
Euroopa Maaelu Arengu Põllumajandusfond: Euroopa investeeringud maapiirkondadesse

# Cold stress prevention
# Winter calf reality

31 March 2021
Biomin TSM Ruminant
Zanetta Chodorowska

# Cold stress and health

Why should be concerned with cold stress?

- Reduces immune resistance
- Reduced phsyiological development
- Reduced daily gains
- Economic impact on breeding goals

Increased risk of culling after first lactation

- ~500 kg less milk with Ab treatment (Soberon et al. 2012)
- Eubiosis important for health and performance

Winter calving:
↑ 4x mortality
↑ 7x morbidity

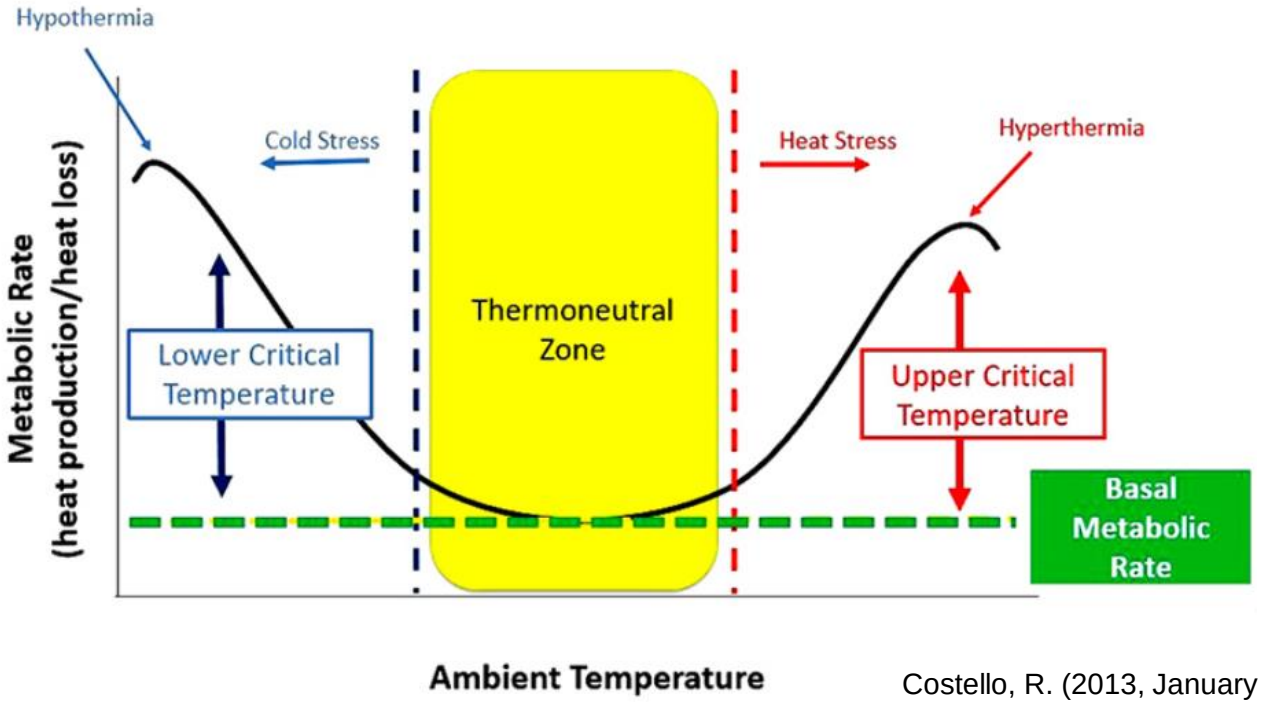
Godden et al. 2005

# The weather has impact on animals performance

The temperature calves feels is a combination: Temperature, Airspeed, Humidity.

,,Calves that have undergone cold stress are more likely to have problems with scours, pneumonia ” vet. Russ Daly US

TNZ +10---------- +20C




Costello, R. (2013, January 15) Calf Feeding: Environmental Temperature & Energy Intake

# Cold stressed calves

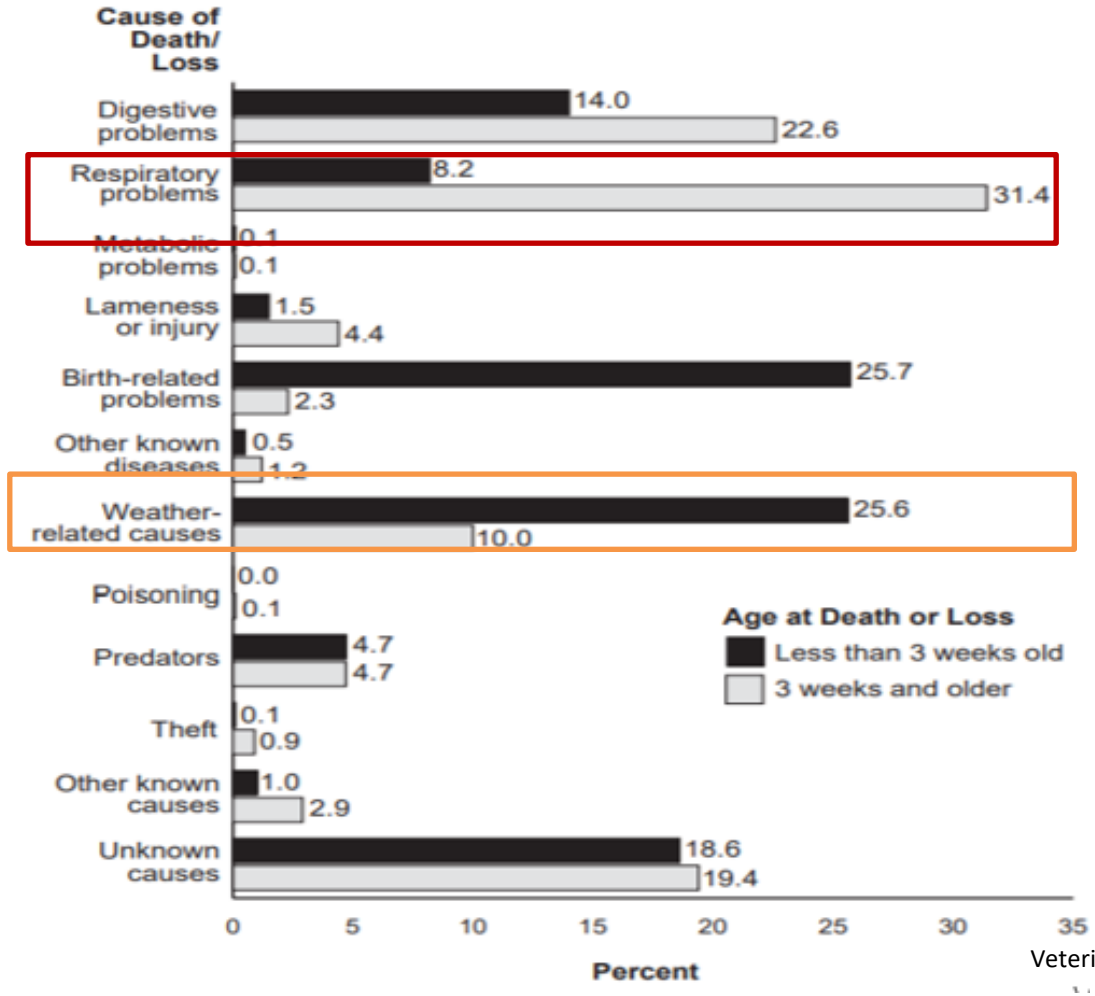
Temp. below 10 C < 4 weeks old calves

Temp. below 0 C > 4 weeks old calves

- Calves are born with 2-4% of BW as fat.
- Below TNZ starts burning body fat for heat,
- Reduced growth rates, compromised immune status, and even death.
- The critical temperature increases (+15C) for calves kept in draft, on wet bedding, ammonia, humidity exceeding 20% or if immune system is challenge.
- The more energy a calf loses, to stay warm, the more calories needs to consume.

Michigan State University Extension

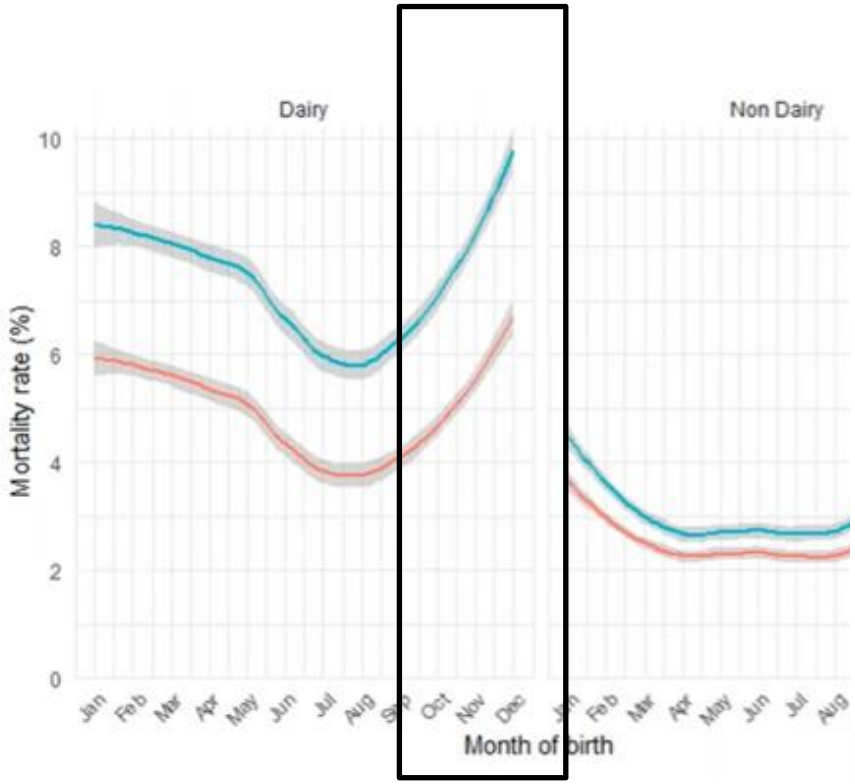
# Calf mortality _ 25% of calves below 3 weeks of age die, due to weather related causes

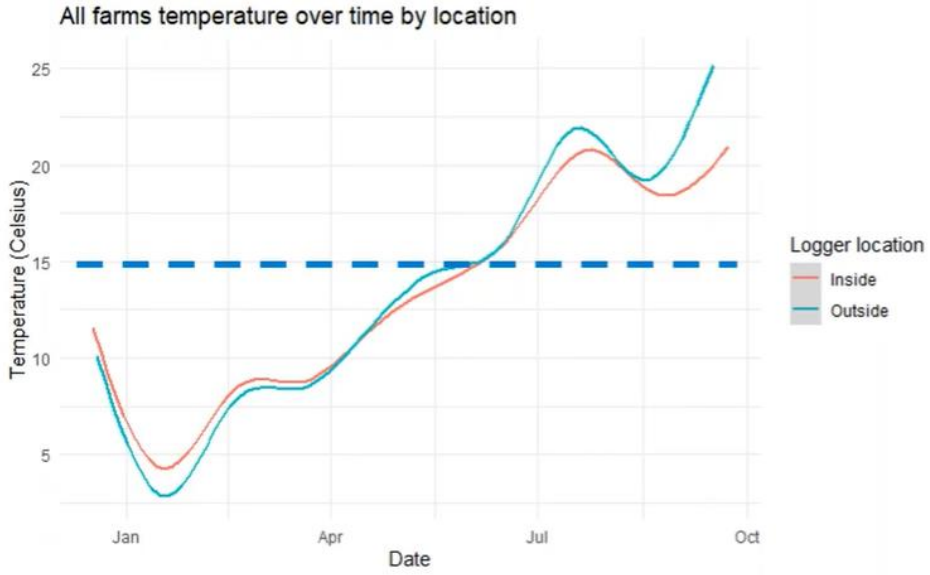



Veterinary Services Centers for Epidemiology and Animal Health 2007

# Research from UK 2011 -2018 calves mortality rises in Oct-Nov-Dec


0-3 month % of mortality , Impact factors

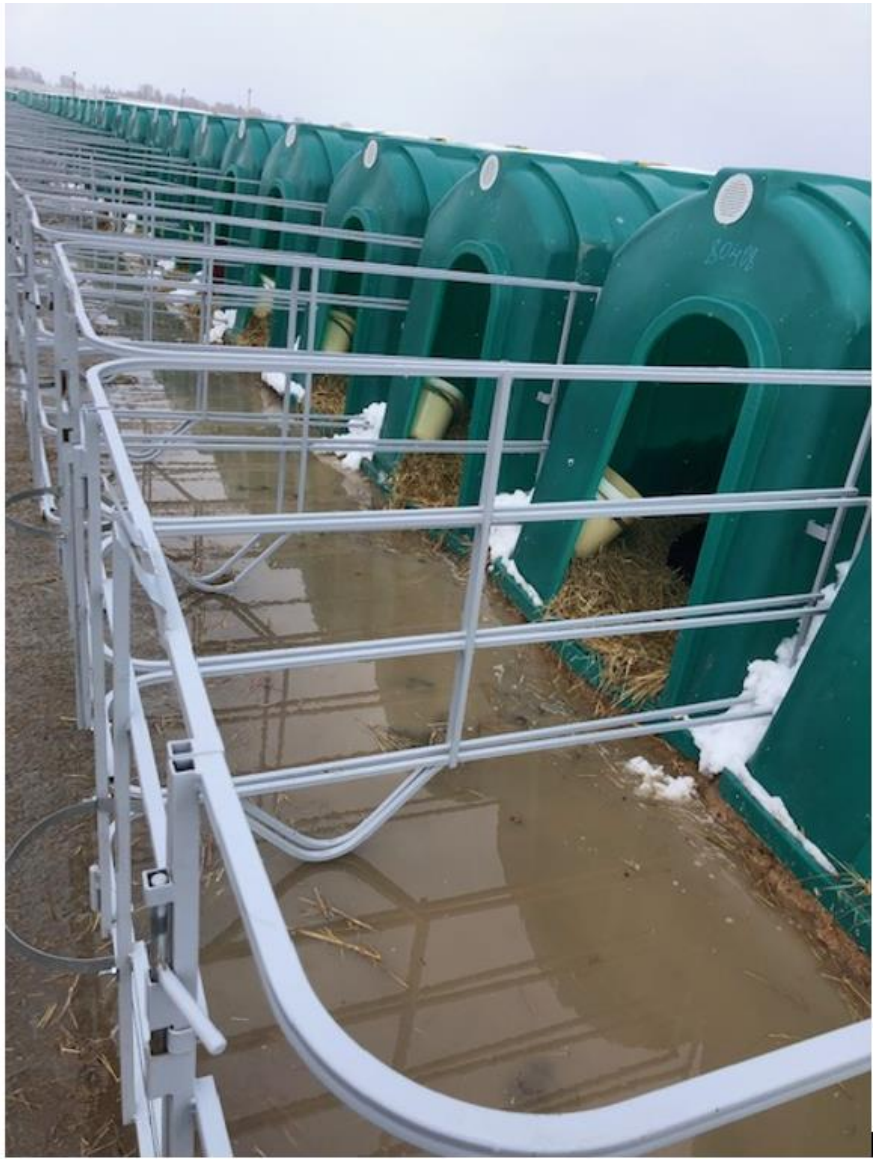


# Where the problem starts

## 1. Housing and management,
## dry bedding, good ventilation & good feeding

Housing inside vs. outside

# Where the problem starts?

## 2. Standard feeding pattern (summer- winter )

Calves fed at/ or below maintenance for 2 wks in periods of cold stress:

- Body fat depots are depleted,
- Immune challenge - fever response – increased maintenance energy output (~ 0.4 Mcals ME/d).
- Calf goes off feed (cytokine/leptin response).
- Energy supply reduced to “labile” protein - acute phase protein production limited.
- System is compromised – calf is slow to recover.


Dr Robert Corbett

# Where the problem starts _Jersey suffer more

### 3. Larger heat escaping surface area to Body Weight

Initial body fat is quickly expended by the calf to generate body heat.

Surface Area to Body Weight Relationship.

Body heat dissipates more quickly.

More prone to chilling and also dehydration.

Have a higher maintenance energy requirement (NRC2001)

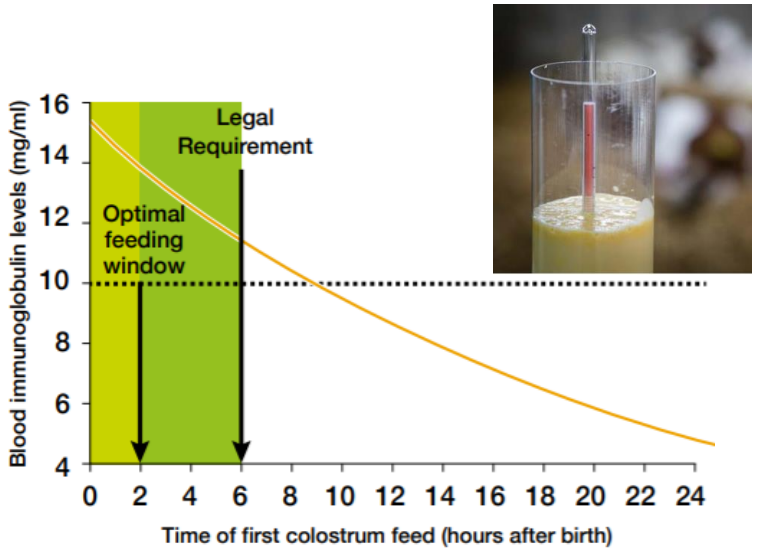
**Calves do not have compensatory gain mechanisms**.
If early growth is interrupted, health and future production will be impaired.
"Calves will never grow to their full potential," Mike Van Amburgh 2008

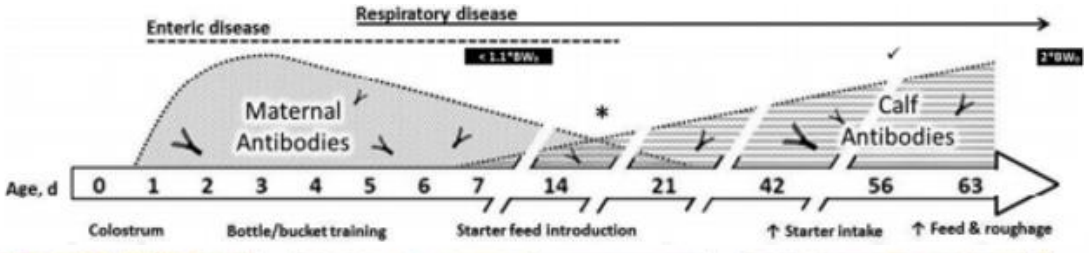
# Where the problem starts?

## 4. Failure of passive immune transfer > 36%

Feeding Dairy Calves for Performance Jon D. Robison

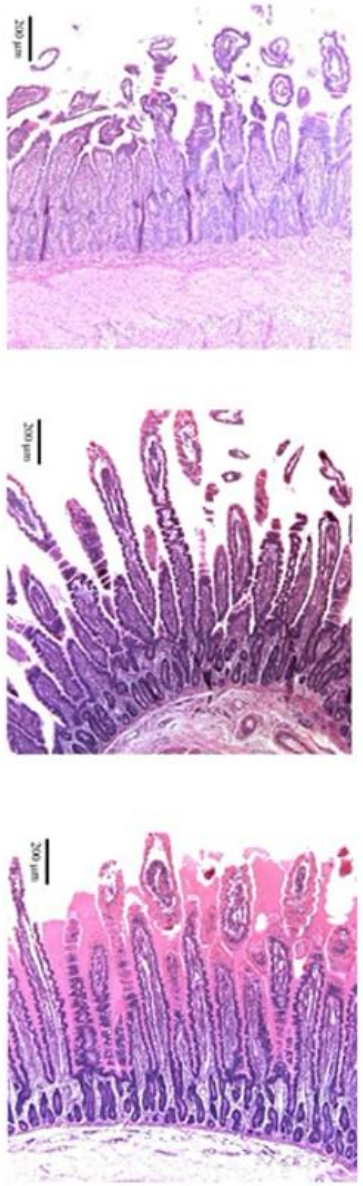
Total costs per calf with FPT were est. to be €60 (€10–109) and €80 (€20–139) for dairy and beef, respectively.




Source: Radoisson et all, Failure of passive immune transfer in calves

# Where the problem starts?




Pyo et al, 2020

## 5. Gut closure, takes usually up to 3 weeks

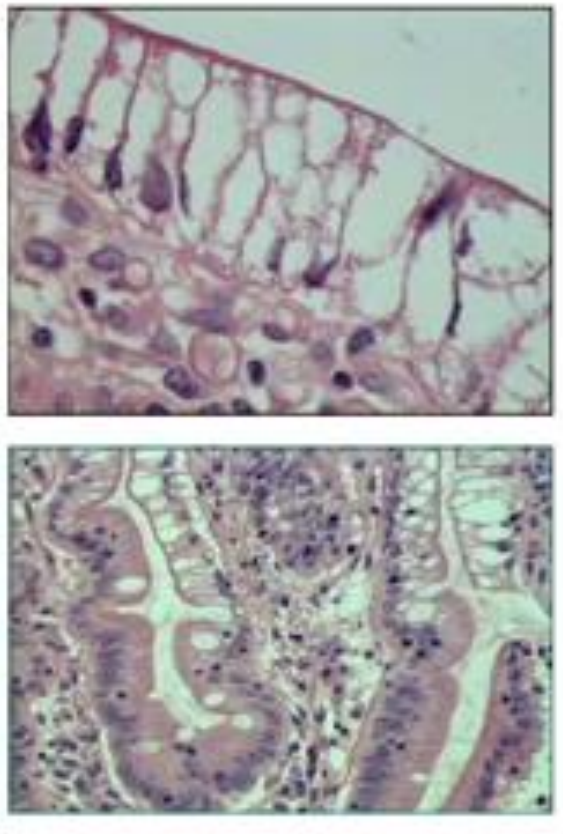
Process of intestinal maturation —gut closureⅡ, increases the risk for enteric disease.

Physical Barrier

Many holes in GI immune system in the first few weeks of life

Reduced tight junctions

The gut maturation process occurs from the crypt to the villus tip; —gut closureⅡ likely persist for a longer period of time .



Michael A. Ballou, Ph.D. Associate Dean for Research & Associate Professor
Department of Animal and Food Sciences Texas Tech University, Lubbock, TX, US

# Where the problem starts?

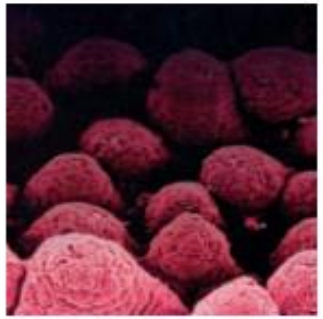
## 6. Scours and/or respiratory infections

Calves that have undergone cold stress are more likely to have problems with scours, pneumonia and other infections

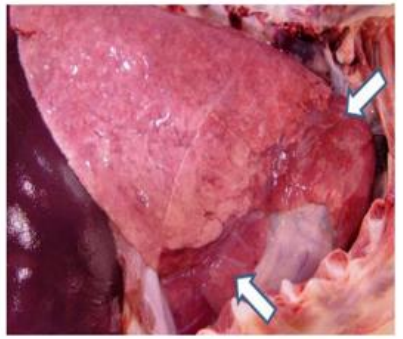
Birth to 1 month
**Scours** > Respiratory > Systemic Infections…
1 to 5 months
Respiratory > **Scours** > Systemic infections…
6 to 12 months
Respiratory > Clostridia disease …

Calves treated for pneumonia 2.5 X more likely to die
Calves treated for diarrhea 2.5X more likely to be sold
Heifers treated for diarrhea 2.9X more likely to calve >30 mos.

*Normal healthy gut lining.*



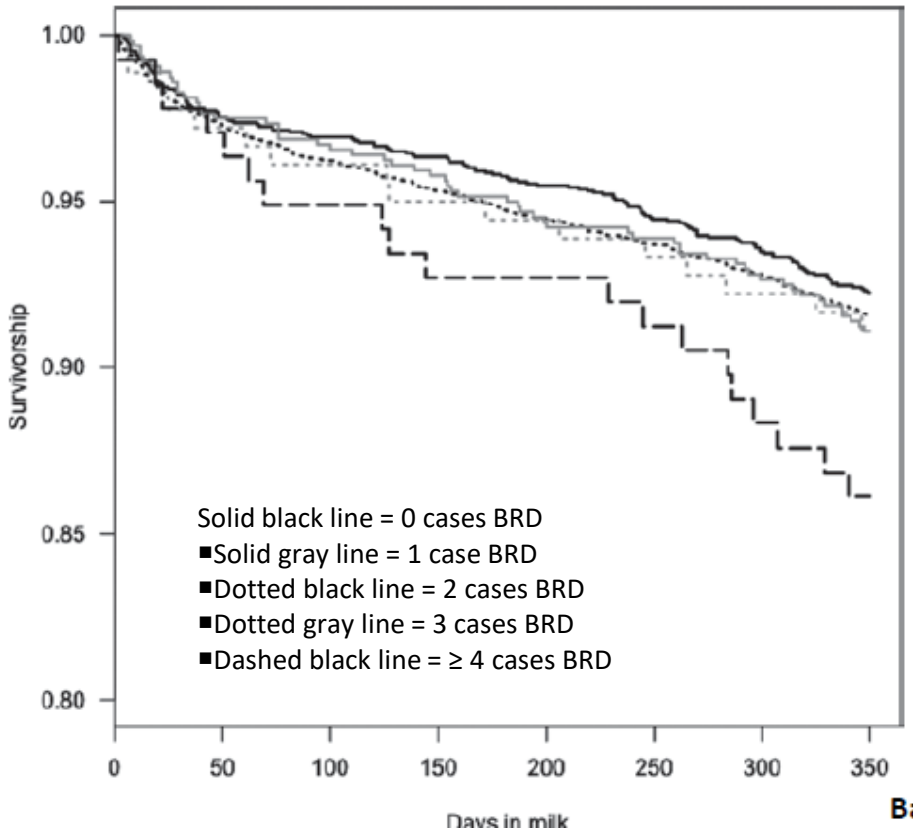
*Diseased gut lining.*



Walter-Towes et al., 1986

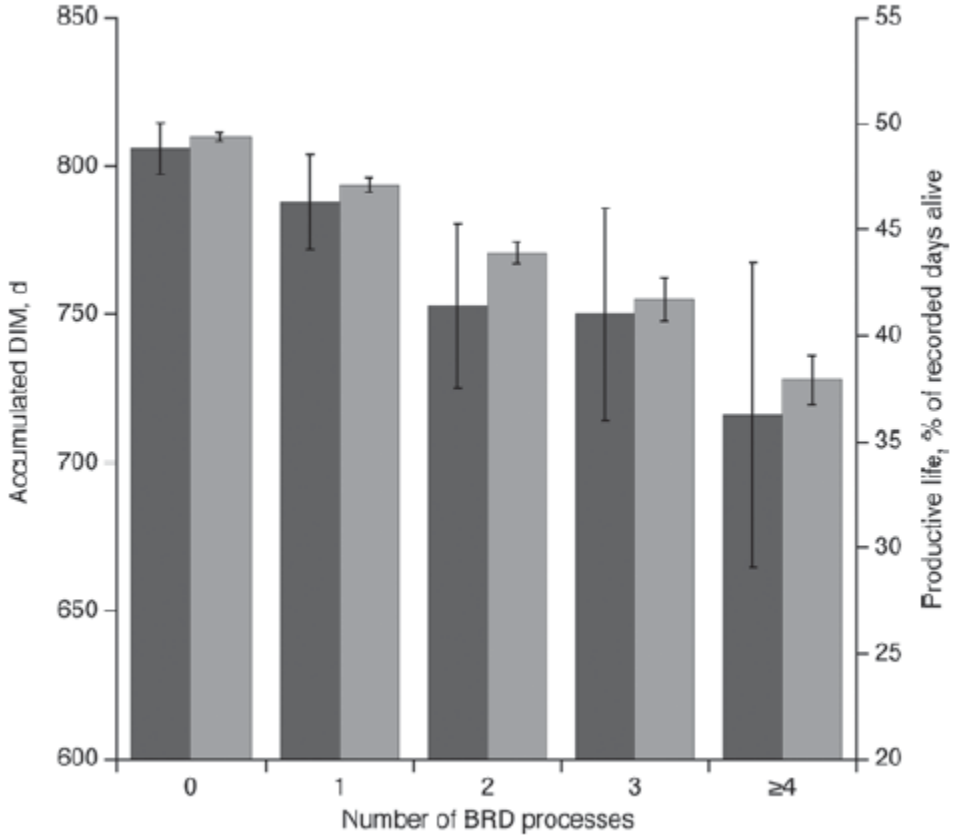
# Effects of bovine respiratory disease (BRD) experienced before first calving

## Survivorship throughout first lactation as influenced by the number of bovine respiratory (BRD) episodes experienced before first calving




Bach, 2011

Dark bars = accumulated DIM
Light bars = productive life




Bach, 2011

# Where the problem starts?

## 7. Antibiotic Treatment

More than 25% of the pre-weaned calves is treated with antibiotics

Calves that went thru antibiotic therapy before weaning produce 492 kg milk less in 1st lactation

(Mike Van Amburgh Cornell University ;Soberon 2012)

Calves receiving antibiotics prior to 4 months of age tended to have increased age at first calving up to 6 months

(Heinrichs et al., 2005)

# Winter feeding strategy for cold stress prevention

## Which will you go for ?

< 4 weeks calves


**Different ways to meet nutrient demand**

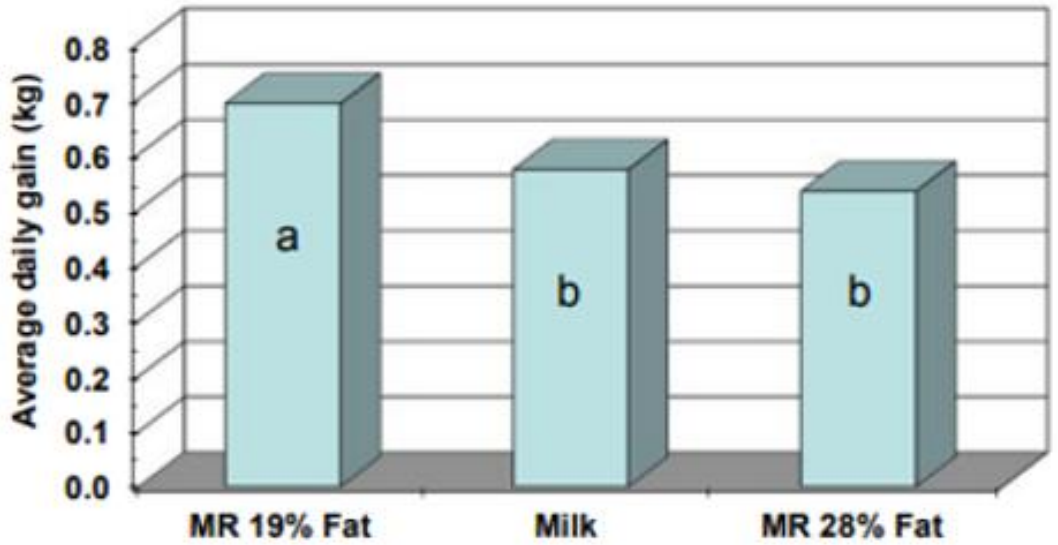
1. Increase powder concentration in CMR
2. Increase fat content of CMR
3. Increase sugar content of CMR
4. Increase liters per feeding
5. Increase number of feeding daily
6. Feed  more starter
7. Offer more water
8. Include additives
9. All of the above ..

# Feeding strategy for cold stress prevention

## 1. Increase fat intake CMR as exchanging for Lactose

Compared with whole milk, conventional CMR provide high levels of lactose (42–50% vs. 33–38% of DM) and low levels of fat (16–22% vs. 30–40% of DM).

| L46/F20/CP 23 | vs. | L34/F31 /CP23 |
|---|---|---|




Bartlett et al., 2001

Excess fat deposited in liver
Decreases metabolic funtion

Calves are completely dependent on glucose absorbed from intestine. Not much glucose is synthesized in the liver.

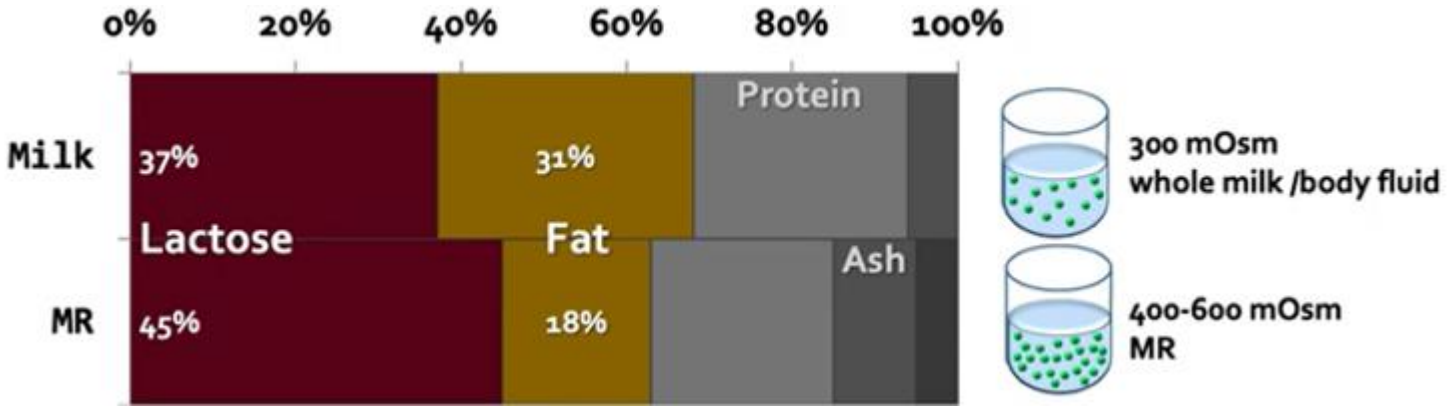
Journal of Dairy Science Volume 103, Issue 5, May 2020,

# Feeding strategy for cold stress prevention

## 2. Increase sugar's intake

**Carbohydrates in CMR _( hypertonic)_** reduce glucose tolerance

Most of the CMR are high in lactose and osmolarity,
low in fat compared with whole milk




Hypertonic CMR increase gut permeability Wilms et al.,20019

Higher lactose results in increased gastric emptying and lower glucose tolerance in the first weeks of life .
Welborenet al., in review

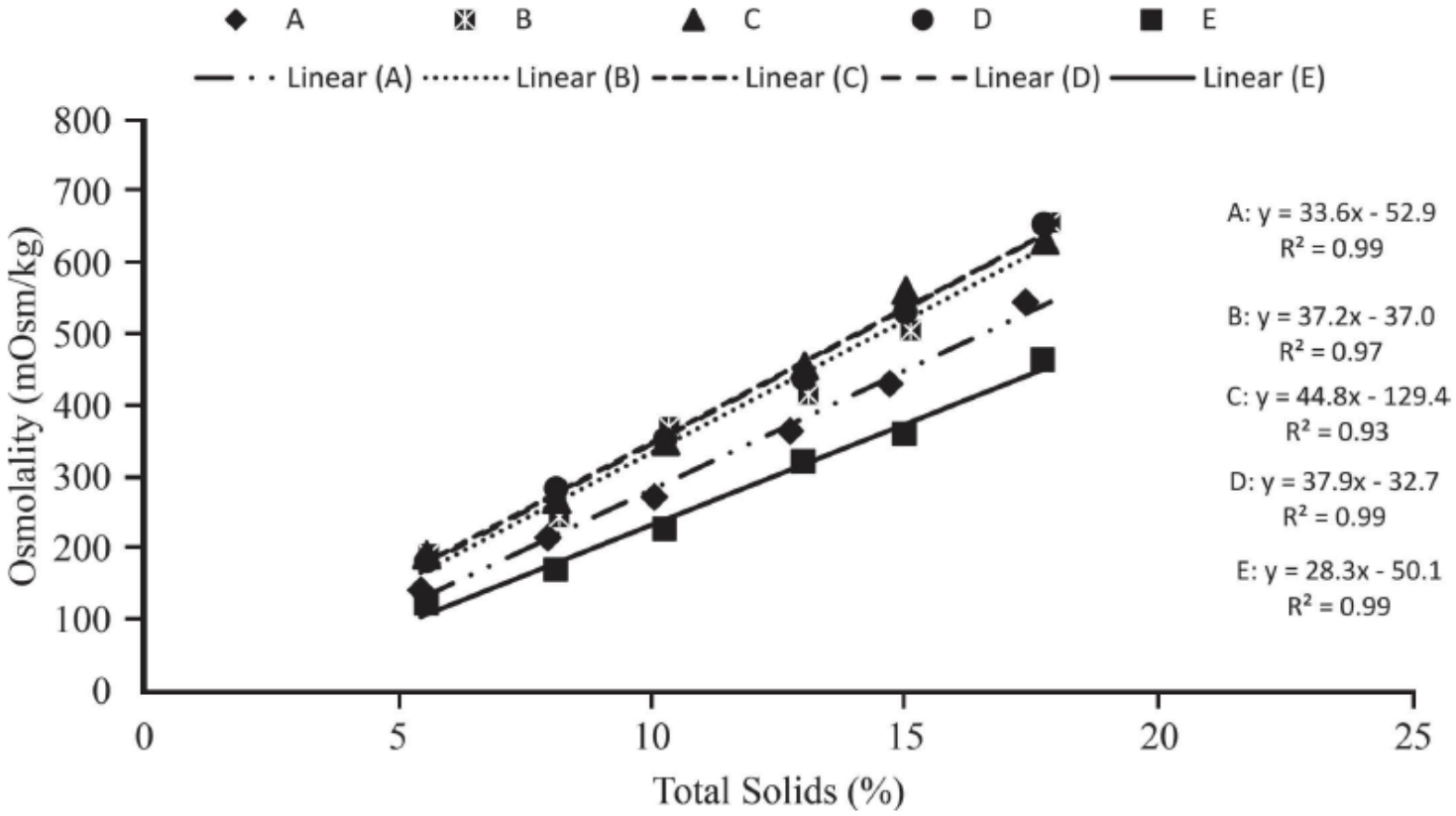
Hypertonic milk replacers increase gastrointestinal permeability in healthy dairy calves
November 2018 Journal of Dairy Science 102(2)

# Concentration affects osmolarity

Intestine osmolarity 600 mOs

High CMR concentration risks slow empty

- Abomasal bloat
- High pH
- Osmotic diarrhea




Slope depends on composition

Floren et al. 2016 J. Dairy Sci.

# Feeding strategy for cold stress prevention

## 3. Increase powder intake in CMR

NRC Recommendation :Keep the solids level 13,8%

National Research Council. 2001. Nutrient Requirements of Dairy Cattle*:*

Feeding higher solids, in the CMR increases the total solids fed and may subject baby calves to a higher risk of bloat.

| Predicted Gains (milk only)--Varied Nutrition, Ambient Temperature and Body Weight | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Protein (dry matter) | Fat (dry matter) | Feeding rate (lbs. dry matter) | % solids | Energy Allowable Gain lbs./d | ADP Allowable Gain lb./d | **Actual predicted gain lbs./day** | Quarts water |
| Feeding Plan 1 | 22.0% | 20.0% | 1.50 | 13.8% | 0.00 | 1.03 | **0.00** | 4.5 |
| Feeding Plan 2 | 22.0% | 22.0% | 1.50 | 13.8% | 0.00 | 1.03 | **0.00** | 4.5 |
| Feeding Plan 3 | 22.0% | 20.0% | 1.67 | 13.8% | 0.17 | 1.18 | **0.17** | 5 |
| Feeding Plan 4 | 22.0% | 20.0% | 2.00 | 13.8% | 0.72 | 1.46 | **0.72** | 6 |

(Ambient Temperature 0° F., Body Weight 100 lbs., Ash 9%)

The chart using the National Research Council (NRC) calf model equations comparing different feeding rates of milk – one with fat added and two with increased volume – clearly shows that a little extra volume goes a long way in meeting the energy needs of a young calf.

# Feeding strategy for cold stress prevention

## 4. Incerase DM Intake of CMR to meet Maintenance req. kg/d

Increase DMI kg/d from CMR or WM _ Reduce starter intake

| BW kg | Temperature, °C | | | | | | |
|---|---|---|---|---|---|---|---|
| | 20 | 10 | 0 | -10 | -15 | -20 | -30 |
| 27 | 0.27 | 0.36 | 0.41 | 0.45 | 0.5 | 0.54 | 0.64 |
| 36 | 0.36 | 0.41 | 0.5 | 0.59 | 0.64 | 0.68 | 0.77 |
| 45 | 0.45 | 0.5 | 0.59 | 0.73 | 0.77 | 0.82 | 0.91 |
| 55 | 0.5 | 0.59 | 0.68 | 0.77 | 0.86 | 0.91 | 1.05 |

Milk Replacer/Milk Dry Matter Required (kg/d)

# Feeding strategy for cold stress prevention

## 5. Increase starter intake _ Starter drives rumen development

Early starter feeding in calves decreased the expression of tight junctions in the gut (Malmuthuge et al., 2013)

# Biomin solution _Management & Nutrition

## Early Sick Calves Identification & PFA in CMR & CS Prevention - Protocol – People

Managment : Clean, dry, draft free, sized, good,ventilated pans, temperature 15C,

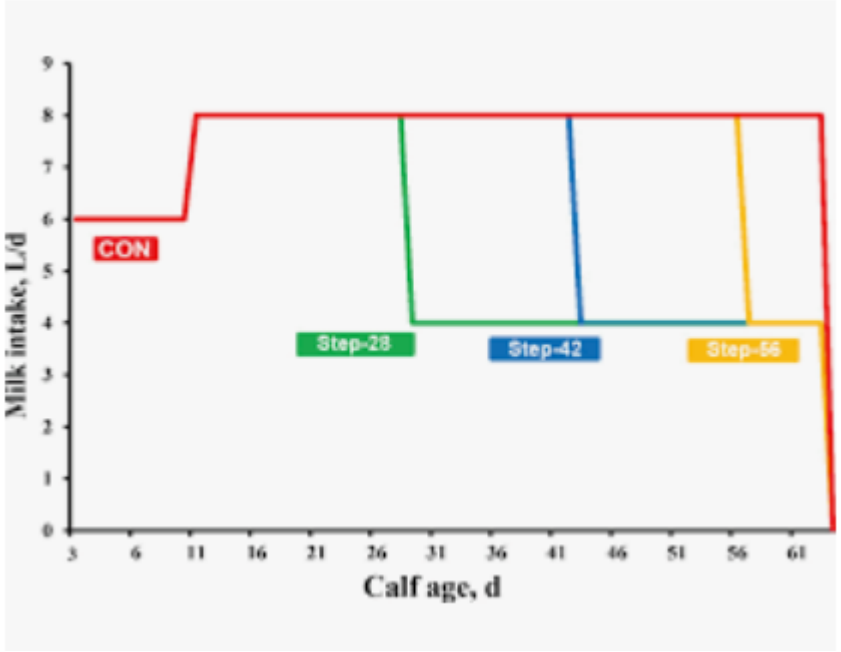
**Proper Dry cows feeding _ PFA and management**

Colostrum 4 + 2 L than transition milk

**Increase intake _ High feed acceptance CMR & CS _ PFA**

Feed more milk or CMR 6-8 l in 2 weeks, correct volume and concentration 12,5-15%

Feeding additional CMR or milk to achieve av. grow rate target of 0,75kg/day _Follow NRC 2001 recommendation



# Cold stress

## NRC 2001 Recomendation

**Effect of cold stress on** predicted calf growth using the 2001 Dairy NRC calf model (National Research Council, 2001).

The energy content of most milk replacers is similar; therefore the energy allowable gains predicted are transferable

Mike Van Amburgh

| **50kg calf BW** | **Temperature , degrees C** | | | | |
|---|---|---|---|---|---|
| | 20C | 10C | 0C | -5C | -10C |
| CMR kg DMI | **Predicted Growth Rate , kg/d** | | | | |
| 0.5 | 0.2 | 0 | < 0 | < 0 | < 0 |
| 0.56 | 0.4 | 0.23 | 0 | < 0 | <0 |
| 0.68 | 0.6 | 0.42 | 0.25 | 0 | < 0 |
| 0.80 | 0.75 | 0.6 | 0.44 | 0.25 | < 1 |
| 0.9 | 0.9 | 0.75 | 0.6 | 0.43 | 0.3 |
| | Temperature, degrees C | | | | |
| 60 kg calf BW | 20 | 10 | 0 | -5 | -10 |
| CMR kg DMI | Predicted growth rate , kg/d | | | | |
| 0.5 | 0.08 | < 0 | < 0 | < 0 | < 0 |
| 0.56 | 0.26 | 0.08 | 0 | < 0 | < 0 |
| 0.68 | 0.45 | 0.28 | 0.08 | < 0 | < 0 |
| 0.80 | 0.6 | 0.47 | 0.28 | 0 | 0 |
| 0.9 | 0.75 | 0.6 | 0.47 | 0.26 | 0.08 |

# Adjusting maintenance for cold stress

| Temp. °C | Increase ME, MJ/d | Calf ME req., MJ/d | | % increase ME req. |
|---|---|---|---|---|
| 20 | 0 | 7,3 | | 0 |
| 15 | 0,98 | 8,2 | | 13 |
| 10 | 1,95 | 9,2 | EU weather | 27 |
| 5 | 2,93 | 10,2 | | 40 |
| 0 | 3,90 | 11,2 | | 54 |
| -5 | 4,88 | 12,2 | | 67 |
| -10 | 5,85 | 13,1 | | 81 |
| -15 | 6,83 | 14,1 | | 94 |
| -20 | 7,80 | 15,1 | | 108 |
| -25 | 8,78 | 16,0 | | 121 |
| -30 | 9,75 | 17,0 | | 134 |

* Calf < 3 week, LCT 20°C, >3 week, LCT 10 ° C

NRC 2001

# Dry cow feeding and management
# Colostrum and transition milk feeding

Colostrum and Transition milk,

Prebiotics MOS , FOS, Yeast fractions , EO

Digestarom®

## Colostrum

Bioactive compounds from colostrum and transition milk, such as hormones or oligosaccharides, stimulate development of the GIT. (Fischer A.J., Malmuthuge N., Guan L.L.)

Hormones, cytokines and nonspecific antimicrobial factors. Trypsin inhibitor, in concentrations nearly 100 times greater than in milk, serves to protect Ig and other proteins from proteolytic degradation in the intestine of the neonatal calf. (Amelia DR. Woolums from the University of Georgia)

## Prebiotics for CS

Levabon® Rumen E

Used by bacteria in the lower intestines to improve their growth.

The common, commercially-available prebiotics available are the fructooligosaccharides (FOS),Yeast fraction, Yeast extracts , mannanoligosaccharides (MOS), lactulose, and inulin.

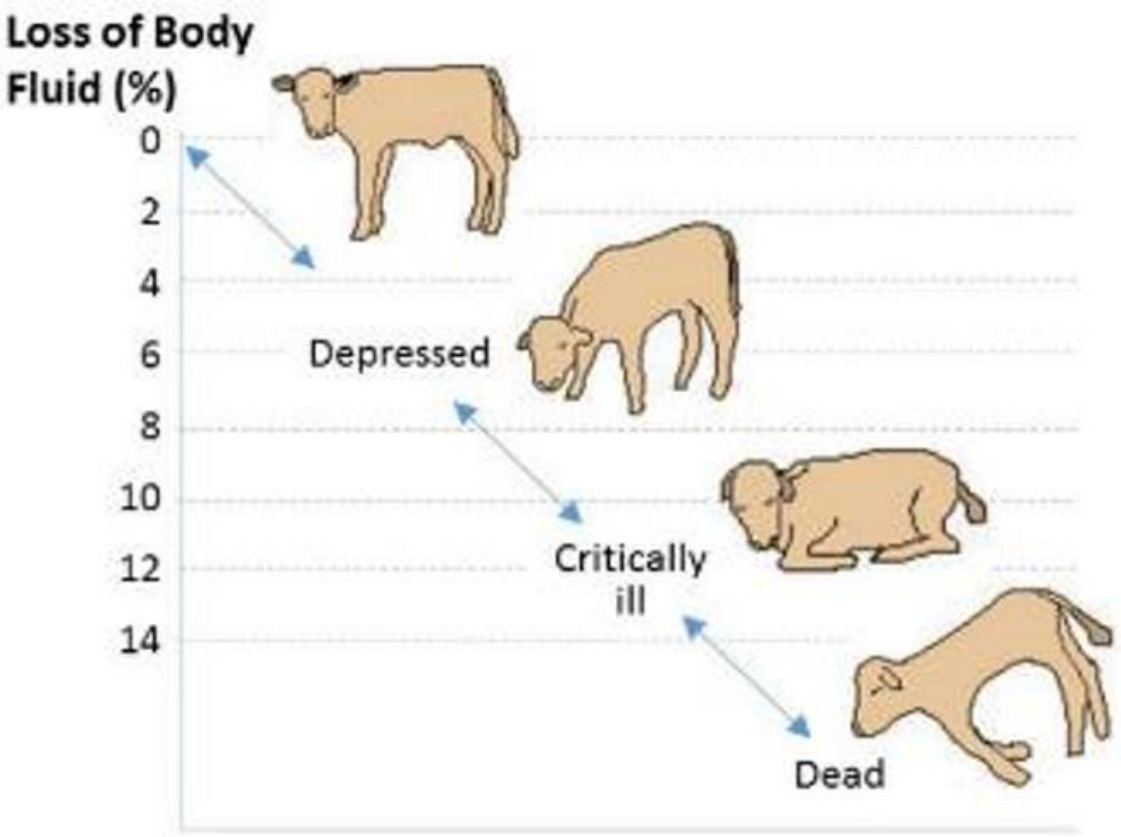
Michael A. Ballou, Ph.D. Professor of Nutritional Immunology Texas Tech University

## Essential Oils for CMR & CS

can help optimize digestibility and nutrient absorption; supports palatability which assists with milk replacer and starter intake. LAND O LAKES

# Dehydration main killer

- Electrolyt helps restore osmotic balance
- Avoid mixing with CMR, too salty
  - Osmolity too high, dehydrates calf
- Need to enhance absorbent properties
  - Slow fluid loss
  - Reduce tissue damage
  - Enable microbiota to recover



# Diarrhea control - 1st response

## Digestarom P.E.P. Liquid

- Complex synergistic blend of phytogenic compounds
- Specially tailored for newborn animals
- Microbial modulation
- Non-specific diarrhea control

- Liquid oral, on-farm
- Non-pharma alternative for ABF production

# Summery


Risk factors: Management - contagious bacteria, viruses, parasites - calf

Management

1. colostrum management,
2. energy intake,
3. calf diets,
4. bedding,
5. vaccination program
6. general sanitation.