LARGE ANIMAL I CONTINUING EDUCATION



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The past five years have seen a strong increase in the use of oral calcium supplements on Irish dairy farms, a key driver for this being a greater understanding of the prevalence¹ and significant costs associated with sub-clinical hypocalcaemia.² Also, post-quota expansion has left farmers with many more cows to calve in a shorter calving window and now, dairy farmers are looking for a more proactive approach to reducing the extra workload and stress associated with milk fever. So, what are the costs of milk fever, what are the proactive supplementation options, and what does the research show?

THE REAL COST OF MILK FEVER

Milk fever/hypocalcaemia is the second most costly disease on Irish dairy farms, with an average annual cost of €7,625 per 100 cows.³ Much of the cost of milk fever (80% or €6,250 per 100 cows) comes from the 'invisible' form of sub-clinical milk fever, not from 'visible' clinical milk fever cases.

CLINICAL MILK FEVER COSTS

A lot of the cost of milk fever does not come from milk fever itself but from the fact that clinical milk fever tends to lead to a higher risk of secondary metabolic diseases⁴ such as:

- 1.7x more likely to suffer from metritis;
- 2x more likely to be culled from the herd in the first 30 days of lactation;
- 2.6x more likely to experience dystocia;
- 3x more likely to experience a retained foetal membrane;
- 4.8x more likely to have a left displaced abomasum;
- 8x more likely to suffer from ketosis; and
- 8x more likely to suffer from mastitis.

PREVALENCE OF SUB-CLINICAL MILK FEVER

Research published in The Veterinary Journal⁵ was among the first to truly expose the scale of sub-clinical hypocalcaemia exposure on dairy farms. In this study, second lactation and older cows had average incidence of 50% for sub-clinical milk fever, compared to 8% for clinical milk fever.



Table 1: Clinical and sub-clinical milk fever levels in cows (by lactation). Reinhardt, 2011.

PROACTIVE SUPPLEMENTATION STRATEGIES

Given the large prevalence and cost of sub-clinical hypocalcaemia there has been a growing focus on implementing pro-active supplementation strategies. Reducing the risk of milk fever at calving usually boils down to one of two approaches:

1. Pre-calving dietary intervention

A key contributor to milk fever on Irish farms every year

Table 2: The effect of intravenous calcium therapy on plasma calcium. Goff, 1999.



is high potassium levels in second- and third-cut silages, which generally end up being fed to dry cows and young stock. Winter slurry-spreading restrictions have probably exacerbated this issue in recent years. In my opinion, all dry cow silages should be tested for their mineral levels and evasive action should be taken to tackle high potassium silages (K>1.8%), such as diluting these high potassium silages with lower potassium silages if available or low potassium straw. Magnesium supplementation is a must in all dry cow diets and more important in high-potassium scenarios, given the antagonistic relationship between potassium and magnesium. Dry cow diets should contain magnesium at a rate of 0.4% dry matter (DM).

Farmers working closely with their nutritionist and/or vet can adopt a proactive approach of adding a calcium binder or an acidifying agent (DCAD) to the close-up diets (last two to three weeks pre-partum) of their cows. The window of opportunity to tackle herd-level milk fever issues with an effective pre-calving dietary intervention is almost certainly closed by now.

2. Post-calving calcium supplementation

Post-calving calcium supplementation allows for the targeted supplementation of high-risk cows, by supplementing them with extra calcium to boost their calcium status during the critical first 12 or 24 hours post calving, and avoiding a drop in blood calcium levels to clinical or sub-clinical levels. There are many different protocols followed on farms; from the practice of treating all third lactation and older cows, to identifying the 25% of the herd at highest risk (fat cows, high yielders, old cows, cows with history of milk fever, etc.) and proactively treating them.

CLINICAL MILK FEVER TREATMENT

Calcium (borogluconate) – intravenous

A bottle of calcium borogluconate, given intravenously, is the only realistic option for treatment for a cow showing clear signs of clinical milk fever. As a vet in Kerry said to me: "The bottle of calcium into the vein is one of the last pieces of 'magic' that the vet has in his tool kit – farmers think you've literally risen the cow from the dead." The intravenous infusion of calcium can raise blood-calcium levels so much that it prompts a calcitonin release which, Table 3: Effect of subcutaneous calcium therapy on plasma calcium. Goff, 1999.



at the point when the cow needs a lot of calcium, starts to shut down supply. It is common for a rapid drop in bloodcalcium status to occur after intravenous treatment. Research carried out in the US⁶ shows that cows with clinical milk fever, given intravenous calcium can become hypocalcaemic again within four hours. Professor Peter Constable from the University of Illinois⁷ recently reported that the relapse rate to a single intravenous treatment of hypocalcaemia in down cattle is in the range of 24-53%. The prevailing advice from US researchers^{8,9} is now to give a combination of intravenous calcium, followed by an oral calcium supplement. The oral calcium supplement should help to elevate blood-calcium levels as calcium from the intravenous source begins to drop rapidly.

SUB-CLINICAL HYPOCALCAEMIA-PREVENTION OPTIONS

Calcium (borogluconate) - subcutaneous

The traditional preventative approach for milk fever was to give one or two bottles of calcium, subcutaneously, to the cow. This approach is still practised today but research shows that there may be more effective ways of supplementing calcium to cows for preventative purposes. Giving a bottle of calcium subcutaneously can be quite slow and cumbersome as its correct application requires the pre-warming of the calcium solution and slow administration into minimum of four to six sites around the cow. Research from Goff¹⁰ shows that when given 10.5g of calcium, as calcium borogluconate, into 10 sites around the body, blood-calcium levels were elevated by 20% for four hours before calcium levels dropped back very close to their baseline levels within five hours.

ORAL CALCIUM SUPPLEMENTATION OPTIONS

Oral calcium supplements were developed to offer a more effective way to boost calcium levels in cows and come in numerous forms such as boluses, drenches and powder sachets which are mixed into warm water for cows to drink. In general, oral calcium supplements will elevate blood-calcium status for about 12 hours and it is common for manufacturers to advise a second administration 12 hours after the first, something most farmers see as a negative. Unfortunately, such is the level of demand for calcium from the cow that, by and large, the calcium boost given to her by any calcium supplement will wane after 12 hours and a second dose may be required to help the cow through the critical 12-24-hour post-calving calcium dip. Statistically, most cows get milk fever 24 hours after calving.¹¹

Calcium boluses

Calcium boluses have been gaining in popularity in Ireland as well as globally over the past decade. They, generally, contain a combination of fast- and sustained-release calcium sources, to give the ideal profile of calcium release to accommodate the cow's needs.

Pros: They provide a quick way of supplementing calcium to cows and have the added benefit of almost fully protecting the cow from the caustic nature of calcium chloride in a liquid form. Some products have the added benefit of a waxy coating for ease of swallowing by the cow. **Cons:** Cows need to be restrained for safe bolus administration. Cows should be observed so that any boluses coughed up can be replaced. Calcium boluses don't bounce and so if dropped on the concrete will generally snap in two, you should never attempt to readminister a broken bolus.

Calcium drench

Generally presented in a 500ml or 600ml single-use drench bottle with long neck for easy administration to the cow. It still requires catching the cow and dosing her.

Pros: This can be a viable option for vets and farmers who do not like bolusing their cows but still want a quick way of administering calcium to their cows.

Cons: Can be a messy affair and cows can be prone to coughing up some of the drench, which usually ends up all over the administrator or on the floor.

Post calving drink/powder mix

Generally provided in a 500-1,000g powder sachet to be mixed into warm water and offered to the cow as a palatable drink shortly after calving. These products usually offer a combination of calcium, energy and electrolytes and so can offer a broader spectrum solution to freshly calved cows.

Pros: Convenience is a big plus here and certainly a good option for farmers who don't like the stress of catching and dosing cows. Most products suggest mixing into 15-20kg of water and this can have a double benefit of helping to rehydrate the cow after calving but also the extra weight in the stomach is anecdotally recognised as helping to reduce the risk of displaced abomasum.

Cons: This product format relies on the cow voluntarily taking in the product. Offering the warm drink to cows immediately after calving is the key to success here. If left too late there is a chance the cow will not drink it at all. Other challenges include: the risk that the cow knocks over the bucket and spills the mix; or in group calving scenarios, ensuring that the correct cow gets the drink.

WHAT DOES THE RESEARCH SHOW?

There has not been much published research carried out in the area of calcium supplementation in Ireland; however, two research papers on Irish spring calving herds have been published over the past couple of years. The most recent published paper¹² looked at the effect of calcium supplementation in low-risk herds, on cows with either sub-clinical hypocalcaemic or normocalcaemic blood-calcium levels. In effect the study asked two key questions:

1. Is there a benefit to supplementing calcium to cows with no clinical milk fever issues?

Is a calcium-only supplement sufficient to meet the needs of modern transition cows or is there merit in supplementing other key nutrients at calving (calcium+ option, eg. Cow Start Calcium) such as a higher level of calcium (+50%), magnesium and key anti-oxidants (vitamin E and Se)? The study evaluated three supplementation options:

- 1. Control (no calcium supplement);
- 2. Calcium only (2x calcium boluses <45g Ca); and
- Calcium+ (2x calcium boluses 65g Ca, 4g Mg, 1,200mg vit E + 4.65mg Se).

The study looked at three key transition cow performance indicators:

- 1. Post-partum metabolic issues
 - Rates of retained placenta, uterine infection, displaced abomasum and ketosis
- 2. Early lactation energy status
 - Milk beta-hydroxybutyrate (BHBA) levels, as an indicator of fat reserve mobilisation at week two and four in lactation, a lower result indicates a lower level of body fat mobilisation and, consequently, better early lactation-energy status
 - Body weight loss measurement of body weight lost between calving and week eight of lactation
 - Body condition score loss measurement of body condition score loss between calving and week six of lactation
- 3. Milk-production performance
 - Daily milk volume for the first 90 days of lactation and milk components

	Control	Calcium only	Calcium+	P-value
Study population	n = 30	n = 30	n = 31	
Post-partum metabolic issues	23%	23%	6.5%	ns
Energy status (milk	0.98mg/	0.74mg/	0.43mg/	P<0.05
BHBA)	dL	dL	dL	
Body weight loss (from calving to week 8)	-32kg	-47kg	-24kg	ns
Body condition score Loss (from calving to week 6)	-0.49	-0.53	-0.39	P=0.07
Milk-production difference (kg/day)	0kg	+0.5kg	+1.3kg	P<0.05
Milk fat and protein (kg/day)	2.16	2.21	2.26	ns

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Safety and efficacy of these products together have not been evaluated. A decision to use either of these vaccines before or after any other veterinary medicinal product therefore needs to be made on a case-by-case basis.



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RESULTS

The findings of this study show that while a calcium only supplement does perform better than control in terms of milk production and milk BHBA, the calcium+ group delivered the best performance across the board. This result may indicate that while calcium is clearly an important factor, there may be merit in offering a broader spectrum transition cow supplement at calving to address the additional nutritional needs of these cows.

CONCLUSIONS

Calcium supplementation on Irish dairy herds is growing in popularity as farmers are looking for proactive strategies to avoid having to treat milk fever cases during an ever busier spring calving season. There are numerous options when it comes to calcium supplementation with a bottle of calcium given intravenuously being the best choice for clinical milk fever and oral calcium supplementation growing in popularity for preventaive actions. There are numerous oral calcium supplementation options each with their own pros and cons. The latest Irish calcium supplementation research suggests that while there is a benefit to calcium supplementation, there may be additional benefit to addressing further nutrient needs such as magnesium and anti-oxidants at calving.

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READER QUESTIONS AND ANSWERS

- 1. WHICH CATEGORY OF MILK FEVER IS MORE PREVALENT AND COSTLY ON FARMS
 - A. Clinical milk fever
 - **B.** Sub-clinical milk fever
- 2. COWS WITH CLINICAL MILK FEVER ARE MORE LIKELY TO SUFFER FROM WHICH SECONDARY METABOLIC ISSUES?
 - A. Metritis
 - B. Culling in first 30 days of lactation
 - C. Dystocia
 - D. Retained foetal membrane
 - E. Left displaced abomasum
 - F. Ketosis
 - G. Mastisis
 - H. All of the above

- 3. WHAT IS THE BEST CHOICE FOR TEATMENT OF CLINICAL MILK FEVER?
 - A. Bottle of calcium intravenuously
 - B. Bottle of calcium subcutanuously
 - c. Oral calcium supplement
 - **D.** Bottle of calcium intravenuously followed by oral calcium supplement
- 4. WHICH OF THE BELOW IS NOT AN ORAL CALCIUM SUPPLEMENT
 - A. Calcium bolus
 - B. Calcium bottle
 - C. Calcium drench
 - D. Powder sachet preparation