Nutrient intake in the pre-weaning period has a direct impact on mammary gland development

Soberon F, Van Amburgh ME. Lactation Biology Symposium: The effect of nutrient intake from milk or milk replacer of preweaned dairy calves on lactation milk yield as adults: a meta-analysis of current data. *J Anim Sci.* 2013;91:706-712.

LACTATION BIOLOGY SYMPOSIUM:

The effect of nutrient intake from milk or milk replacer of preweaned dairy calves on lactation milk yield as adults: A meta-analysis of current data¹

F. Soberon* and M. E. Van Amburgh†²

*Shur-Gain USA, Nutreco Canada Inc., Guelph, ON N1G 4T2, Canada; and †Cornell University, Ithaca, NY 14850

Table 1. List of studies comparing preweaning calf nutrition and future milk yield of the same animals

Study	N	ADG of control, kg	ADG of treatment, kg	Milk yield of control, kg	Milk response ¹ , kg	Estimated ME, Mcals/d above control calves	Source of nutrient ²
Foldager and Krohn (1994)	30	na ³	na	na	1,405 ^a 3,091	na	WM
Bar-Peled et al. (1997)	20	0.56	0.85	9,171	453 ^b 997	0.290	WM/MR
Foldager et al. (1997)	20	0.60	0.90	7,716	519 ^a 1,142	0.266	WM
Ballard et al. (2005), at 200 DIM ⁴	14	0.44	0.73	6,100	700 ^a 1,540	0.200	MR
Shamay et al. (2005)	20	0.59	0.88	10,784	981 ^a 2,159	0.270	WM/MR
Drackley et al. (2007) block 1	10	0.52	0.75	9,245	1,332 ^b 2,930	0.410	MR
Drackley et al. (2007) block 2	14	0.56	0.71	8,796	342 752	0.360	MR
Raeth-Knight et al. (2009)	26	0.56	0.79	12,962	718 ^c 1,580	0.540	MR
Terré et al. (2009)	30	0.80	0.90	9,888	624 ^c 1,373	0.100	MR
Morrison et al. (2009)	38	0.34	0.50	6,862	0 ^c	0.160	MR
Moallem et al. (2010)	23	0.73	0.80	9,150	732 ^a 1,610	0.074	WM/MR
Davis-Rincker et al. (2011)	40	0.44	0.64	9,778 ⁵	416 ^c 916	0.200	MR
Soberon et al. (2012)	400	0.32	0.70	10,605	552 ^a 1,214	0.450	MR

Milk and Future Production

- For every 0.25 lb increase in ADG in the first 8 weeks of life – milk production increases by ~600 lb in 1st lactation¹⁰
- Minimum goal is to at least double body weight by 8 weeks of age (ADG ~1.6 lbs/day)
- Better goal is ADG of 1.7-1.8 lbs/day
- Ad libitum milk feeding will be 2.0-2.2 lbs/day

Soberon F, Van Amburgh ME. Lactation Biology Symposium: The effect of nutrient intake from milk or milk replacer of preweaned dairy calves on lactation milk yield as adults: a meta-analysis of current data. *J Anim Sci.* 2013;91:706-712.

Feeding – Best Practices

- 1) Consider feeding colostrum and/or transition milk for the first few days if possible
- 2) Good quality milk replacer (minimum 24% protein)
- 3) Invest in a computerized milk mixing system with good weigh cells (weigh powder) and temp monitoring
- 4) Increase milk feeding early (6 liters by 5-7 days of age) – not “after” they are done with scours
- 5) Have access to good quality, hot water
- 6) Consistency is critical (meal, TS, feeding times)

Feeding – Best Practices

- 7) Use a Brix refractometer to measure consistency
- 8) Limit the number of cooks in the kitchen
- 9) Proper step-down (2 periods lasting at least 5 days each)
- 10) Weight calves at weaning – you need to monitor ADGs in order to evaluate the milk feeding program
- 11) Implement good washing of feeding equipment with regular sanitation audits
- 12) Use chlorine dioxide



Weighing Calves

- Weighing individual calves at birth at weaning is really the only way to evaluate the nutrition program
- Don't have to weigh every calf – but at least do it regularly
- Trailer (group) weights really don't offer much information



Calf Wellness Goals

	Great	Good	Problem
Mortality	<3%	<5%	>6%
Number of calves with disease	<10%	<25%	>25%
Brix reading (colostrum)	>25	22-24%	<22%
Colostrum culture	<50,000 CFU/mL	50-100K CFU/mL	>100,000 CFU/mL
Average daily gain (lbs)	>1.75 lbs/day	1.5-1.75 lbs/day	<1.4 lbs/day

Post-Weaning Nutrition

- Need to continue positive plane of energy balance after weaning
- Goal is to calve heifers at 85% of mature body weight
- Smaller heifers won't be as productive
- Rapidly transitioning to a “cheaper” ration post-weaning will create stress and ↑ disease
- Study shows beneficial effects of calving heifers at an appropriate body weight lasts multiple lactations
(Overton, ADSA, 2023)

The Prevention and Control of Epidemics of Acute
Undifferentiated Diarrhea of Beef Calves in Western Canada

O. M. RADOSTITS AND S. D. ACRES*

disponibles mais, comme c'est le cas avec la plupart des produits biologiques, on ne peut pas déterminer leur impact avant de les avoir utilisés durant plusieurs années. On ne doit cependant considérer ces vaccins que comme un des moyens de contrôle

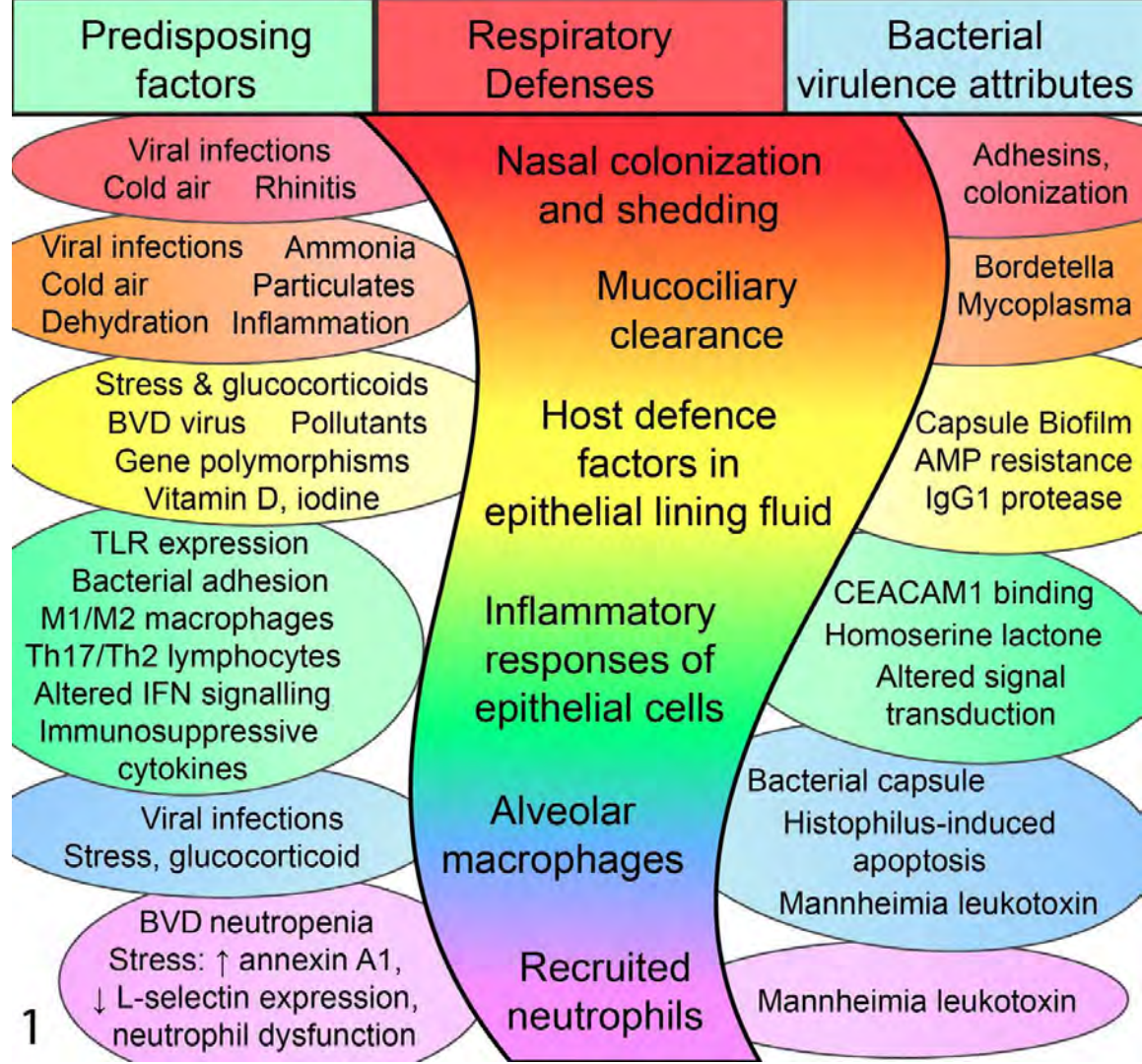
- Stress – defined as reaction by which an animal responds to natural and environmental conditions
- Recognized stress as one of the key factors responsible for disease in beef calves
- “Because many different conditions can cause stress and because stress is difficult to measure, it has not been possible to identify all of the factors which contribute to the problem”

Causes of Stress

- 1) Nutrition
- 2) Weather
- 3) Overcrowding
- 4) Weaning
- 5) Transportation
- 6) Poor ventilation
- 7) Movement (social stress)
- 8) Castration/dehorning (pain)
- 9) Disease



Stress and Pneumonia



Conventional (CONV)



Housing

Moderate (MOD)







Arrival cortisol measurement in veal calves and its association with body weight, protein fractions, animal health and performance

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- Male Holstein calves (2-4 weeks of age) across multiple growing cycles were transported (variable distances) to a veal grower
- Calves were bled on arrival for [cortisol] and [TP]
- Calves were ultrasounded frequently for lung lesions and clinical signs/ADG were calculated

Prev Vet Med 2021;187:105521

Results

- Cortisol concentrations varied widely upon arrival (from 50 to 317 ng/mL)
- Arrival cortisol, body weight and IgG concentrations were not significantly associated with each other
- However ↑ cortisol at arrival was associated with chronic, unresponsive pneumonia
- For every 10 ng/mL ↑ in cortisol, the odds for lung consolidation at the 2nd US increased significantly

Results

- The presence and severity of lung consolidation with strongly correlated with ADG
- Interestingly – 2 clusters of calves were found in the data:
 - 1) A low risk cluster with below average cortisol values, above average body weight, no FPIT and minimal acute phase response during transport
 - 2) A high risk cluster with above average cortisol, below average body weight and FPIT

Conclusion

- Stress is bad – there are some things we can do to help minimize the effect
 - Focus on colostrum management
 - Aggressive nutrition program
- However stress responses seem widely variable within a population of calves
- We can't always avoid stress – but we can somewhat control “how much” stress occurs at a time

Strategies to Prevent Post-Weaning Pneumonia

- 1) Aggressive nutrition (with proper step-down)
- 2) Keeps calves in pens/groups for a period after weaning
- 3) Limit transportation around times of other stress?
- 4) Plan vaccinations before period of stress
- 5) Have a plan to manage heat/cold stress in calves
- 6) Limit group sizes pre and post-weaning
- 7) Maximize ventilation
- 8) Consider genomic testing to improve genetic resistance

Coccidiosis

- A common cause of diarrhea in juvenile calves (2-6 months of age)
- In calves caused by *Eimeria zurneii* and *Eimeria bovis*
- Eggs are ingested from the environment – they first undergo reproduction in the small intestine producing inflammation
- Then oocysts multiply in the large intestine producing severe damage to the cecum and colon

Bovine (*E. bovis*) Coccidiosis Life Cycle

1 oocyst = 23,000,000+ yet only 50,000 needed to cause disease!

Clinical Coccidiosis





Coccidiosis – Clinical Signs

Subclinical Infection

- Often no clinical symptoms seen
- However calves have decreased weight gain and feed efficiency
- Genetic potential will not be realized
- Coccidiosis will also suppress the immune system and make calves more susceptible to respiratory disease



Immune System Effects

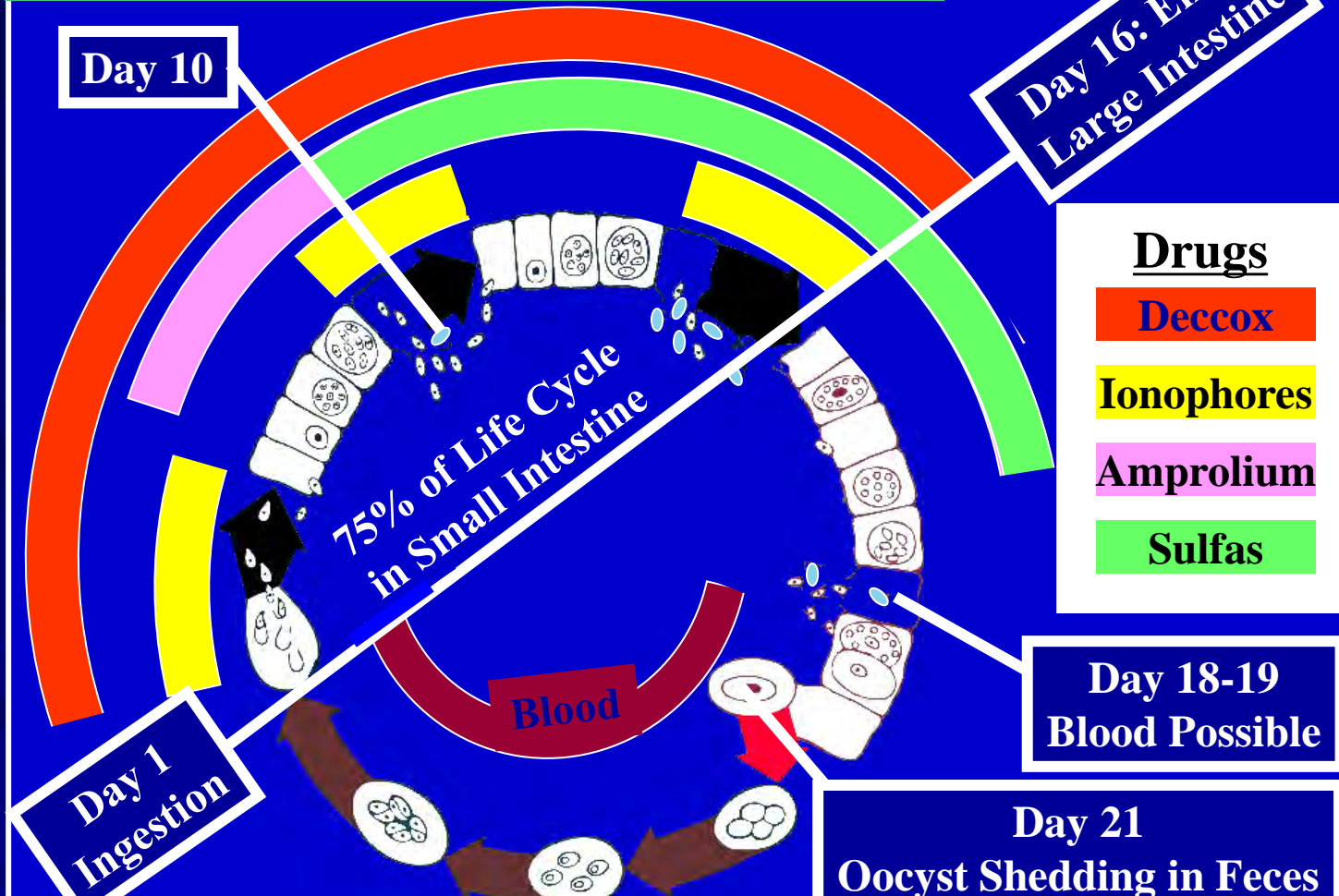


**Any
System
Can**

**Be
Over
loaded**

Developing a Proactive Strategy to Minimize the Impact of Coccidiosis

Available Anticoccidial Drugs



Summary

Coccidiosis

- A very costly disease, that is commonly overlooked
- If you wait until you see bloody stools...you are already behind!!!
- We must create a proactive plan
- This likely starts with feeding an anti-coccidial from day 1 of life
- Preventing cocci has advantages relative to:
 - Feed Intake, efficiency and BRD



Things to Think About

- 1) Am I keeping records on disease, treatments and death loss in my calves
- 2) Do I ever check total protein values in calves?
- 3) What are my birth to weaning ADGs?
- 4) Do I know what weight my heifers are calving in at?
- 5) Are there enough heifers in the pipeline to support current replacement needs?
- 6) Do I have a coccidiostat in the milk?

Conclusions

- Calves are an expense – yet should be considered an investment in the farm's future
- The key is not only heifer survival – but quality
- The quality of your calf crop will significantly affect how your lactating cows' milk in the future
- Prioritizing newborn and wet calf nutrition can help producers prevent disease when calves are most vulnerable

Questions?



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