The role of chemical and physical nutrition in rations designed to achieve sustained high standards of animal health and welfare in profitable systems of milk production.

Professor David Beever

Status of World dairying

Milk produced under many different farming systems.

- **Smallholder:** 5-10 cows or buffalo but produce significant proportion of world milk
- **High forage systems:** Extensive seasonal use of pasture, limited supplementation – average milk yields
- **All year calving:** Grazed and conserved forages, higher milk yields, some cows permanently housed.

More countries seeking self reliance for milk and milk products

World dairying progress

Genetics:

- **Within breeds:** Introduction of improved genetics
- **Between breeds;** increased consolidation of breeds with significant Holstein dominance

Management:

- **Larger herd sizes**
- **Increased mechanisation** of feeding and milk harvesting

Welfare issues

- Excessive body condition loss in early lactation
- Increased lameness
- Increased mastitis
- Compromised fertility
- Increased animal health issues
- Reduced longevity

- Occurred at time of accelerated genetic progress
- Possible association with limited trait selection for milk production

Going forwards

Genetics: Now with increased focus on non production traits

e.g. 'The Robust cow project'

Limited evidence of any real outcomes, progress likely to be slow

Management: More likely candidate for early success

but

1.Low returns have limited structural improvements

2.Reduced staffing has reduced cow-contact hours on many farms

Nutrition: Continues to receive little serious attention.

In many countries nutritional advice is monopolised by overzealous and under-qualified feed salesmen

'Genetics has created the potential: nutrition has failed to deliver that potential'

Professor Paddy Cunningham Trinity College Dublin

Current nutritional practices

- **Chemical nutrition;** Focuses on energy and protein supply
- **Energy:** providing rations of suitable energy density that will be consumed in sufficient amounts to meet cow's maintenance & production needs
- **Protein:** Recognises dual contribution of microbial protein (balanced ruminally degradable carbohydrate and protein supplies) & degraded feed protein

But major emphasis has been on optimising feed DM intake

Considered to be main driver of milk production

But where does efficiency of feed use and animal health fit?

- **Increased feed intake will impact negatively on feed digestibility**

- **Increased concentrates can impact negatively on animal health**

Improving lactational performance

Improving forage quality:

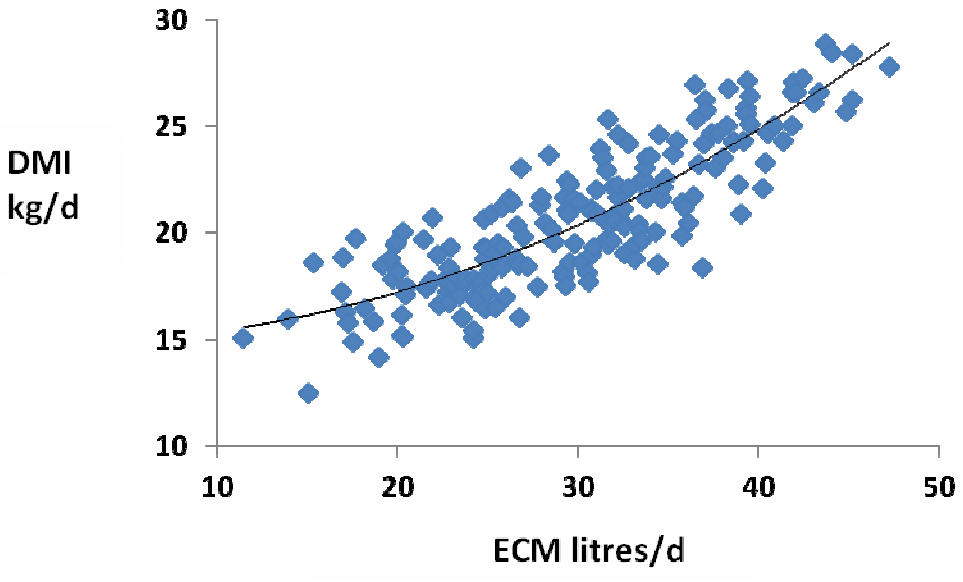
- **Higher quality forages:** Higher levels of soluble carbohydrates and protein with lower amounts of chemical fibre
- **Lower sward grazing heights and increased mechanical processing at harvesting;** Lower amounts of physical fibre

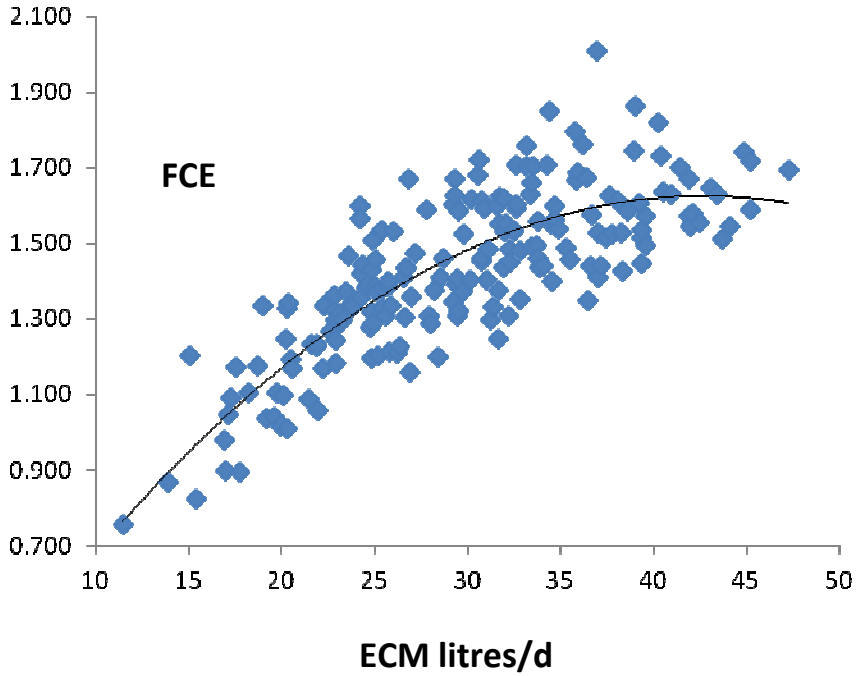
Increasing concentrates:

- **Increased concentrates:** Increases ration nutrient (energy) density but increases proportion of small particles in ration

Higher milk yields should increase feed efficiency (MILK/FEED) as maintenance feed component is covered with more litres

Impact of increased feeding





$DMI = 0.0067*ECM^2 - 0.0172*ECM + 14.91$
($r^2=0.733$)

$FCE = -0.0009*ECM^2 + 0.0754*ECM + 0.0159$ $R^2 = 0.6733$

Curvilinearity indicates:

1. More feed for each increment in milk yield

2. Reduced FCE at higher milk yields

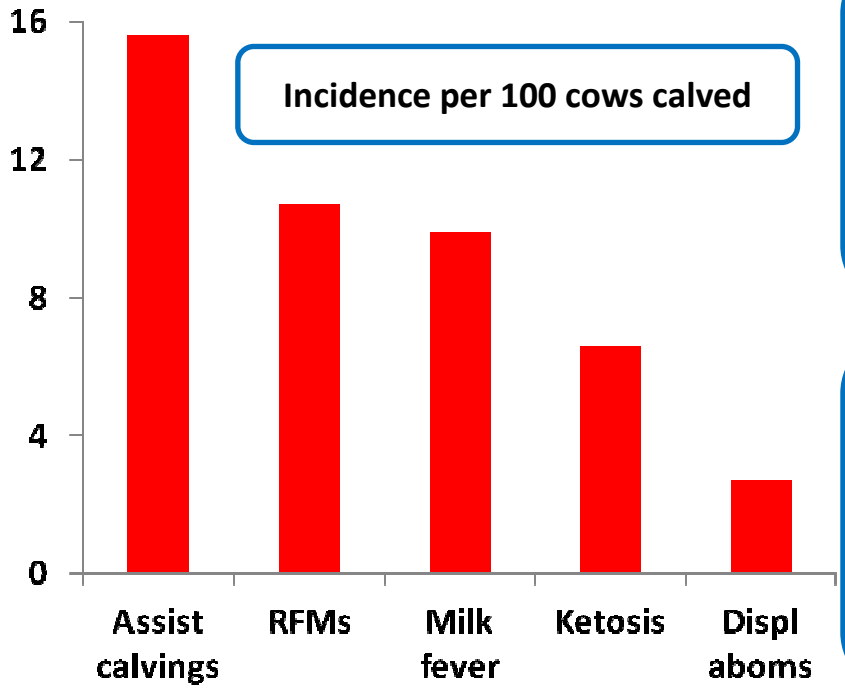
Impaired digestion?

Indiscriminate overfeeding is not limited to milking cows

Many systems recommend increased feeding during dry period to increase body reserves in anticipation of body condition loss in early lactation.

But dry cows with ad libitum feed consume in excess of their daily requirements

Recent Univ of Illinois study (Richards et al) reported upto 80% overconsumption at weeks 5-3 before calving



Based on 277 herds with 27470 cows: (Sweden, France, Ireland< UK)
Combined incidence: 45.5 cases/100 cows with some cows suffering more than one insult

Such events impact negatively on;
1.Feed intake
2.Milk yield
3.Post-calving body condition loss
4.Fertility

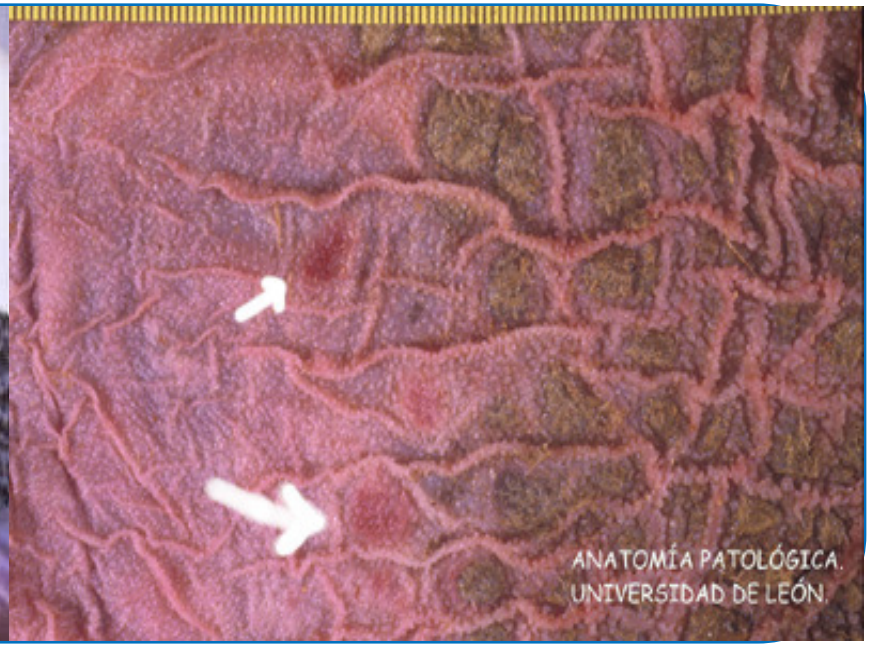
Optimising feed use and lactational performance

Optimal feed conversion requires optimal rumen function with:

1.Strong regular rumen contractions to stimulate mixing of rumen contents

2.Prolonged bouts of rumination to promote feed particle breakdown and saliva production

3.Control of rumen pH



Causes of acidosis

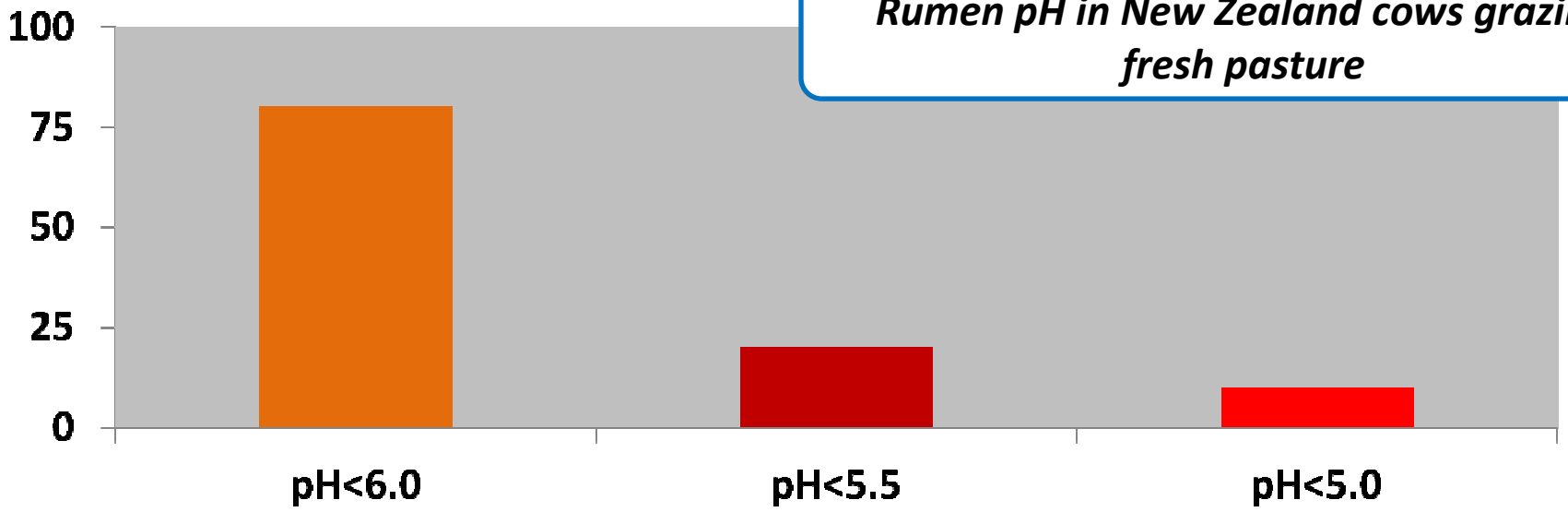
Housed cows:

1. Increased grain feeding
2. Large discrete meals of concentrates at milking
3. Lack of adequate amounts of physically effective fibre
4. Ability of the animal to select ration ingredients
5. Inadequate feed space which allows dominant cows to over consume

Pasture fed cows:

1. Continuous access to lush fresh pasture
2. Abrupt introduction of lush fresh pasture
3. Increased grain feeding
4. Large discrete meals of concentrates at milking
5. Lack of adequate amounts of physically effective fibre

Rumen pH in New Zealand cows grazing fresh pasture



Avoiding rumen acidosis

Increasing number of farmers have:

- **Abandoned or *reduced* concentrates feeding at milking**
- **Increased feeding of concentrates with forages in mixed rations**

BUT:

Oetzel et al showed that increased number of small meals per day did not prevent 24hr rumen pH range of <5.25 to >6.25

Also showed that increased number of small meals per day increased daily feed intake, thus acerbating rather than negating any rumen acidity problems

Providing physically effective fiber in the ration promotes improved rumen function

Providing physically effective fiber

Providing long hay or cereal straw results in variation in intake by:

1. Individual cows within days
2. Same cow between days

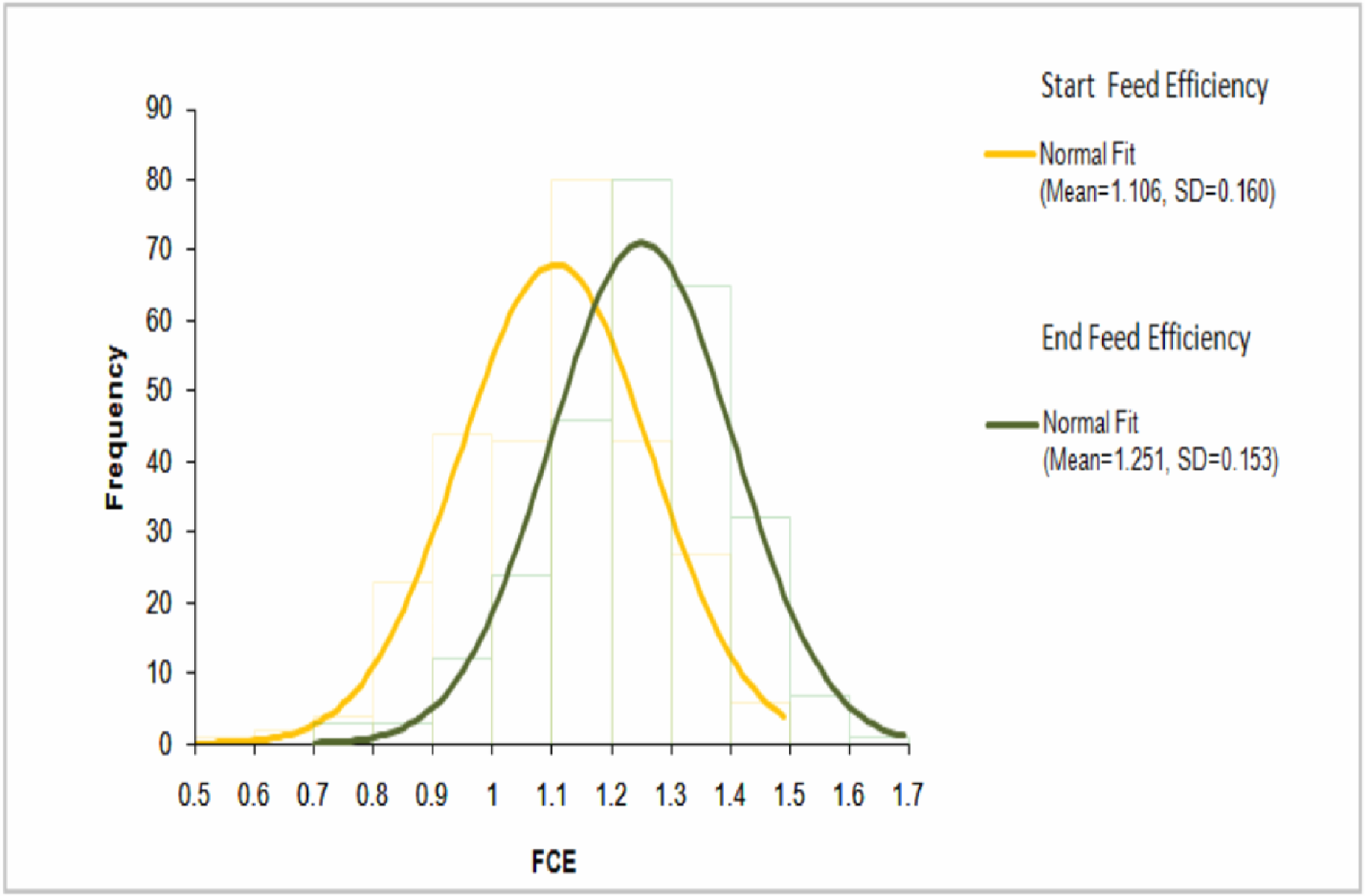
Processed long forage in mixed rations reduces risk of disparate intakes of physically effective fiber but:

- Uncontrolled processing provides forages of contrasting lengths
- Excessive mixing will destroy physically effective fiber structure
- Poor mixing increases ration sorting and selection against physically effective fibre

To achieve maximum rumen benefits the physical effective fiber content of rations needs to be of:

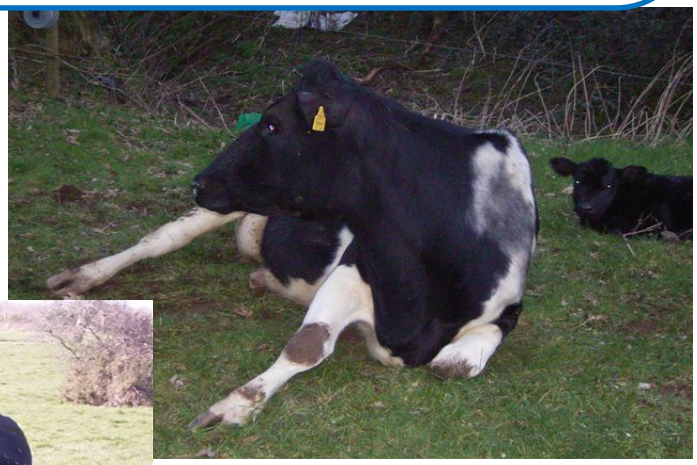
- Defined composition
- Consistent composition

Providing physically effective fiber



The role of Physically Effective Fiber for dry cows

- Classic Far Off and Close up feeding of dry cows has not brought universal success
- Too many health and production-related issues occur around the calving period
- Negative impact on subsequent lactational performance





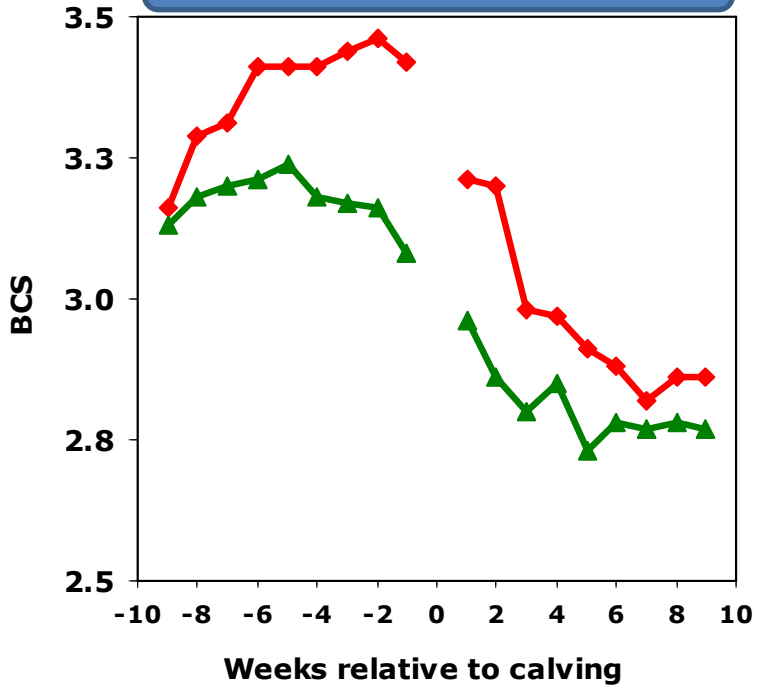
Total cows 27,470	Before CEHF	After 6m CEHF
Assisted calvings	15.6	7.3
Retained membranes	10.7	4.6
Milk fever	9.9	2.5
Ketosis	6.6	1.4
Displ.abo-masums	2.7	0.4

45.4 disorder cases per 100 cows

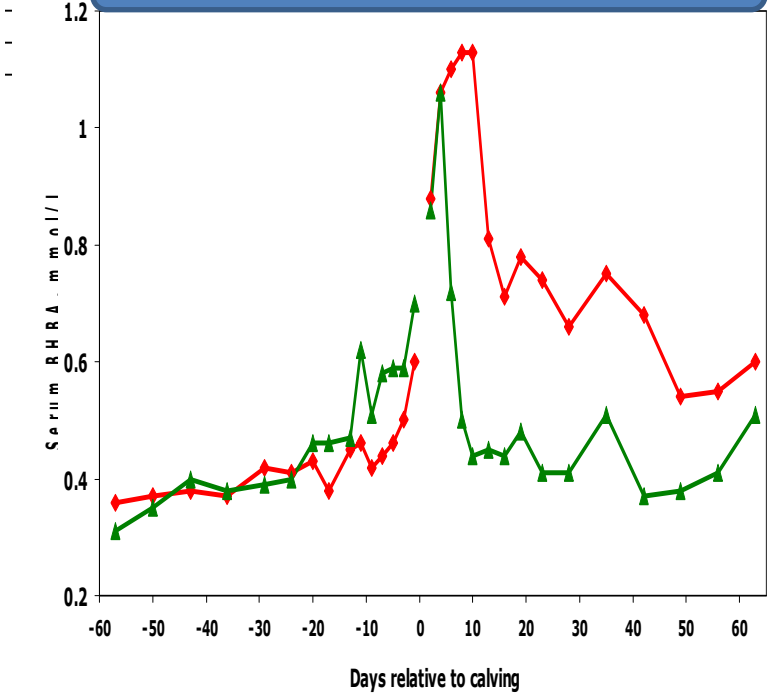
16.2 disorder cases per 100 cows

Controlled Energy/Hi Fiber rations; evidence

Body condition change



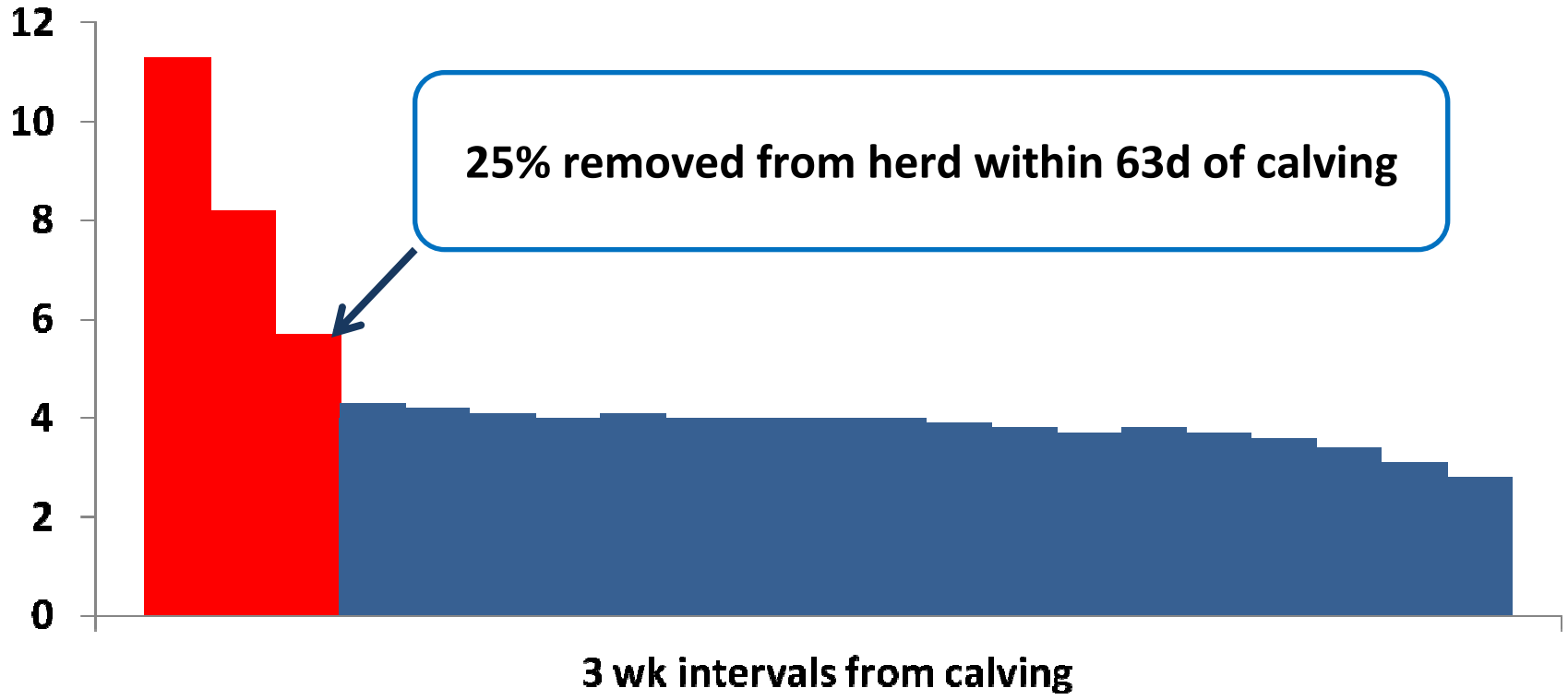
B OH Buytrate concns



RED: Conventional feeding GREEN: CEHF feeding

- No noticeable BCS change during dry period
- 50% less internal fat at calving
- Less BCS loss after calving
- Post-calving BHBs elevated for only 10 days

Distribution (%) of cows leaving herds over 5 years



625,000 cows in 5750 herds

Minnesota DHIA

A healthy cow needs a healthy rumen

- Improving cow welfare,
- Improving product (milk) quality
- Improving farm profits and
- Reducing emissions from dairying systems

Requires:

1. Recognition of the importance of rumen health
2. Recognition of the importance of PHYSICAL NUTRITION
3. Recognition of the importance of FCE
4. Improved nutritional training