The Importance of Colostrum Feeding

Calves are born without the antibodies (immunoglobulins) required to protect them from disease. They rely on colostrum to provide the antibody they need for the first few weeks of their life. It is critical that they receive a sufficient quantity of first milked colostrum within the first six hours of life.

Research indicates that on average 35 percent of calves have inadequate transfer of antibodies from the dam. In some dairy herds levels of failure or partial failure in passive transfer can be much higher.

Factors which can contribute to failure of passive transfer include:

- Insufficient volume of colostrum
- Poor quality colostrum
- Delayed colostrum intake after birth
- Bacterial contamination
- A weak calf

These are discussed in more detail in the following sections.

Failure of passive transfer has short and long term effects on calves including:

- Higher risk of disease and death in the young calf
- Higher disease risks after weaning
- Poorer liveweight gains
- Lower first lactation yields
- Premature culling

Hygiene, housing, concurrent disease and other stressors must be managed alongside robust colostrum policies. Where passive transfer is adequate, provision of additional colostrum to the new-born calf does not further reduce disease and mortality.

Calving Ease

A difficult birth can impact on a calf's ability to ingest and absorb colostrum. It increases the time to standing and reduces the suck reflex, making it less likely for the calf to suck unaided. Calves that experience a difficult birth are also less able to absorb antibody when tubed and may have suboptimal antibody despite good quality care.

Early intervention in difficult calvings is essential to assist the calving and to care for any calf that has had a difficult birth by administering colostrum at the earliest opportunity.

Where more than 4% of calvings require assistance then it is important to review the factors that contribute to this. These are essentially late lactation and dry cow nutrition, condition scores and bull selection.

Colostrum Quality

High yielding dairy cows may have poorer quality colostrum and this is exacerbated by delayed milking. This is not the case in all animals, and the best advice is to test colostrum and make decisions on the basis of this reading.

Colostrum antibody concentration falls after calving, decreasing by a third by 14 hours. To maximise colostrum quality cows should be milked promptly after calving. Having calving pens close to the parlour (or mobile milking equipment), safe flooring and good nutritional control of milk fever are important factors in achieving this.

Leaking of colostrum means that the best quality colostrum is lost, and the colostrum harvested at milking is of poorer quality. Select from cows which have not leaked colostrum prior to calving, and use only first milked colostrum for the critical feeds.

Prompt milking maximises colostrum quality, but little can be done to further improve the initial antibody concentration in colostrum from individual cows. Testing can help to select the highest quality colostrum to store. This can be done either using a colostrometer, or a Brix densometer. The densometer tends to be more accurate than the colostrometer for this purpose.

Colostrum with a reading of 22% of more on the Brix densomter can be used or stored, while colostrum below this should be discarded, or used for follow-up feeds where colostrum is fed for a few days. If using the colostrometer, readings in the green zone (more than 50 mg/ml) indicate good quality colostrum.

Colostrum Cleanliness

The standards of hygiene during collection and storage significantly influence the quality of colostrum reaching the calf. Bacterial contamination and growth reduce antibody absorption across the gut wall.

Bacterial contamination is influenced by:

- Udder cleanliness
- Teat preparation
- Hygiene of collection buckets
- Storage
- Hygiene of feeding equipment

Advice for colostrum storage:

- Don't store colostrum in buckets at room temperature, as bacteria replicate rapidly.
- Refrigeration only slows bacterial growth. Colostrum stored in the fridge should be used within 24 hours.
- Label stored colostrum with the dam identity and date of collection.
- Pasteurisation or chemical treatment can reduce, but not eliminate bacterial contamination. They improve antibody absorption and prolong storage times.

- Freezing is a cheap and effective option for longer storage. Bags or bespoke containers provide a wide surface area for rapid thawing.
- Thaw below 60°C to prevent antibody damage.

Laboratories can culture colostrum samples to assess the level of contamination. This is useful when investigating failure of passive transfer (see figure one).

Figure one: Bacterial contamination of colostrum impairs absorption. Culture of colostrum samples can be carried out to assess this.

Time of Administration

After birth, the length of time during which a calf's intestine can absorb antibodies is limited. Closure of the transport mechanisms accelerates following the first feed or following ingestion of bacteria and is minimal after 24 hours.

It is essential to provide a sufficient volume of good quality colostrum as soon as possible after birth, ideally within two hours and definitely within six hours.

A low volume or low quality first feed will impair the absorption of any further antibodies. The first feed should be the highest quality available.

Quantity of Colostrum Administered

The impact of poorer quality colostrum can be offset in part by providing a greater total volume. The quantity required is greater than a calf would voluntarily suckle in one meal. Voluntary feeding may be reduced after two initial three litre feeds but this should not prompt a reduction in colostrum volume given. The initial doses will provide plentiful energy in addition to antibodies.

Advice can vary but a consistent message is to feed three litres of first milking colostrum within six hours (and ideally two hours) with a further three litres fed within the first twelve hours. Very small calves, for example Jersey calves, will require less.

Provision by stomach tube or bottle is more successful in delivering a sufficient volume of colostrum than natural suckling alone.

Method of Administration

Dairy cows tend to have poor mothering ability. In herds where the calves are left to suckle colostrum themselves, research shows that 69 percent of calves have inadequate passive transfer of antibody. This was reduced to 10% with early intervention by bottle feeding or stomach tubing.

Calves left to suck the dam themselves also have an increased risk of Johne's disease and *Salmonella* infection.

Policies for colostrum feeding and timing of separation from the dam should be set as part of the herd health plan.

Measuring the Success of a Colostrum Policy

The success of the colostrum policy is easy to monitor using blood tests in animals less than seven days old. Serum refractometry and ZST testing are both simple and cheap methods which provide a guide to antibody levels in the calf. Specific ELISA tests for directly measuring immunoglobulins are becoming more widely available.

Antibody levels in the blood should be measured routinely as part of regular calf health monitoring. This means that a problem can be detected quickly, before levels of disease and mortality begin to increase. On a herd basis at least 80% of sampled calves should have absorbed adequate levels of antibodies.

If blood antibody levels are not measured routinely then this should be undertaken when levels of navel ill, diarrhoea and pneumonia are high, or increasing. Blood sample healthy, rather than sick calves, as dehydration affects the validity of the test.

Continued Feeding of Colostrum

The immunoglobulin concentration of colostrum falls rapidly with each milking after calving. Colostrum from anything other than the first milking should not be used for calves in the first 12 hours of life. However, all colostrum benefits calves more than 24 hours old by providing antibodies

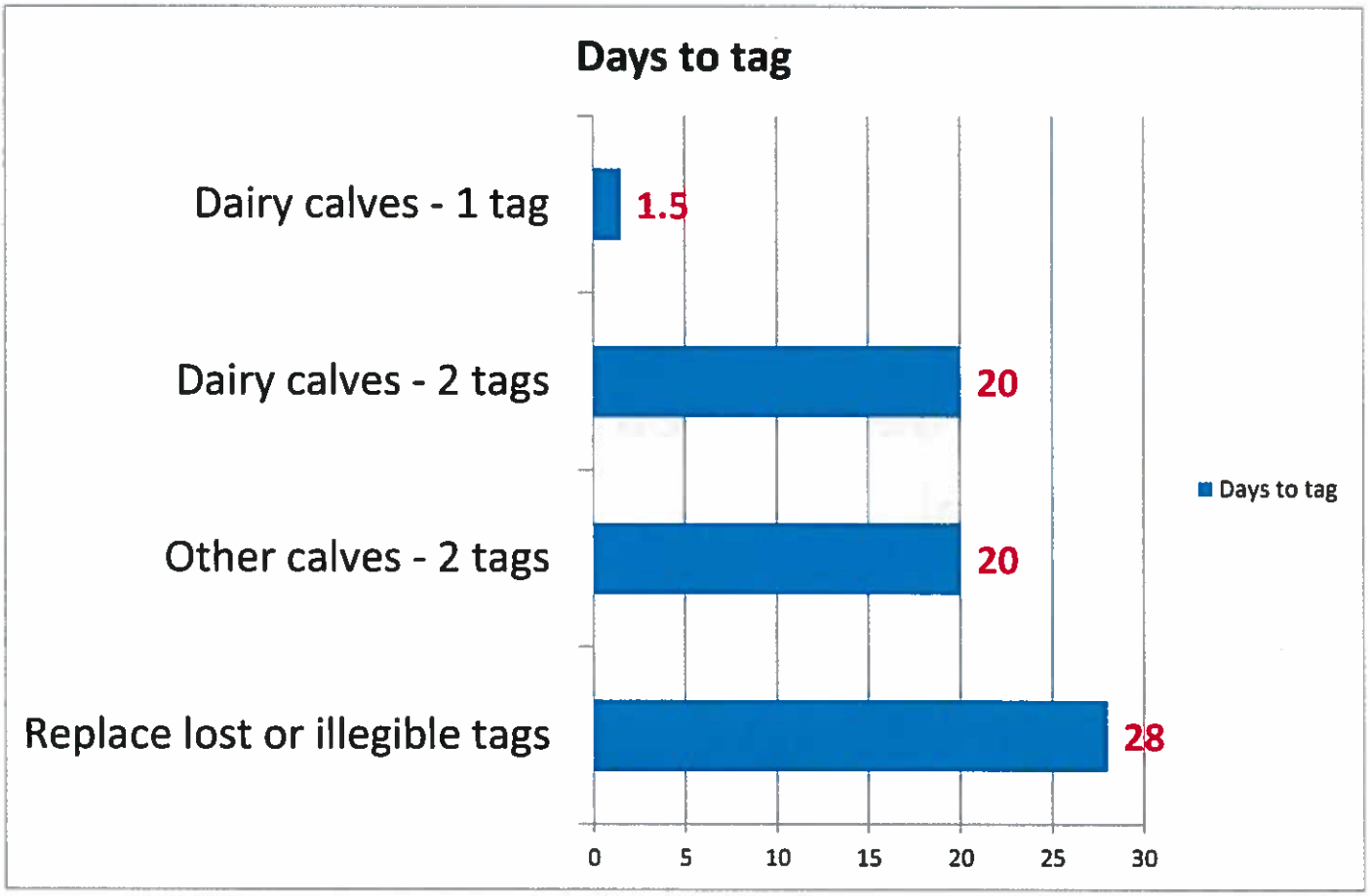
locally in the gut and a greater density of energy than milk or milk replacer. Continued colostrum feeding up to seven to ten days of age offers additional health benefits to calves but disease risks must be considered.

Colostrum – Key Advice

- Plan the colostrum policy with veterinary advice.
- Milk cows as soon as possible after calving.
- Prepare the teats and udder for this milking to the same standard as would apply for routine milking.
- Test colostrum quality.
- Refrigerate any colostrum not used immediately .
- Pasteurisation, chemical treatment and freezing increase storage times.
- Thaw at less than 60°C.
- Sterilise tube feeders or bottles.
- Provide three litres of colostrum within the first six hours (ideally two hours) after birth and a further three litres within the first 12 hours.
- Continuing feeding colostrum or milk from the first six milkings to calves until seven to ten days of age can have additional health benefits.

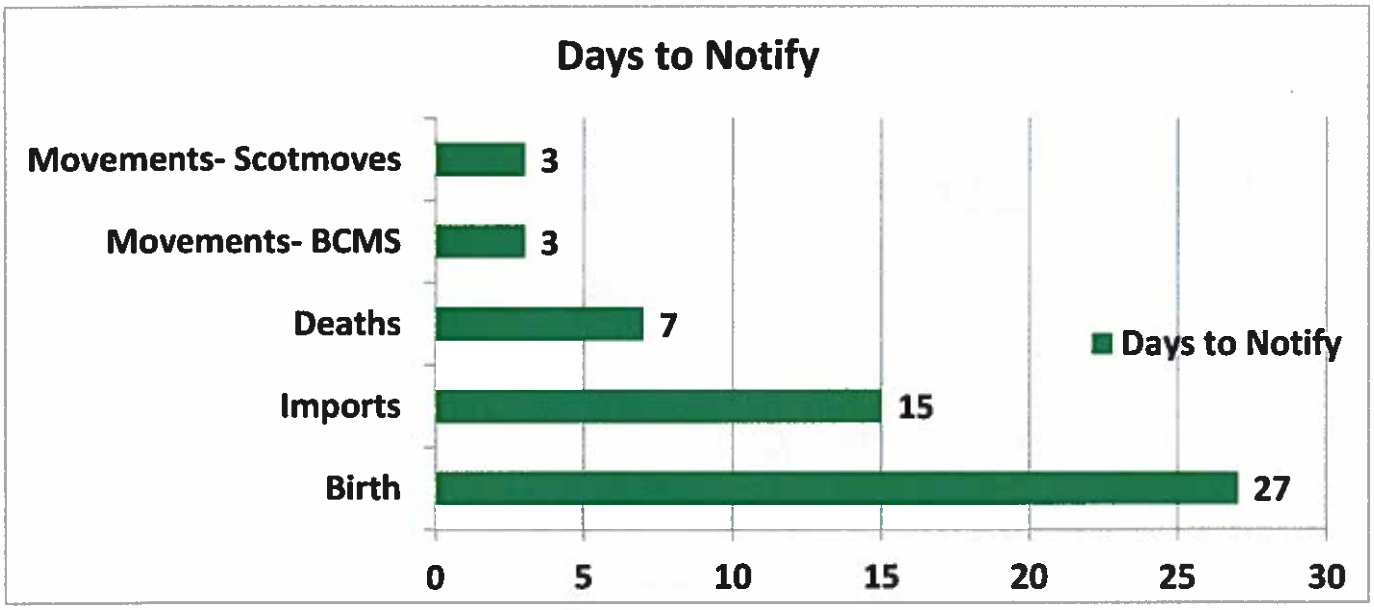
CROSS COMPLIANCE

Tagging Timescales



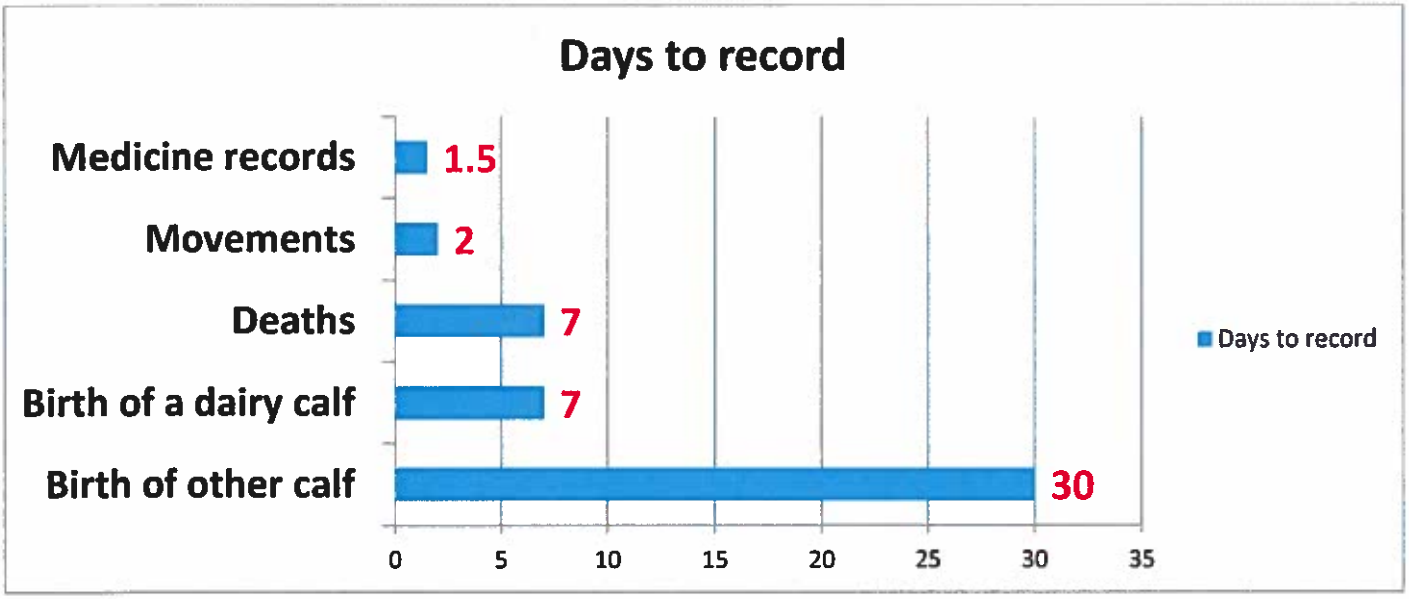
All animals leaving holding must have 2 tags

Notification Timescales



Passport must be returned within 7 days of death of animal

Farm Record Timescales



Holding registers must be kept for 10 years

Heifer Nutrition and Growth Targets for Optimum Performance and Longevity

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Heifer Rearing – The Issues

- Average age at first calving is just under 29 months
- 14% of heifer calves born fail to make their first lactation
- >50% of heifers fail to make their 3rd lactation
- High replacement rate > 25%
- Forage quality and suboptimal growth rates
- Rearing costs account for 20% of production costs
- Cost of rearing hearing heifers varies from £1000 to £1500, possibly more!

Consequences of Failing to Achieve 24 Month Calving

Increased Replacement Rate

Increased replacement costs in order to achieve herd size. For a 100 cow herd the following table shows the number of youngstock required based on replacement rate and age at first calving.

	Herd Replacement Rate (%) (Assume 5% Calf Mortality)				
Age at 1st Calving (months)	**20**	**23**	**26**	**29**	**32**
24	36	42	55	61	61
26	39	46	59	66	73
28	42	49	64	71	78
30	45	53	69	76	84

Effect of replacement rate and age at first calving on youngstock requirements for 100 cow herd.

Poorer Lifetime Fertility

Heifers that calve down older than 24 months have reduced fertility in their 1st and 2nd lactation. There is a significant effect on % conceived to first service, services per conception and days open between heifers calving at 24 months versus 30 months of age.

	Calving <23months	Calving 23-25 months	Calving >30 months
Lactation 1			
1st service conception rate	47%	42%	32%
Services per conception	2.4	2.2	3.0
Days open	128	117	170
Lactation 2			
1st service conception rate	28%	47%	33%
Services per conception	2.7	2.1	2.2
Days open	127	111	144

Effect of age at first calving on fertility in 1st and 2nd lactation. Source RVC

Lower Milk Yield

Research shows poorer lifetime milk production with increasing age at first calving.

	Calving <23 Months	Calving 23-25 months	Calving >30 months
Lact 1 - 305 day yield (kg)	8494	8811	8914
Lact 2 - 305 day yield (kg)	9340	9908	9633
5 year life yield (kg)	21072	22477	15777
% life in 1st 5 years spent in milk	46	45	34

Effect of age at first calving on lifetime milking performance. Source RVC

Size Matters!

Puberty is governed by body weight and not by age. Achieving the correct growth rates and weights at various stages of the heifer rearing process is paramount to achieving an age at 1st calving of 24 months. Key targets based on a mature body weight of 650kg for Holstein-Friesians are as follows:

Age	% Mature Body Weight	Live Weight (kg)	DLWG (kg)	Wither Height (cm)
Birth	-	40		
8 weeks	12	80	0.8	87
6 months	30	195	0.8	104
9 months	40	260	0.8	
13-14 months (mating)	55-60	357-390	0.86	125
21 months		520	0.7	135
Pre-calving	90	585	0.7	138
Post-calving	85	553	0.7	

Targets for body weight, DLWG and wither height at various ages for Holstein-Friesian heifers

If you can't weigh heifers then use a measuring stick. Wither height is a very good indicator to ensure heifers are at the right size for breeding and is easier to measure than liveweight. Target would be for a wither height of 125cm for breeding Holstein-Frisian heifers and 110cm for Jerseys.

Target Growth Rates and Nutrition

The target growth rate for heifers is to achieve an average live weight gain of 0.75kg/day from birth until calving. For the pre-weaned calf the aim is to double birthweight at weaning so a 40kg calf should be a minimum of 80 kg by 8 weeks of age and 120kg by 3 months.

Maintaining good growth rates after weaning are essential to make sure heifers achieve 55-60% of mature body weight for bulling at 13-14 months. There is nothing wrong with pushing growth rates in the early part of the rearing period and it is a good idea to have heifers on a rising plane of nutrition just before bulling to give them more energy to maintain growth but also to improve

oestrus activity and conception rates. Once they're in calf you need to control growth so they do not get over fat so at this point energy intake can be reduced slightly. There is no evidence that rapid weight gain in heifers reduces the number of milk secreting cells in the mammary gland, affecting milking performance. The key is to provide sufficient protein for frame growth without overdoing starch and resulting in over-condition of heifers. Aim for a body condition score of 2.75 to 3 at calving.

Ideally straw should be fed as a source of forage up to 6 months of age, with 3-4kg of a high quality concentrate (18-20% protein). Once feeding silage it is very important to have your silage tested so it can be balanced with the appropriate concentrate to meet energy and protein requirements.

Heifers can go to grass ideally at a minimum age of 6 months. On good spring grass, growth rates of 0.8% can be achieved but later in the season when grass quality declines, concentrate feeding will be of benefit. Feeding concentrate at grass will ensure target growth rates are achieved. The cost of feeding 1kg/day of a 15% protein feed, (at say £180/T) for 180 days is only £32/heifer. This is a very small cost compared to the total rearing cost of a heifer, but could make the difference for achieving target weights and condition. Underfeeding during the first 12 months restricts growth of the pelvis. Combined with over-condition and laying down fat later on will result in calving difficulties.

Silage Analysis

Know the quality and get your silage tested! Silage alone will rarely meet requirements for a 350kg bulling heifer to achieve a minimum target growth rate of 0.7kg/day and would need to be a minimum of 14% crude protein and 10.5ME.

Parameter (DM basis)	Target	Comment
Dry Matter %	25-30	Very wet or very dry silages will reduce dry matter intake
ME MJ/kg	11-12	Energy content and related to D value, the higher the better. Mostly related to crop maturity at cutting
D value %	>65	Indicator of digestibility, the higher the better. Depends mostly on crop maturity
Crude Protein %	>14	Generally the higher the better, saves on supplementary protein costs
Intake Factor	100+	Shows potential intake of silage alone. Depends on DM, D value and fermentation characteristics
Ammonia %	< 8	Indicates good fermentation
Lactic:VFA's	3:1 ratio	Indicates predominantly lactic acid fermentation
Ash %	< 8	Higher indicates soil contamination

Set Your Own Targets!

- Measure the body weight of mature cows in your herd
- Calculated target body weight at 1st calving (85-90% of mature body weight)

- Set target age at first calving (24 months)
- Calculate required daily live weight gain from birth to age at first calving

For example:
Mature body weight of 675kg.
Aim to calve at 85% of mature body weight so 574kg.
Target age of first calving at 24 months (720 days). 574kg – 40kg birth weight = 534kg gain.
534kg/720 days = 0.74kg average live weight gain required from birth to calving.