Nutritional management of high-risk calves

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PART 1

Supplemental Readings

Duff, G. C., and M. L. Galyean. 2007. Board-Invited Review: Recent advances in management of highly stressed, newly received feedlot cattle. J. Anim. Sci. 85:823–840. doi:10.2527/jas.2006-501

Galyean, M. L., L. J. Perino, and G. C. Duff. 1999. Interaction of cattle health/immunity and nutrition. J. Anim. Sci. 77:1120–1134. doi:10.2527/1999.7751120x

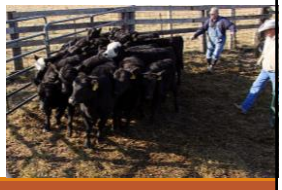
Wilson, B. K., C. J. Richards, D. L. Step, and C. R. Krehbiel. 2017. Beef Species Symposium: Best management practices for newly weaned calves for improved health and well-being. J. Anim. Sci. 95:2170–2182. doi:10.2527/jas2016.1006

Stress, Risk Classification, and Bovine Respiratory Disease (BRD)

Stress vs. Sickness

Stress is not a disease

Stress enables or causes animals to be more **susceptible to disease**



Examples of Stress

Three General Categories

- **Pre-Marketing**
  - Stress occurring prior to weaning or as a component of the weaning or preconditioning process
- **Marketing**
  - Stress occurring as a component of the transportation and marketing process
- **Post-Marketing**
  - Stress occurring after arrival at a feedlot, stocker operation, or backgrounding and preconditioning facility

Reducing and Avoiding Stress

Steps should be taken to reduce stress on animals

- **Wean calves!!!**
- Castrate, vaccinate, dehorn, etc. **PRIOR** to weaning/shipping
- Minimize transporting and shipping events
- Minimize commingling
- Don't handle cattle excessively or with poor stockmanship
- Provide an escape/release from stress (if possible)
- Provide critical nutrients and energy
- Provide comfortable environment
- Adapt to new environments, diets, etc. gradually

Good animal husbandry and stockmanship!!

Weaning and Preconditioning

Receiving Health by Weaning Program

Item	Market	Ship	Wean 45	Wean Vac45
Morbidity, %	41.9[a]	35.1[a]	5.9[b]	9.5[b]
Treated 1X, %	31.9[a]	22.2[a]	5.0[b]	7.7[b]
Treated 2X, %	4.0[ab]	9.2[a]	0.9[b]	1.8[b]
Treated 3X, %	6.0[a]	3.7[ab]	0.0[b]	0.0[b]
Case fatality, %	3.1	0.0	0.0	0.0

[ab]Means within row with different superscripts differ ($P < 0.05$).

(Step et al., 2008)

Low Risk Cattle vs. High Risk Cattle

Unfortunately, it isn't a perfect world...

Good animal husbandry and stockmanship are not always practiced...

- Groups of calves can and should be classified according to the **probability or perceived risk** that they will contract BRD
  - Three Categories
    - **Low-risk, Medium-risk, or High-risk**

Low Risk Cattle vs. High Risk Cattle

Low-risk Cattle

- Customarily are older and heavier-weight
- Been weaned at least 45 d before marketing
- Possibly enrolled into a recognized preconditioning program
- Come from a single source or very few sources
- Arrive with some vaccination or herd health history
- Appear to be less stressed on arrival to the feedlot

Low Risk Cattle vs. High Risk Cattle

High-risk Cattle

- Characteristically younger and lighter-weight
- Typically weaned immediately before being marketed
- Come from multiple lots of cattle at multiple livestock markets
- Potentially transported long distances
  - Southeast U.S. to Southern Plains
- Have unknown disease and vaccination histories
- Frequently are not dehorned or castrated
- Are highly stressed on feedlot arrival

High-risk calves are typically suffering from dehydration, malnourishment, and exhaustion at the time of arrival

Low Risk Cattle vs. High Risk Cattle

Moderate-risk Cattle

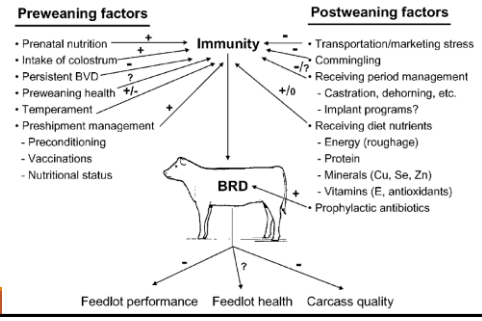
- Calves often fall somewhere in between high-risk and low-risk
- Classification is difficult...
  - Lack of critical information on groups of calves that would aid in risk classification
- Not all calves sold through auction markets would be classified as high-risk
- Not all calves originating from a sole source would be classified as low-risk
- Occasionally...
  - Groups of calves from auction markets may be castrated and have some vaccination or health history
  - Groups of ranch calves from a sole source may have been recently weaned and never been vaccinated
- These calves exemplify **moderate-risk cattle**
  - We expect fewer health problems when compared with high-risk calves
  - We expect more BRD incidence when compared with low-risk calves

What is BRD?

- BRD
  - Shipping fever, respiratory disease, pneumonia, undifferentiated fever
  - Ultimately a disease of the upper and lower **respiratory tract**
  - Resulting from **viral and bacterial** pathogens within the body
  - Term **BRD Complex** is used to encompass all causative agents, including stressful situations such as shipping
  - Most common and most devastating health problem in stocker or feedlot calves

What is BRD?

Source: Duff and Galyean, 2007
J. Anim. Sci. 2007. 85:823–840
doi:10.2527/jas.2006-501



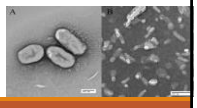
BRD Pathogens

VIRAL

- Bovine Respiratory Syncytial Virus (BRSV)
- Parainfluenza 3 (PI3)
- **Bovine Viral Diarrhea Virus (BVDV)**
- Infectious Bovine Rhinotracheitis (IBR)
- Bovine Coronavirus

BACTERIAL

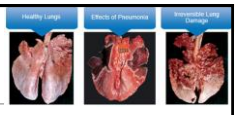
- *Pasteurella multocida*
- ***Mannheimia haemolytica***
- *Histophilus somni*
- *Mycoplasma bovis*



Sources of Infection

- Commingling at livestock auctions, order buying facilities, backgrounding or preconditioning facilities, stocker operations, or feedlots
- Bacteria are always there
  - ***Mannheimia haemolytica*** is always present in the respiratory tract
- Viruses are usually due to exposure
  - Commingling or persistently infected (PI) BVDV animals

BRD Pathogenesis



- BRD
  - While stress certainly plays a role and can lead to BRD incidence
  - BRD is ultimately a disease of the upper and lower **respiratory tract** resulting from **viral and bacterial** pathogens
  - Stress inhibits immune defenses
    - Weakened immune system allows viral replication
      - Viral pathogens further weaken the immune system and rapid bacterial infection/colonization
        - Pathogens cause sickness behavior (**temporary**)
          - Bacterial infections destroy lung tissue (can be **permanent**)

Nutritional management of high-risk calves

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PART 2

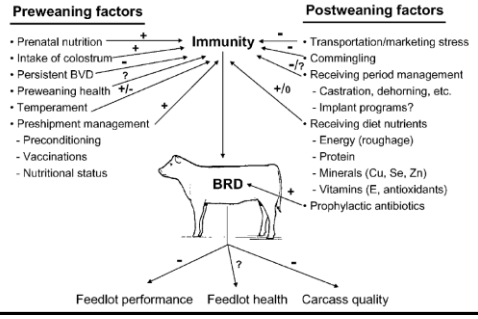
Supplemental Readings

Samuelson, K. L., M. E. Hubbert, M. L. Galyean, and C. A. Löest. 2016. Nutritional recommendations of feedlot consulting nutritionists: The 2015 New Mexico State and Texas Tech University survey. J. Anim. Sci.94:2648–2663. doi:10.2527/jas2016-0282

Starting high-risk calves on feed

What is BRD?

Source: Duff and Galyean, 2007
J. Anim. Sci. 2007. 85:823–840
doi:10.2527/jas.2006-501



Two strategies for cattle purchases

Focus on production and efficient gain

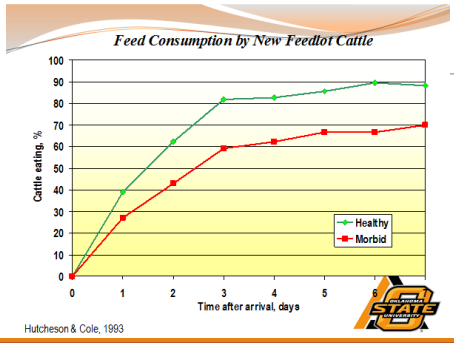
- Buy preconditioned, low risk calves
- Pay a premium
- Keep performance and efficiency high
- Keep COG low
- Hopefully sell at slight premium
  - High quality grade
  - Branded programs
  - Etc.

Focus on market upgrade

- Buy mismanaged, commingled calves
- Purchase at a discount
- Accept high risk
  - Higher processing costs
  - Higher treament costs
  - Higher morbidity and mortality
- Question is how much higher?
- Hope to upgrade cattle and sell at market average price

Feed Intake of Newly Arrived Calves

Hutcheson and Cole, 1986



Starting cattle on feed

- Most critical time period for cattle management
- Get cattle adjusted to the feedlot and new diets
  - **Adaptation of rumen microbes**
  - Behavior and environment
  - **Stress and health (sickness)**
- Done properly
  - Sets cattle up for success
- Done poorly
  - Lots of problems

Starting cattle on feed

- Goals:
  - **Get cattle to the bunk**
  - Get cattle on feed
  - Increase and then stabilize intakes
  - Identify cattle with health issues
  - Gain weight quickly and efficiently

Starting cattle on feed

- Problems:
  - **ALL** calves are stressed upon arrival
    - Level of stress or risk varies
  - **MOST** calves will have poor DMI
    - Low energy and nutrient intake
    - Length of time varies with risk/cattle type

Starting cattle on feed: Pen environment

- All feed comes from the bunk
- Pen space: 16.3 sq m (175 sq ft) per calf
  - Shade if needed: 1.9 sq m (20 sq ft) per calf
  - Bedding if needed
- Bunk space: 35 cm - 46 cm (14 - 18 in) per calf

Starting cattle on feed: Pen environment

- Water space: 5 - 8 cm (2 – 3 in) per calf
  - About 5% of cattle should be able to drink at once
  - Likely need more research
- Water equipment:
  - Open tanks
  - Be careful with heaters
  - Clean every day

Starting cattle on feed: Behavior

- Train cattle to settle and stop walking
- Train where the feed and water is
- Train to go in and out of the pen
- Cattle may need exercise

Starting cattle on feed: Day 1

- **REST!**
- Provide clean, fresh water
- Long stem grass hay (no alfalfa)
  - **ALL calves recognize forage**
- At least 1.0% of BW (free choice is OK)
  - In the bunk
- Add 0.5 - 0.9 kg (1 - 2 lbs) of a high CP supplement or 0.5% to 1.0% of BW of the starter/receiving ration on top of the hay
- **WATCH THE CATTLE**
  - Behavior, intakes, sickness, etc.

Backgrounding and receiving nutrition and management

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PART 3

Supplemental Readings

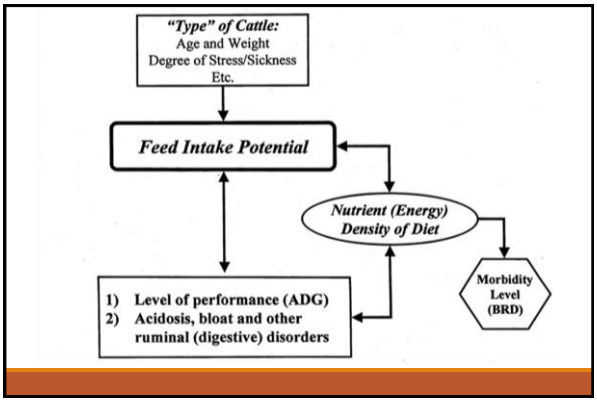
NASEM. 2016. National Academies of Sciences, Engineering, and Medicine (NASEM). Nutrient requirements of beef cattle. 8th rev. ed. Natl. Acad. Press, Washington, DC.

*Specifically review information in chapters 3, 6, 7, 8, 10, 12, and 15

Starting cattle on feed and backgrounding and receiving diets

Starting cattle on feed: Day 1

- A few options
  - Standard receiving starter diet
    - 30 to 50% roughage, 10 to 30% byproducts, 10 to 50% grain, 5% supplement
    - 14.5% CP (little or no NPN)
    - Avoid high levels of silage
  - Good quality grass hay with a high protein supplement
    - Prairie hay, Bermuda grass hay, etc.
    - 0.5 - 2.3 kg (1 to 5 lbs) of a 20 to 40% CP supplement
  - Byproduct based starter feed
    - RAMP, High WDGS, or WCGF with a little added roughage
  - Dry commodity based starter feed
    - Similar to the byproduct based starter feed with dry ingredients and hulls



Starting cattle on feed: Day 1

- A few options
  - Standard receiving starter diet
    - Increased performance (ADG, G:F, etc.)
    - Increased morbidity and mortality
    - More true with lower roughage, higher energy receiving diets
    - Also a concern with limit/program feeding low roughage, high energy diets
  - Good quality grass hay with a high protein supplement
    - Decreased performance (ADG, G:F, etc.)
    - Decreased morbidity and mortality
    - Low input, low risk, low reward

Starting cattle on feed: Day 1

- Combination
  - Started on 40 to 50% concentrate mixed ration
    - 14 to 15% CP
  - Long-stem native grass hay is provided
    - Free choice
    - Limited basis
    - 0.5 - 0.9 kg (1 to 2 lbs) /hd/d for up to 7 days and then withdrawn
  - Achieves much of the improvement in morbidity while permitting good performance during the receiving period

Starting cattle on feed: RAMP™

- Complete starter feed
  - Cargill® product
- Mostly Sweet Bran™
  - Wet corn gluten feed
- Some alfalfa hay and cottonseed hulls
- Supplement pack
- Green dye
- Logistical benefits to feedyards
  - Likely some improved performance in cattle

Classical data: Comparison of receiving rations

Data from Lofgreen, 1979			75 % concentrate diet
Item	Hay	Ration alone	Ration plus hay
Daily feed intake, kg (lb)			
Mixed ration	0.00 (0.00)	5.28 (11.64)	3.64 (8.03)
Hay	3.93 (8.67)	0.00 (0.00)	1.47 (3.25)
Total intake	3.93 (8.67)	5.28 (11.64)	5.12 (11.28)
Average daily gain, kg (lb)	0.48 (1.05)	1.28 (2.82)	1.15 (2.54)
Gain:Feed (Feed:Gain)	0.121 (8.26)	0.242 (4.13)	0.225 (4.44)
Cost per kg (lb) of gain	$1.04 ($0.47)	$0.73 ($0.33)	$0.71 ($0.32)

Classical data: Comparison of receiving rations

Data from Lofgreen, 1979			75 % concentrate diet
Item	Hay	Ration alone	Ration plus hay
Number of calves	131	66	196
Purchase weight, kg (lb)	165 (363)	162 (358)	163 (359)
Percent of calves treated	38	53	49
Percent of calves retreated	0.0	8.6	5.2

Effects of exercise and roughage source on the health and performance of receiving beef calves

Table 1. Composition of experimental diets[1]

Item	HY	HLS
Ingredient, % DM		
Dry-rolled corn	10.00	10.00
Wet corn gluten feed[2]	54.80	54.80
Dry supplement B-273[3]	5.20	5.20
Prairie hay	30.00	—
Cottonseed hulls	—	15.00
Soybean hulls	—	15.00
Analyzed nutrient composition (DM basis)[4]		
DM, % (as-fed basis)	71.99	70.79
NE_m, Mcal/kg	2.01	1.76
NE_g, Mcal/kg	1.34	1.15
TDN, %	82.10	74.30
CP, %	17.40	18.57
Crude fiber, %	16.57	18.23
NDF, %	42.87	46.33
ADF, %	18.40	25.17

The Professional Animal Scientist 34:183–191
https://doi.org/10.15232/pas.2017-01673

Table 2. Effects of roughage source[1] and exercise[2] on BW, ADG, DMI, and G:F

	HY		HLS			*P*-value	
Item	EX	NEX	EX	NEX	SEM	Roughage source	Exercise
BW,[3] kg							
d 0	251	249	249	249	12.1	0.74	0.74
d 14	275	270	273	274	10.9	0.91	0.63
d 28	302	298	300	303	11.0	0.61	0.97
d 42	330	326	324	330	10.9	0.78	0.86
d 56	357	354	356	357	11.4	0.81	0.68
ADG,[4] kg							
d 0 to 14	1.73	1.55	1.70	1.77	0.18	0.56	0.74
d 15 to 28	1.89	1.96	1.93	2.06	0.16	0.62	0.53
d 29 to 42	2.03	1.99	1.77	1.94	0.14	0.24	0.62
d 43 to 56	1.95	1.97	2.23	1.91	0.16	0.50	0.35
d 0 to 56	1.90	1.87	1.91	1.92	0.05	0.56	0.83
DMI,[5] kg							
d 0 to 14	6.38	6.39	6.42	6.37	0.17	0.92	0.90
d 15 to 28	8.55	9.03	8.44	8.64	0.40	0.32	0.19
d 29 to 42	9.87	10.10	8.27	9.37	0.52	0.04	0.22
d 43 to 56	11.27	11.58	8.76	10.28	0.58	<0.01	0.12
d 0 to 56	9.02	9.27	7.97	8.67	0.34	0.01	0.12
G:F[6]							
d 0 to 14	0.271	0.241	0.266	0.282	0.030	0.44	0.77
d 15 to 28	0.221	0.218	0.231	0.242	0.021	0.38	0.85
d 29 to 42	0.208	0.201	0.215	0.205	0.015	0.68	0.51
d 43 to 56	0.173[b]	0.169[b]	0.256[a]	0.186[b]	0.011	<0.001	<0.01
d 0 to 56	0.212	0.202	0.240	0.223	0.009	<0.001	0.02

Table 4. Effects of roughage source[1] and exercise[2] on clinical health variables

	HY		HLS			*P*-value		
Item	EX	NEX	EX	NEX	SEM	Roughage source	Exercise	Roughage source × Exercise
First antimicrobial treatment,[3] %	37.0	30.7	36.0	32.0	16.4	0.98	0.45	0.86
Second antimicrobial treatment,[4] %	8.00	0.00	20.0	8.00	5.66	0.08	0.08	0.71
Third antimicrobial treatment,[5] %	4.00	0.00	4.00	0.00	2.83	1.00	0.11	1.00
Total antimicrobials,[6] %	49.0	30.7	60.0	40.0	20.4	0.38	0.11	0.94
Rectal temperature,[7] °C	40.2	40.1	40.0	40.2	0.16	0.63	0.76	0.35
Severity score[8]	1.37[a]	1.86[ab]	1.99[b]	1.38[a]	0.32	0.75	0.76	0.02

Cottonseed hulls in combination with soybean hulls compared to hay

- Cottonseed hulls in combination with soybean hulls
  - Can be an effective roughage source for receiving calf diets
  - Calves fed a combination of CSH and SBH gained weight more efficiently
  - Negligible differences in receiving calf health due to roughage source

The effects of receiving diet roughage inclusion on performance, health, and serum metabolite characteristics of newly received beef calves

Translational Animal Science, 2023, 7, txad039
https://doi.org/10.1093/tas/txad039

Table 1. Ingredient and nutrient composition of experimental diets[1]

	Experimental dietary treatment[1]		
Ingredient, % of DM	R15	R30	R45
Rolled corn	32.50	25.00	17.50
Prairie hay	15.00	30.00	45.00
Sweet Bran[3]	46.50	39.00	31.50
Dry supplement[4]	6.00	6.00	6.00
Nutrient composition, DM basis			
Dry matter, %	71.59	73.02	74.23
Crude protein, %	16.94	15.96	14.98
Acid detergent fiber, %	18.10	22.60	28.93
peNDF[5], %	23.38	29.74	36.11
TDN[6], %	70.70	63.88	60.35
NE_m[7], Mcal/kg	1.47	1.26	1.15
NE_g[7], Mcal/kg	0.88	0.69	0.59
Ca, %	0.71	0.85	0.74
P, %	0.65	0.58	0.50
K, %	1.01	0.96	0.93
Mg, %	0.30	0.31	0.30

Table 2. Effect of roughage inclusion in receiving diets on growth performance, intake, feed efficiency in newly received high-risk heifers (experiment 1)

	Experimental dietary treatment[1]				Contrasts	
Item	R15	R30	R45	SEM[2]	Linear	Quadratic
BW[3], kg						
d 0	225	225	226	7.9	0.26	0.38
d 14	244	243	241	8.8	0.13	0.95
d 28	267	263	259	9.5	<0.01	0.89
d 42	288	280	272	8.3	<0.0001	0.99
d 56	309	301	291	9.8	<0.0001	0.69
ADG[4], kg						
d 0 to 14	1.38	1.28	1.11	0.134	0.04	0.73
d 14 to 28	1.59	1.45	1.29	0.114	0.05	0.94
d 28 to 42	1.50	1.17	0.89	0.160	<0.0001	0.84
d 42 to 56	1.56	1.54	1.40	0.140	0.18	0.51
d 0 to 56	1.51	1.36	1.17	0.058	<0.0001	0.53
DMI[5], kg						
d 0 to 14	4.94	4.77	5.02	0.212	0.54	0.08
d 14 to 28	7.60	7.65	7.82	0.348	0.24	0.70
d 28 to 42	8.54	8.81	9.15	0.455	0.04	0.89
d 42 to 56	8.82	9.45	10.36	0.477	<0.001	0.60
d 0 to 56	7.45	7.62	8.07	0.346	<0.01	0.41
G:F[6]						
d 0 to 14	0.279	0.275	0.223	0.0298	0.04	0.28
d 14 to 28	0.212	0.190	0.166	0.0144	0.03	0.96
d 28 to 42	0.176	0.134	0.099	0.0187	<0.0001	0.74
d 42 to 56	0.176	0.163	0.133	0.0118	<0.001	0.31
d 0 to 56	0.204	0.180	0.146	0.0075	<0.0001	0.24

Table 3. Effect of roughage inclusion in receiving diets on clinical health outcomes in newly received high-risk heifers (experiment 1)

	Experimental dietary treatment[1]				Contrasts[3]	
Variable	R15	R30	R45	SEM[2]	L	Q
Treated once for BRD[4], %	14.17	15.74	11.40	4.372	0.53	0.44
Treated twice for BRD[5], %	3.36	6.10	2.08	1.656	0.59	0.11
Treated thrice for BRD[6], %	0.95	2.96	0.00	0.969	0.38	0.02
Total antimicrobial treatments[7], %	18.07	24.40	13.00	6.245	0.44	0.13
Days to first BRD treatment	8.00	8.15	6.19	2.006	0.53	0.63
Rectal temperature[8], °C	40.32	40.12	40.24	0.211	0.74	0.38
Severity score[9]	1.28	1.57	1.24	0.167	0.86	0.11

Receiving diet roughage inclusion level (15, 30, or 45%)

- Historical research indicates that performance and efficiency increase as roughage decreases
- Improvements in performance come at the expense of slight increases in animal morbidity
- Classical research was conducted before the widespread use of fibrous byproducts

- Feeding a receiving diet containing 15% roughage and 0.88 Mcal NEg/kg
  - Provided superior performance without increasing the percentage of calves treated for BRD
  - BW, ADG, and G:F in the increased linearly while DMI decreased linearly with decreased roughage
  - Should be noted that overall morbidity did not exceed 16% for any experimental treatment
  - Morbidity results may differ when a greater percentage of calves become morbid
- Providing more energy dense receiving diets with lower levels of roughage may be a suitable alternative to traditional high roughage receiving diets when fibrous byproducts make up a large portion of the concentrate within the diet

Young Lightweight Calves: Under 159 kg (350 lbs)

- Nutrient requirements HIGH (on a concentration basis)
  - **Lower feed intakes**
- Calves don't have the capacity to consume large amounts of roughage
- Rations must be very **palatable**
- Because of lower feed intakes, calves are less prone to acidosis than yearling (older) cattle

Starting cattle on feed: Day 2 - ?

- Receiving ration is used in most cases
  - Main source of nutrients
- 1.5% of BW, work up to 2.5% of BW in even increments
  - Don't over feed
- Feed 2X per day
- Hay (in the bunk) only if needed to encourage consumption
  - Some may include hay at low levels for first 1 - 7 days
  - 0.5 - 0.9 kg (1 to 2 lbs) /hd/d

Starting cattle on feed

- We know that...
  - Newly received cattle may have low intakes
    - Worse if dealing with BRD
  - Low feed intake makes correction of deficiencies difficult
    - Further compromised immune function
    - Potential increase in susceptibility to infection
- Due to decreased intake...
  - Nutrient amounts should be increased for the first 2 weeks after arrival
  - Until the cattle are consuming at least 2% of BW or more feed on DM basis

Starting cattle on feed

- Diets for starting calves feed should...
  - Be formulated to maximize/stimulate intake
  - Provide greater concentrations of required nutrients
    - Provide acceptable levels of critical nutrients
  - Be highly palatable
  - Minimize the potential for nutritional disorders
    - Limit receiving diets to less than 55% concentrate

Starting cattle on feed

- Diets for starting calves feed should...
  - Be formulated based on age and size of the calves
  - Calves should receive at least maintenance requirements for energy, protein, vitamins, and minerals when intake is only 1.0 to 1.5% of BW
  - Lighter BW 159 kg (350 lbs) or less and early-weaned (at or before 4 months of age) calves need more nutrient dense diets than larger, normal-weaned calves

Starting cattle on feed

Table 3. Needs of a 400-lb calf at different rates of gain[a]

Gain, lb/d	Protein, %	NE_m, Mcal/100 lb DM	NE_g, Mcal/100 lb DM	Calcium, %	Phosphorus, %
Calf consumes 1% BW (4 lb) 1.8 kg		(Ne_m, Mcal/45.4 kg DM)	(Ne_g, Mcal/45.4 kg DM)		
0	15.0	95	0	.30	.30
0.5 (0.22 kg)	21.2	128	61	.55	.50
Calf consumes 2% BW (8 lb) 3.6 kg					
0	7.0	48	0	.16	.16
1 (0.45 kg)	13.0	76	46	.31	.29
2 (0.91 kg)	15.2	105	70	.59	.46
Calf consumes 3% BW (12 lb) 5.4 kg					
1 (0.45 kg)	9.2	32	0	.11	.11
2 (0.91 kg)	10.5	65	20	.31	.28
2.5 (1.13 kg)	11.1	80	49	.48	.35

[a] Adapted from Hutcheson (1993).

Suggested dietary concentrations for stressed, newly received calves (NASEM, 2016)

Nutrient	Unit	Suggested Range
Dry matter	%	80.0 - 85.0
Crude protein	%	12.5 - 14.5
NEm	Mcal/kg	1.3 - 1.6
NEg	Mcal/kg	0.8 - 0.9
Calcium	%	0.6 - 0.8
Phosphorus	%	0.4 - 0.5
Potassium	%	1.2 - 1.4
Magnesium	%	0.2 - 0.3
Sodium	%	0.2 - 0.3
Copper	mg/kg	10.0 – 15.0
Iron	mg/kg	100.0 – 200.0
Manganese	mg/kg	40.0 – 70.0
Zinc	mg/kg	75.0 – 100.0
Cobalt	mg/kg	0.1 - 0.2
Selenium	mg/kg	0.1 - 0.2
Iodine	mg/kg	0.3 - 0.6
Vitamin E	IU/d	400.0 – 500.0

Typical Starter Ration

Ingredient	%
Steam-flaked or Dry-rolled Corn	30-40
Average Alfalfa Hay and Corn Silage	30-50
Byproduct (WCGF and WDGS)	20-40
Molasses or Solubles	5
Protein and/or Vitamin and Mineral Supplement	6-10

Table 5. Examples of starter diets for newly received calves[a]

	50% concentrate					60% concentrate					70% concentrate				
Ingredient	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	% as-fed														
Oats					21.9										
Barley				22.1					26.7					31.2	
Corn	43.2	15.4		22.9	22.7	51.9	25.7		27.4	27.3	60.7	37.5		32.3	32.0
Ear corn			50.5					61.6					72.0		
Grass hay[b]	24.6	11.0	19.8	24.8	24.8	19.7	9.4	13.4	19.8	19.8	14.8	7.6	7.4	14.9	14.9
Alfalfa hay[c]	25.4	11.4	20.5	25.6	25.6	20.4	9.8	13.8	20.5	20.5	15.2	7.9	7.7	15.4	15.4
Corn silage[d]		55.4					47.4					38.2			
Supplement[e]	6.8	6.8	9.2	4.6	5.0	8.0	7.7	11.2	5.4	5.9	9.3	8.8	12.9	6.2	6.8

[a] Adapted from Wagner et al., 1993.
[b] 88% DM, 11% CP.
[c] 85% DM, 17% CP.
[d] 35% DM, 8% CP, 50% concentrate.
[e] Supplements for oats and barley diets contain about 32% CP, 5.0% calcium, 2.5% phosphorus, 1.5% potassium, 1.2% magnesium, 9.0% salt and 48,000 IU/lb vitamin A. Supplements for the other diets contain 36% CP, 3.6% calcium, 2.0% phosphorus, 1.7% potassium, 0.8% magnesium, 6.3% salt and 32,000 IU/lb vitamin A.

Starting cattle on feed: Bunk management

- Keep the cattle a little hungry
- Let them slick the bunk between feedings
- Keep fresh feed in the bunk
- Clean bunks often if needed

Starting cattle on feed: Ration additives

- Ionophores – Coccidiosis and feed efficiency
  - Bovatec
  - Rumensin
    - Consider intake effects
- In feed antibiotics
  - OTC or CTC - Tetracyclines
  - Pulmotil® - Tilmicosin
- Trace mineral and vitamin fortification
- Probiotics

Starting cattle on feed: Ration additives

- Minerals
  - Requirements are essentially the same for stressed/high-risk calves
  - Pay attention to micro/trace minerals involved in immune function
    - Cu, Se, Zn, etc.
  - Pay attention to K as well
  - Need to increase concentrations
    - Compensate for decreased intakes
  - Consider using more bioavailable sources of micro/trace minerals
    - Organics vs. inorganics

Suggested dietary concentrations for stressed, newly received calves (NASEM, 2016)

Nutrient	Unit	Suggested Range
Calcium	%	0.6 - 0.8
Phosphorus	%	0.4 - 0.5
Potassium	%	1.2 - 1.4
Magnesium	%	0.2 - 0.3
Sodium	%	0.2 - 0.3
Copper	mg/kg	10.0 – 15.0
Iron	mg/kg	100.0 – 200.0
Manganese	mg/kg	40.0 – 70.0
Zinc	mg/kg	75.0 – 100.0
Cobalt	mg/kg	0.1 - 0.2
Selenium	mg/kg	0.1 - 0.2
Iodine	mg/kg	0.3 - 0.6

Starting cattle on feed: Ration additives

- Vitamins
  - Requirements are essentially the same for stressed/high-risk calves
  - Pay attention to vitamin E
    - Antioxidant
    - 400 - 500 IU /hd/d for stressed/high-risk calves

Transitioning cattle to finishing diets

- Goals of transitioning or adapting cattle to finishing diets
  - Increase the concentrate level (energy density) of the diet gradually
  - Avoid acidosis and other digestive issues
  - Keep cattle on feed and stabilize intakes
- Gradually shift the ruminal microbial population
  - Predominantly cellulose digesting microorganisms that thrive at ruminal pH ≥ 6
  - Predominantly starch digesting microorganisms that thrive at pH ≤ 6
  - Without causing acidosis
- Utilize a series of "step-up" rations or two-ration blending
- "Starter/Receiving Ration"
  - Approximately 30% to 50% roughage and 50% to 70% concentrate
- "Finisher/Finishing Ration"
  - Approximately 6% to 10% roughage and 90% to 94% concentrate

Options for transitioning cattle to finishing diets

- Utilize a series of "step-up" diets
  - Starter/Receiving diet
  - Typically 2 or 3 step-up diets
  - Finisher diet
- Utilize "two ration blending" approach
  - Starter diet and finisher diet only
  - Changing proportions of the two diets over time

Example step-up program

	Starter (1)	2	3	Finisher (4)
% Roughage	45	33	20	10
% Concentrate	55	67	80	90
% CP	14	13.5	13.5	13
NE_m	75	82	89	95
NE_g	47	52	57	62
Days	7	7	7	Finish

Example two ration blending program

Day	Starter %	Finisher %
1	95.45	4.55
2	90.91	9.09
3	86.36	13.64
4	81.82	18.18
5	77.27	22.73
6	72.73	27.27
7	68.18	31.82
8	63.64	36.36
9	59.09	40.91
10	54.55	45.45
11	50.00	50.00
12	45.46	54.54
13	40.91	59.09
14	36.37	63.63
15	31.82	68.18
16	27.28	72.72
17	22.73	77.27
18	18.19	81.81
19	13.64	86.36
20	9.10	90.90
21	4.55	95.45
22	0.00	100.00