Beefing up the Response to Bobby Calves:

Creating Value and Preserving Trust

A report for

By Sarah Bolton

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Executive Summary

Common dairy industry practices, such as early-life processing or euthanasia of low value non-replacement dairy calves as well as the separation of calves from their dams, are falling out of step with public values. In order to maintain its social licence to operate, the dairy sector must move towards re-aligning production practices with public values. This re-alignment depends on addressing the issue of the inherent low value of non-replacement calves which, in turn, has the potential to improve farm profit margins.

Opportunities to realise the value potential of non-replacement dairy calves lie in improved rearing systems and market pull-through for dairy beef as well as the combined use of sexed semen and targeted beef over dairy crossbreeding. Despite being commonly discounted as unprofitable for beef production, even Jersey beef has significant market potential if sold on the quality of the product as opposed to being sold as a commodity.

When it comes to cow-calf separation, systems where dairy cows and their calves are kept together are becoming increasingly recognised. While they do present significant challenges, these systems can offer several advantages over conventional production systems. Benefits include higher calf growth rates, increased total milk production from cows that suckle calves and increased performance of dam-reared heifers as well as the appeal of the system to public values.

Potential exists to improve the marketing of dairy beef. Aspects that appeal to consumer values include taste and nutrition, animal wellbeing and the significantly reduced carbon footprint of dairy beef in comparison to traditional beef production systems.

Progress on the issue of low value non-replacement calves relies on stakeholder-wide engagement with the issue in consultation with the public and their values. It is also necessary to increase producer awareness of the value of social licence and to combine future dairy science research with social science.

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Foreword

Despite the cliché, I was one of those kids who always wanted to work with animals. I was fortunate enough to grow up on a beef farm in Gippsland as well as a dairy farm that my family leased. After high school, I studied a Bachelor of Veterinary Science at the University of Melbourne, graduating in 2012.

I made the move to Grafton in 2015 with my partner Andrew (also from a family dairy background) to take on a role in a mixed practice veterinary clinic. Soon afterwards we purchased a 220-acre beef property with the view to run a small breeder herd. In 2016, we took on the management of a 300-cow dairy farm and I later accepted a position as a District Veterinarian for Local Land Services, working in livestock health, welfare and biosecurity.

The dairy we were managing was unique in that it bottled milk on farm and sold direct to local homes and cafes under its own brand. This, combined with my role as the local government vet, made us very aware of the importance of running a farm that truly put its best foot forward in terms of public image. The absence of a local bobby calf trade due to lack of dairies in the region and the high Australian beef prices at the time led to our decision to rear all the male jersey and jersey-cross calves born to the dairy on our own property.

In my work as a District Vet, I was often working with landholders who rear bobby calves opportunistically when beef prices are favourable and found myself frustrated by the lack of resources available for dairy beef production in Australia. The gap in my knowledge saw me apply for a Nuffield Scholarship and I initially approached the 'bobby calf issue' from a very 'veterinary' perspective, intending to travel and find information on how best to rear dairy beef.

It wasn't long into my Nuffield journey that I realised the solution may well lie in putting the cart before the horse. The concept of rearing dairy beef had been investigated many times before and adopted to various extents in different ways and yet the problem of low value bobby calves still existed. The dairy industry was still losing public trust as a result of young calves being seen a 'waste product', whilst from a producer's perspective, the idea of rearing dairy calves for beef was a hard sell unless beef prices were favourable.

And so, my topic evolved to become a search for profitable opportunities for dairy beef production that specifically address the issues of industry social licence and public trust. It had

become clear; without public acceptance as well as profitability at every step in the value chain, a proposed solution simply wouldn't be sustainable.

In search of a deeper understanding and potential solutions to this problem, my Nuffield travels saw me spend a total of 17 weeks overseas in 2018, visiting The Netherlands, Denmark (Figure 1), Italy, France, The UK, Ireland, The US, Mexico, Brazil and New Zealand.

Figure 1: The author with organic, grass fed Jersey steers being reared for value added beef in Denmark

Acknowledgments

Nothing prepared me for the doors that the Nuffield experience would open. I will be forever grateful for the welcome I received from farmers, processors, government bodies, research institutions, extension bodies, NGOs, farmers' unions, levy boards and many more.

This life changing experience would never have been possible without the generous support of my investors, Dairy Australia and The Australian Dairy Conference. Thank you for seeing the value in supporting the Nuffield program and for always striving to make the Australian dairy industry the best that it can be.

A very big thank you must also go to my colleagues at North Coast Local Land Services for all their support and for covering my workload during my absences.

To my family – Thank you for your unwavering support over my entire career and for instilling within me a belief that anything is possible. To Roberta, we couldn't have done it without your dedication at home, making sure all our animals were so well cared for. Finally, to Andrew – Thank you for sharing the vision and the journey. I can't wait to share the destination.

Abbreviations

AI – Artificial Insemination

CEO – Chief Executive Officer

CFI – Center for Food Integrity

EBV – Estimated Breeding Value

FAO – Food and Agriculture Organisation of the United Nations

FPT – Failure of Passive Transfer

LW – Live Weight

n.d – No Date (citations)

NGO – Non-Governmental Organisation

NRDC – Non-Replacement Dairy Calf

TMR – Total Mixed Ration

UK – United Kingdom

US – United States

Objectives

- Assess the threat posed by euthanasia and early-life processing of non-replacement dairy calves as well as cow-calf separation to the Australian Dairy Industry's social licence to operate.
- Identify and evaluate methods that can be used to maintain public trust in the dairy sector.
- Identify and evaluate methods that can be used to increase the value of non-replacement dairy calves.
- Evaluate potential benefits and challenges of rearing dairy calves on cows.
- Develop a vision for how the dairy industry can move forward, managing non-replacement dairy calves in a way that maintains public trust, whilst being profitable at every stage of the value chain.

Chapter 1: Introduction

"It is not the strongest of the species that survives, nor the most intelligent. It is the one that is most adaptable to change" - Charles Darwin.

Human social evolution is constant. Once held up as an agrarian vocation conjuring romantic notions of meadows and milk pails, the modern agricultural industry is now coming under increasing scrutiny.

Australian society reflects a similar situation in much of the Western world, whereby citizens are becoming increasingly disconnected from agriculture. In a November 2017 poll conducted by the National Farmers Federation, 83% of Australians described their connection with farming as 'distant' or 'non-existent' (National Farmers' Federation, 2017).

Despite this disconnect, or perhaps because of it, there appears to be a progressive increase in concern about how food is produced, particularly in regard to animal welfare (Coleman & Toukhsati, 2006). When this growing interest is combined with the advent of smartphones and social media, livestock husbandry is now more visible to the public than ever before.

In recent times, the dairy industry has been the subject of public criticism. Common practices on modern dairy farms such as the separation of calves from their dams and early-life processing of non-replacement calves ('bobby calves') are falling out of step with public values (Weary & Von Keyserlingk, 2017).

In February 2018, activist group 'Be Fair Be Vegan' led an international campaign that saw a truck carrying an anti-dairy billboard drive through the streets of Melbourne (Figure 2), highlighting the issues of cow-calf separation and early-life processing of non-replacement calves (Sullivan, 2018).

Figure 2: Billboard protesting against the separation of dairy cows from their calves, Flinders Street, Melbourne CBD, February 6, 2018. (Source: https://www.weeklytimesnow.com.au/news/national/be-fair-be-vegan-campaign-vegans-ramp-up-their-cause/news-story/7ab077f86f62e107e678b59abcf3cc03)

Vegan Australia and Animals Australia have also produced campaigns designed to draw attention to the same practices (Figure 3).

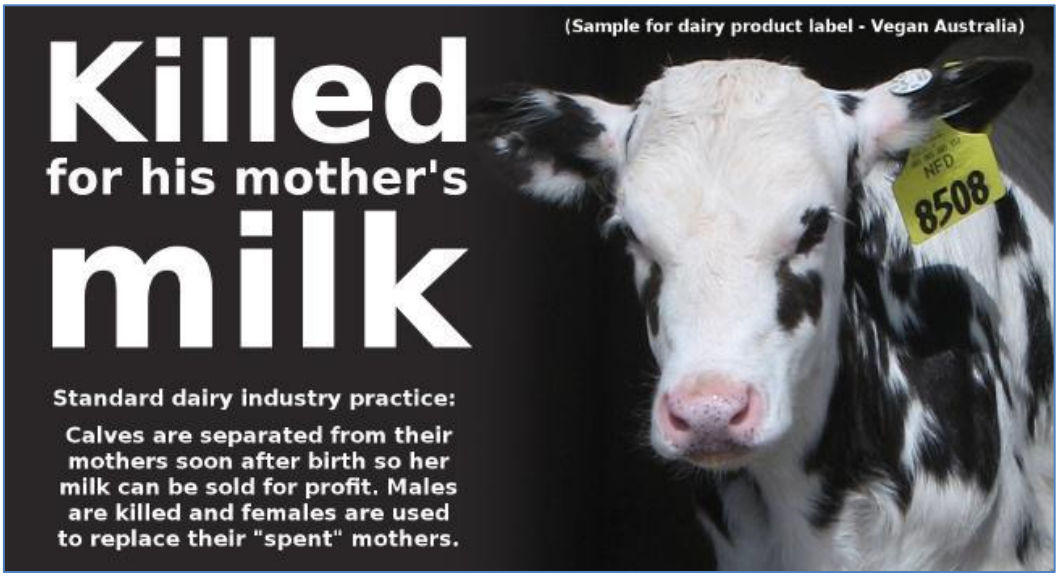

Figure 3: Anti-Bobby Calf graphic produced by Vegan Australia, January 17, 2018. (Source: https://www.veganaustralia.org.au/dairy_industry_label_your_products_honestly)

These incidents have not been isolated, with opposition to the management of non-replacement dairy calves growing both at home and overseas.

In order to produce milk, a cow must give birth to a calf which generally occurs once a year. For a dairy herd not looking to increase in size, only a percentage of the female calves will be retained as replacements. The rest of the calves born in the yearly production cycle, being the

males and some females, are usually surplus to the demands and capacity of the farm on which they were born.

Whilst surplus calves can be reared and sold either as replacement females for other herds or as beef animals, if the demand for these calves is overwhelmed, or does not exist in the first place, then their economic value will inevitably be low. Therein lies the problem. When an animal that is a product of a financial enterprise is, by its nature, of little to no value, the resources and motivations required to uphold acceptable standards of animal welfare are more likely to come under threat.

In Australia, approximately 400,000 surplus calves or 'bobby calves' are processed through abattoirs each year, with the term 'bobby calf' referring to calves under 30 days of age and less than 80kg live weight (Dairy Australia, 2018a). The minimum age at which a calf can be consigned through the sale yards or direct to an abattoir in Australia is five days (Animal Health Australia, 2012). Whilst estimates of numbers are unavailable, it is also recognised that a percentage of non-replacement calves are euthanized at birth when the cost of rearing them to five days old before processing becomes economically unviable.

Bobby calves present a particular challenge for dairy producers as a result of their inherently low monetary value, a lack of on-farm infrastructure with which to rear surplus calves, as well as the high cost and labour inputs associated with management (Jolly, 2016). Despite this, there is growing pressure to reduce or even remove the practices of early-life processing and at-birth euthanasia of dairy calves as a result of the threat it poses to the livestock sector's public image (Smith & Sullivan, 2017).

In order to move forward, it is vital that any proposed solutions to the problem satisfy community expectations, prioritise animal welfare and are profitable at every stage of the value chain. Whilst there is no 'silver bullet', the solution may lie in shifting perspectives and thinking outside the box.

Chapter 2: Preserving public trust

In the face of rising criticism of the management of bobby calves, how should the dairy industry respond? Proposed strategies for maintaining public trust usually fall into one of three main categories, being the restriction of the flow of information, public education and the re-alignment of practices with public values.

2.1 Closing the doors

The rise of undercover investigations involving the acquisition of covert video footage and photographs of livestock industry practices has led many stakeholders to lend their support to legislation that restricts this flow of information. These so-called 'Ag-Gag' laws have been debated in North America and to a lesser extent in Australia (RSPCA, 2014). Could the solution to public criticism lie in closing the doors to citizens that just don't understand?

The debate in itself uncovered the deeply flawed notion of closing the doors. It has been shown in Canada that whilst most people were at first unaware of ag-gag laws, simply learning of the concept lead to a decrease in trust of farmers and an increase in support for animal welfare regulations. Counterproductively, it was also shown that mere awareness of ag-gag laws negatively impacted perceptions of the current status of farm animal welfare, indicating that even the intention to restrict access to information can undermine trust (Robbins, et al., 2016).

2.2 Is education the answer?

The aforementioned disconnect between citizens and the agricultural industry is often cited as a reason for increasing efforts towards educating the public about the realities of where their food comes from in the hope that understanding will breed acceptance (Croney, et al., 2012).

However, Weary & Von Keyserlingk (2017) suggest that efforts to educate the public are unlikely to successfully resolve concerns about practices on farms for several reasons. The first is the 'disconnect' itself; given the fact that such a large percentage of the population is disconnected from agriculture, relying on a small minority of informed stakeholders to educate the masses is unlikely to be successful. Further, they put forward that the public seems to be adopting an 'increasingly jaded view when it comes to the advertising efforts of specific industries'.

Whilst efforts to educate the public can assuage certain concerns about livestock production, equally they have the potential to lead to new criticisms. In one study, Ventura, et al. (2016) surveyed citizens on their perceptions, concerns and values about dairy cattle, farming and welfare before and after a self-guided tour of a 500-cow dairy farm. Although the visit appeared to mitigate some concerns such as gentle human care and the provision of adequate food and water, concerns around issues such as early separation of cows and calves were either reinforced or even raised for the first time during the tour.

Furthermore, it has been noted that the idea of educating the public into acceptance overlooks the fact that a person's opinion on agricultural practices are influenced greatly by their moral and ethical values (Hötzel, et al., 2017). Fraser (2008) draws attention to the fact that people use different criteria to assess animal welfare:

'Some emphasize the basic health and functioning of animals, especially freedom from disease and injury. Others emphasize the "affective states" of animals – states like pain, distress and pleasure that are experienced as positive or negative. Others emphasize the ability of animals to live reasonably natural lives by carrying out natural behaviour and having natural elements in their environment.'

From a purely scientific perspective, it could be argued that the fate of a bobby calf either humanely euthanized at birth or processed at an abattoir at five days of age in accordance with all relevant standards and guidelines could be free from any compromise to welfare. However, this would ignore the emphases on affective states and naturalness often used by citizens to assess animal welfare in a moral and ethical context.

In short, it is one thing to provide a person with information that encourages understanding and acceptance. It is another matter entirely to attempt to educate away their values.

2.3 Transparency, trust and shared values

A social licence to operate has been defined as the privilege of operating with minimal formalised restrictions in regard to regulation, legislation or market-based mandates that comes from maintaining public trust by doing what is right (Fleck, 2015). The withdrawal of a social licence can lead to increased litigation, regulations and consumer demands, all of which hamper the success of industries (Coleman, 2018).

The Center for Food Integrity (CFI) has been carrying out consumer research on trust since 2007 and explains that the foundation for building trust is meeting consumer needs and better aligning food system practices with consumer values and expectations. Their research has shown that shared values are three to five times more important than demonstrated technical ability or science when it comes to building trust (The Center for Food Integrity, 2018).

In order to foster these shared values, CFI CEO Charlie Arnott emphasises the importance of acknowledging problems where they exist and communicating the fact that whilst a perfect solution may not be available, the industry in question is genuinely working towards a better future. When a particular practice is challenged, trust can be maintained by acknowledging the community's concern as valid and offering an insight into how the industry is working to improve the situation (Charlie Arnott, pers. comm., October 2018).

Whilst facts and figures are necessary to quantify industry standards, ultimately it is the winning of hearts and minds that leads to true acceptance. In the case of non-replacement dairy calves (NRDCs), better alignment of industry practices with consumer values and expectations is built on two foundations. The first is upholding an acceptable minimum standard of care. The second is ensuring that animals are valued.

Chapter 3: Turning challenge into opportunity

"What really drives stewardship is value" - Joel Salatin

Whilst not usually a significant contributor to the identity of the Australian dairy producer, the fact of the matter is that every dairy farm produces beef. Whether it is cull cows or surplus calves, failure to appreciate the value of these animals is financial waste, food waste and a genuine threat to the industry's reputation.

On a global scale, the world's dairy and beef herds actually contribute equally to total beef production. Whilst the opposite occurs in Australia, in Western Europe and South Asia, the milk herd dominates beef outputs, with surplus calves and cull cows contributing 80% of Europe's beef (Gerber, et al., 2015).

What, then, are the options available to the dairy sector for realising the value potential of bobby calves?

3.1 Holstein beef

With Holsteins accounting for 65% of Australia's 1.5 million head dairy herd (Dairy Australia, 2018b), a significant opportunity exists to increase the production of beef from surplus Holstein calves.

Despite suffering from somewhat of an image problem, there is little evidence that the quality of meat from Holstein animals is inferior to traditional beef breeds (Cole, et al., 1964; Muir, et al., 2000). It is, however, widely accepted that when compared to beef breeds, dairy bred animals are associated with lower dressing-out percentages (Coleman, et al., 2016) and take longer to reach mature slaughter weights (Muir, et al., 2000).

3.1.1 Case Study: The Beyond Calf Exports Stakeholders Forum

In the early 2000s, the UK dairy industry had been facing rising public criticism of the management of non-replacement dairy calves for many years. Due to low inherent value, NRDCs were often seen as waste products and consequently euthanized at birth or exported live to Europe for controversial white veal production.

In 2006, Compassion in World Farming and the RSPCA convened the Beyond Calf Exports Stakeholders Forum in an effort to bring major stakeholders together to agree on sustainable and practical solutions for male Holstein calves. Stakeholders involved in the forum included retailers, processors, producers, levy boards, veterinarians, academics, farmers' unions and NGOs among others.

With more than 90% of the Great Britain's milking herd comprising of Holsteins at the time, the forum recognised that market pull-through mechanisms were needed to encourage farmers to rear calves instead of euthanizing on farm or exporting to Europe. This resulted in the development of improved rearing systems and new markets for Holstein beef. Between 2006 and 2013, the number of calves being exported to Europe declined by 90%, the number of dairy calves being retained for rearing in Great Britain increased by 58%, whilst the number of calves being killed on farm declined by 36% (Beyond Calf Exports Stakeholders Forum, 2013).

Initiatives undertaken by stakeholders included leading retailer Tesco developing a producer scheme that grew the market for calves, whilst Marks & Spencer, Tesco, Sainsbury's and Waitrose also focussed on high-welfare veal production. Blade farming (now owned by ABP Food Group, UK) implemented a vertically integrated dairy beef model which created an additional 7,500 spaces for male Holstein calves and an additional 12,500 spaces for dairy calves from other breeds. The model sees Blade purchase young calves and contract out the rearing and growing under a forward price contract model in order to promote financial sustainability (Beyond Calf Exports Stakeholders Forum, 2013).

Despite its initial success, it seems that in the years following the forum the number of calves being retained for beef production in the UK has begun to fall again. According to the UK Agriculture and Horticulture Development Board's Dairy Senior Scientist, Jenny Gibbons, the main driver of this change appears to be market saturation in densely populated dairy areas during Spring when both dairy and beef cows are calving, with beef breeds having priority in the marketplace. However, whilst old and new challenges continue to present themselves, widespread stakeholder motivation to improve the situation remains. (Jenny Gibbons, pers. comm., June 2018)

3.1.2 Holstein beef production systems

3.1.2.1 Veal production

In Australia, veal is defined as meat that is pink in colour, coming from young cattle with no permanent incisor teeth, weighing no more than 150kg (Ausmeat, 2018).

When calves on a milk diet have access to adequate roughage, the meat produced is of a pink colour, often marketed as rosé veal. This differs from the traditional white veal produced in Europe where animals are kept indoors on a diet of milk with restricted roughage and iron in order to produce a paler meat.

In the UK, rosé veal systems fall into two main categories, those that finish at 6-7 months at up to 300kg live weight (LW) and those that finish at 10 months at up to 420kg LW (Vickers & Brown, 2015).

In the ten-month system, calves are initially reared on milk replacer and are supplemented with a concentrate blend with ad-lib straw. Calves can be weaned at five to six weeks old at around 60kg or at 12 weeks of age at 110-115kg. They are then finished on a high starch diet to promote muscle growth rather than frame with 16% crude protein (Vickers & Brown, 2015).

3.1.2.2 Bull systems

When Holsteins are reared for beef through to adulthood, bulls require a high energy (usually starch rich) diet to achieve fast growth rates and adequate finish. Entire males can be finished relatively quickly in these intensive systems, processing before they are 16 months of age. Where bulls are finished on forage-based systems, this requires achieving a lifetime growth rate of at least 1.1 kg/day. This is common in New Zealand, although bulls are usually older at slaughter, typically at least 18 months of age (Promar International, n.d.). The superior feed conversion efficiency of bulls compared to castrated cattle is due to the effects of testosterone. They also produce leaner carcases with a higher yield of edible meat in a shorter time frame than steers (Vickers & Brown, 2015).

3.1.2.3 Steer systems

Alternatively, bull calves can be castrated and grown more slowly, finishing between 18 and 24 months of age. There are advantages and disadvantages of both bulls and steers. Steer production can be more flexible, utilise grazing land and can be easier to manage (Vickers & Brown, 2015). They are also more suited to extensive grass-based systems and can better utilise lower quality feed (Promar International, n.d.).

3.2 Sexed semen

The challenge of finding a market for pure dairy breed NRDCs as beef animals has vast potential to be mitigated by the use of sexed semen. The difference between male sperm that carry a Y-chromosome and female sperm that only carry X-chromosomes can be exploited so that semen for artificial insemination (AI) can effectively be 'sorted' into a predominantly single sex dose.

3.2.1 Benefits

The sorting of semen into predominantly female sperm allows cows to be inseminated with dairy breed semen that offers a 90% chance of the resulting calf being a female (Seidel, 2003). In this way, the required number of replacement pure dairy breed heifers can be bred from bulls selected for their dairy traits, allowing the remainder of the herd to be mated to bulls that are selected on their beef merits. The resulting beef cross dairy breed calves offer potentially greater profitability as beef animals compared to pure dairy breeds (Murphy, et al., 2016), thereby going a way towards addressing the issues associated with low value NRDCs (Holden & Butler, 2018).

Further benefits of sexed semen include the potential to accelerate genetic gain of replacement females, with all replacement heifers being born to the top ranked cows in the herd. If sexed semen is used on a greater percentage of the herd than what is required for on-farm replacements, herd expansion can be facilitated if desired. Alternatively, surplus heifers can be sold as valuable replacements for other farms, with the export market remaining an option for Australian dairy heifers. Further, sexed semen has the potential to reduce the birth rate of male Jersey and Jersey-Holstein cross calves, often seen as poor prospects for beef production (Holden & Butler, 2018).

3.2.2 Challenges

The biggest barriers to increased uptake of sexed semen are the increased cost of purchase as well as potentially reduced conception rates.

Holden and Butler (2018) reviewed several studies that have reported improved fertility performance with sexed semen since 2014. However, they note that these higher values are only observed in well managed herds and quickly deteriorate in herds with average to poor management.

Furthermore, in strictly seasonal calving systems, any reduction in conception rates has the potential to disrupt calving patterns and cause financial loss. Leading New Zealand genetics company, Livestock Improvement Corporation (LIC), conducted a trial in spring 2017 comparing straws of 'control' and 'sexed' semen. It was found that the frozen sexed semen resulted in 13.3% less conceptions compared to standard conventional frozen semen (Voogt, 2018). The company therefore concluded that for New Zealand's strictly seasonal herds, the reduction in the reproductive performance would be too great for most farmers contemplating using frozen sexed semen (Hamill, 2018).

3.2.3 Getting the best results

To get the best results when using sexed semen, it is recommended that strategic, planned use be employed. Based on the recommendations from Holden & Butler (2018) as well as Voogt (2018), the following steps should be considered:

- Determine the number of replacement heifers required and breed the desired number from high genetic merit cows using high genetic merit sexed semen;
- Consider inseminating these cows ahead of the main herd's mating start date to minimise the impact of those that do not conceive;
- Choose healthy cows that calved earlier, have already had a premating cycle, and are on full standing heat;
- Inseminate the remainder of the herd (lower genetic merit dams) with beef semen;
- Consider joining yearling heifers to sexed semen 2-3 weeks ahead of the herd. Their naturally higher average conception rates, along with being joined well ahead of the herd may help reduce calving pattern impacts.

3.2.4 Case Study: VikingGenetics, Denmark

In Denmark, increasing dairy herd sizes and environmental restrictions have been leading to increases in NRDC euthanasia over the last 30 years. Whilst pressure to address the handling of NRDCs has come from a small section of the public, most are not aware of the issue. Instead, the pressure to change the way the Danish dairy sector deals with NRDCs has come from dairy stakeholders themselves, wanting to be in control of any strategies used to address the problem, rather than waiting for government regulations to be imposed that may disadvantage the sector. As a result of this, in February 2019 Danish Jerseys and the Danish Cattle Federation agreed to ban NRDC euthanasia from January 2022.

Peter Larson, Jersey Breeding Manager for VikingGenetics in Denmark, has seen an increase in the uptake of sexed semen in recent years, with the figure at 59% as of June 2019. VikingGenetics Denmark will continue to promote this uptake and plans to stop producing unsexed Jersey semen within the next two years in an effort to reduce the number of unwanted male jersey calves as much as possible before the practice of euthanizing calves at birth is phased out in the near future.

According to Peter, "*it will make it easier for farmers if they can't buy (unsexed Jersey semen) anymore. Today they have the issue of deciding whether they are better to pay extra for sexed semen or whether unsexed bulls are better. The decision will be easier if it is all sexed. The new top Jersey bull will only be available once he produces sexed semen*" (Peter Larson, pers. comm., October 2018).

3.3 Beef over dairy crossbreeding

Using beef bulls over dairy cows that are not required as dams of replacement heifers is not a new concept. However, the practice has developed somewhat of a stigma, with many producers having suffered bad experiences with calving difficulties and associated production losses (Jolly, 2016). Despite this, the use of carefully chosen beef bulls has the potential to increase the number of NRDCs that are profitable as beef animals while minimising negative impacts on dairy cow performance.

3.3.1 Calving ease and gestation length

The concern that a beef bull will create issues with dystocia has been cited as one of the major barriers to increased uptake of the use of beef genetics by dairy farmers (Oliver & McDermott, 2005). However, significant work has taken place in New Zealand, placing heavy selection pressure on beef bulls for high calving ease and shorter gestation length. This theoretically has the potential to mitigate ill-effects that may occur when using beef bulls as 'mop-up' sires at the tail end of the joining period.

The Beef + Lamb New Zealand Dairy Beef Integration Project compared the performance of calves sired by unrecorded Hereford bulls with those sired by Ezicalve Hereford sires which have high estimated breeding values (EBVs) for both calving ease and calf growth. Results showed that there were no assisted calvings for Ezicalve sired calves in either year of the study. In contrast, of the calves sired by unrecorded Hereford bulls, 4% required calving assistance in the first year and 2% in the second year of the study (Burggraaf, 2016).

3.3.2 Growth rates

Whilst an emphasis on calving ease and gestation length are important factors to consider when selecting a beef sire for dairy crossbreeding, emphasis should also be placed on the quality and growth potential of resultant calves.

The Dairy Beef Integration Project found no difference across sire types in the time for their calves to reach 100 kg LW, live weight gain during finishing, or revenue received per day on the finishing farm, indicating that using lower birth weight bulls did not result in a disadvantage in terms of growth once the calf was born. It appears that despite being born smaller, these calves catch up relatively quickly (Burggraaf, 2016).

3.4 Jersey beef

Whilst prejudices exist against dairy beef in general, no other animal seems to have been so categorically rejected as uneconomical for beef as the male jersey calf. The Jersey breed is these days synonymous with quality, high butterfat content milk and in truth, does not exhibit the growth characteristics of traditional beef breeds. But are we overlooking the potential of this breed as a beef animal that offers quality rather than quantity?

3.4.1 Disadvantages

The most frequently cited reasons for the lack of economic viability associated with rearing Jersey calves for beef is their slow growth rates and reduced carcase yields, with growth rates being on average 25% slower than Friesians (Morris, Navajas & Burnham, 2001). The Jersey animal's reduced carcase yield in comparison to traditional beef breeds has also been confirmed by several studies (Cole, et al., 1964; Coleman, et al., 2016; Morris, Navajas & Burnham, 2001), with dressing percentage often being down around 50% (Albertí, et al., 2008).

3.4.2 Meat quality

Despite their slow growth rates and low carcase yields, the Jersey breed's strength as a beef animal lies in the quality of the meat, namely marbling, tenderness, taste and fat characteristics.

Morris, Navajas and Burnham (2001) noted that "one of the most outstanding characteristics of beef from Jersey cattle is the high level of intramuscular fat." This was confirmed by Siebert and Pitchford (1999) who found similarities to Wagyu in regard to the marbling of Jersey beef.

Further, the tenderness of Jersey beef has been confirmed, measuring lower Warner-Bratzler shear force values than traditional beef breeds (Morris, Navajas & Burnham, 2001) and

performing better on taste panels for tenderness (Cole, et al., 1964; Morris, et al., 2001). Overall eating experience has also been rated highly (Morris, et al., 2001), in one instance being ranked similar or even superior eating quality to Hereford or Angus beef (Cole, et al., 1964).

3.4.3 Market potential

Whilst it has been recognised that the use of Jersey animals for dairy beef is unlikely to be profitable if payments are based on carcass weight alone (Morris, et al., 2001), opportunity exists to add value by marketing the product on its superior eating quality (Cook, 2014).

Nielsen (2016) identified the potential to brand Jersey beef not only on its eating quality and comparison to Wagyu, but also on ethical aspects such as animal welfare. Arguably, there could also be a place to use the smaller carcase yields to a marketing advantage, with smaller servings of red meat being in line with current health recommendations (Australian Government Department of Health and Ageing, 2013).

Furthermore, changing food attitudes could present a unique opportunity to turn one of the most commonly cited disadvantages of Jersey beef into an opportunity. Meat from Jersey animals tends to exhibit more yellow fat compared to Friesians (Morris, et al., 2001). This has been attributed to the presence of beta-carotene in the tissues; a combined effect of genetics (Tian, et al., 2010) and the amount of grass in the diet (Daley, et al., 2010). Historically, this has been interpreted by consumers as a sign of poor quality (Nielsen, 2016).

However, there appears to be an emerging trend towards an increased consumer desire for yellow fat, fuelled by the rise in popularity of grass fed beef. Gerard Hickey of Firstlight Wagyu, New Zealand has noted that their business has started getting negative reactions from Californian consumers towards their grass fed wagyu beef if the fat colour appears too white. “Suddenly, the yellow fat, which for generations has been scorned, is now a bit of a claim to fame” (Gerard Hickey, pers. comm., October 2018).

Further evidence of this emerging trend has appeared on social media. A recent Instagram post (Figure 4) by Victor Churchill, a high-end butcher shop in Sydney, praised the quality of meat from a retired Jersey cow, clearly showing bright yellow fat in the cuts of meat.

Figure 4: Instagram post from Victor Churchill butcher praising jersey beef and its yellow fat, June 21, 2018. (Source: https://www.instagram.com/p/BkRswZylycv/).

Praise of yellow fat on social media has also come from highly acclaimed American chef, Dan Barber (Figure 5) who compared the fat of a 'conventionally raised cow' with the strikingly yellow fat of a grass fed retired dairy cow, describing it as nutrient dense and high in omega-3 fatty acids with a higher percentage of unsaturated fats.

Figure 5: Instagram post from chef Dan Barber praising the yellow fat of a grass fed retired dairy cow, October 19, 2018. (Source: https://www.instagram.com/p/BpFkYEfBvu1/).

It appears that the real obstacles to increased uptake of value added Jersey beef is a lack of knowledge and support from the retail sector as well as a lack of conviction of the product's merits from producers, slaughterhouses and consumers. However, better communication of the qualities and story behind Jersey beef holds significant potential for increasing uptake (Nielsen, 2016).

3.4.4 Case Study: Thise and Ko, Denmark

In an attempt to create a proactive solution to the challenge posed by NRDCs, Danish organic milk co-operative, Thise Dairy, looked to offer a viable alternative to calf euthanasia. To this end, Thise developed its own branded Jersey beef product known as Thise & Ko (Nielsen, 2016).

The project has involved connecting Thise's 28 suppliers with organic arable farmers looking to reintegrate livestock back into their cropping rotation to improve soil fertility. Non replacement Jersey calves are reared through to weaning on Thise's dairy farms before being grown out and finished on organic arable farms. Organic grain grown on farm is fed to the calves while the composted bedding from the barns is used as organic soil ameliorants. Cattle also graze sections of the farm as part of the cropping rotation.

When Thise secured a procurement contract with Danish retail group Coop, beef advisor Per Spleth worked to establish a fixed price for the Jersey beef that would allow them to be at least as profitable as raising Holstein animals for beef. The resulting product is one that sells on Coop's shelves for a higher price per kilogram than conventional beef with excellent consumer uptake (Figure 6).

Figure 6: Thise and Ko branded Jersey beef, November 18, 2018. (Source: https://thise.dk/historier/thise-ko/).

From Per's perspective, the program is attractive to arable farmers based on the fact that it requires no investment in breeding stock, provides the ability to destock quickly if seasonal conditions deteriorate and offers a guaranteed price for the product produced.

The bull calves are not castrated or dehorned and are finished at approximately 14 months of age and 400kg live weight (Figure 7). Alternatively, some producers have castrated calves and

finished them as steers at 22-24 months of age. Per emphasises the importance of concentrate supplementation as without starch in the diet, bulls struggle to reach an adequate fat score.

Whilst Holsteins generally record daily live weight gains of around 1.4kg per day in similar systems, the Jersey bulls can achieve 1kg per day with most recording gains in the range of 0.7-0.85kg per day. Whilst this impacts the amount of feed required to produce a finished animal, these costs are recouped at the supermarket end through effective marketing of the product.

Figure 7: A 14-month old Jersey bull ready for processing at 400kg live weight, September 25th, 2018

Whilst the program has been successful, there is still a desire to maintain the niche market, with Thise actively encouraging the use of sexed semen and beef crossbreeding to minimise the number of purebred male Jersey calves born. Per attributes the success of the program to good marketing, emphasising that the story behind the product must be told in order to receive an adequate price (Per Spleth, pers. comm., September 2018).

3.5 The case for increasing early nutrition

When it comes to rearing dairy beef, it has been recognised that the most intensive and expensive phase of production is the rearing of calves from birth to weaning. These expenses are largely attributed to milk, labour and facilities (Meat and Livestock Australia, n.d.). It should also be noted that pre-weaning is the highest risk phase of rearing, with 50% of the calf mortalities that occur in the first year of life taking place during the first 6 weeks from birth (Teagasc, n.d.).

Traditional recommendations for profitable dairy beef rearing systems are based on feeding a daily milk volume equivalent to 10-12% of bodyweight (approximately 4L of milk or 500g of milk solids) and aiming for early weaning at four to six weeks of age by promoting early concentrate consumption through restricted milk intakes. Target growth rates in these systems are 0.4kg per day (Meat and Livestock Australia, n.d.).

However, studies have suggested that increasing the amount of milk fed in the pre-weaning phase could have significant production and welfare benefits. The feeding of ad-libitum milk to calves from a nipple has been shown to result in significantly higher growth rates of up to 1.1kg per day, with calves drinking approximately 20% of their bodyweight (Appleby, Weary & Chua, 2001; Jasper & Weary, 2002; Marshall & Smith, 1970; von Keyserlingk, et al., 2006). A further benefit of feeding increased volumes of milk is the potential to reduce cross-sucking – a behaviour linked to inadequate satiation that increases the likelihood of disease transmission and is consequently one of the primary reasons for housing calves individually (Lidfors, 1993).

Regardless of the system used, concentrate consumption in calves less than 3 weeks of age has been shown to be negligible (Appleby, et al., 2001). Therefore, calves on restricted feeding regimens at this age can be significantly disadvantaged in regard to energy consumption and consequent growth rates compared to their ad-libitum counterparts.

It is a commonly held belief that feeding calves too much milk will cause diarrhoea (Grøndahl, et al., 2007). However, the above-mentioned studies found that feeding *ad-libitum* milk had no effect on the incidence of diarrhoea. Whilst Appleby, et al. (2001) suggested that feeding *ad-libitum* milk from a bucket could result in some milk entering the reticulum and causing digestive problems, this can be mitigated by feeding milk via a nipple.

One disadvantage of feeding increased milk volumes could be the reduced pressure on calves to consume more concentrates early in life (Appleby, et al., 2001). Careful consideration therefore needs to be given to weaning calves that have been fed higher milk volumes, as those weaned abruptly have been shown to experience drops in weight gain as a result of low intake of starter pre-weaning. Gradual weaning over ten days appears to overcome this challenge (Sweeney, et al., 2010).

3.6 Cow-calf separation – could there be benefits in rearing calves on cows?

In addition to the management of bobby calves, the practice of early-life separation of dairy calves from their dams is emerging as a significant public concern and a threat to the dairy industry's social licence (Ventura, et al., 2016). When this is considered in light of the challenges that come with conventional calf rearing, as well as the production benefits associated with feeding more milk, it begs the question – could there be merit in dairy systems that rear calves on their dams?

3.6.1 Public and producer attitudes

In order to assess attitudes to cow-calf separation, Ventura, et al. (2013) surveyed a cross section of dairy industry stakeholders as well as the 'disconnected' general public. Regardless of whether they supported or opposed separation, affective states and health were key themes behind most participants' justifications, demonstrating that despite their differing opinions, people on either side of the argument shared similar core values.

For opponents, the idea of breaking the cow-calf bond provoked strong reactions, in part because of similarities drawn to the human mother-child relationship. Affective states were also referenced by supporters who viewed separation as more stressful the longer the cow and her calf stayed together. Supporters of early separation also believed that it protected the health of the calf, largely because it provided a "means to break disease transmission" with reduction in Johne's disease (*Mycobacterium avium subspecies paratuberculosis*) most often mentioned. In contrast, opponents to early separation expressed scepticism towards this concept, claiming that "current methods of management still result in high levels of disease in dairy calves" (Ventura, et al., 2013).

Another study surveyed a section of the public largely living in urban environments with little or no association with dairy production. In this case, the majority of participants did not support the separation of dairy cows from their calves and only 33% of respondents were even aware that the practice occurred prior to participating in the study. Interestingly, when further information justifying the practice was provided, higher rates of rejection were recorded (Hötzel, et al., 2017).

In regard to the producer's perspective, Flower & Weary (2003) reviewed reasons cited by dairy farmers for early-life separation of cows and calves. Reasons included economic limitations, facilitation of closer monitoring of calves, avoidance of nutritional diarrhoea from

overconsumption of milk, minimisation of post-partum anoestrous, avoidance of issues with milk 'let-down' and, interestingly, compassionate grounds, with producers often arguing that early removal minimises the stress of separation in comparison to later calf removal.

3.6.2 Effects of Separation on the cow

3.6.2.1 Behavioural

The suggestion by producers that delayed separation of cows and calves elicits a more intense behavioural reaction compared to separation immediately after birth has been supported by multiple studies (Flower & Weary, 2001; Lidfors, 1996; Sandem & Braastad, 2005; Stěhulová, Lidfors & Špinka, 2008; Weary & Chua, 2000).

However, Hudson & Mullord (1977) showed that even five minutes of contact with a calf immediately post-partum is sufficient for the formation of a strong maternal bond (Figure 11). If we therefore accept that cows will experience negative affective states upon separation from their calf if carried out any later than five minutes post-partum, what then are our options for reducing the stress of separation? Work has been undertaken in this space and is discussed in 3.6.4 'weaning'.

Figure 8: Cow with her calf at Old Hall Farm, United Kingdom, June 20th, 2018

3.6.2.2 Health

The majority of studies to look at the effects of rearing calves on cows have recorded positive effects on overall cow health, with the incidence of mastitis being of particular note. Walsh (1974) found that cows suckled twice daily for 100 days recorded 2.1% of udder quarters with mastitis as opposed to machine milked cows that recorded 29.2% of quarters. This difference persisted into the mid-lactation period. Further, a review by Krohn (2001) concluded that whilst a link between suckling and decreased incidence of mastitis has not been proven, a number of papers point to overall positive effects on the udder that also appear to cover a good part of the post-weaning period. This finding is supported by Beaver, et al. (2019), a systematic review which did not find any benefits to early separation on cow health, with all included studies demonstrating either a reduced risk of mastitis or no difference for cows suckling calves.

3.6.2.3 Production

Whilst some papers have recorded no significant effects of suckling on the volume of milk produced (de Passillé, et al., 2001; Flower & Weary, 2001; Lee, et al., n.d.), some studies have found that suckling calves actually increases total milk yield. During the suckling period, both Bar-peled, et al. (1994) and Thomas, Spiker & Mickan (1981) found that total milk production was higher for cows feeding calves compared to those that were machine milked. Increases in recorded milk yields have been up to 16% over a 300-day lactation (Fulkerson, Hooley & Findlay, 1978). Suggested reasons for the increase in milk yield from cows suckling calves are more complete milk let-down and better udder health (Fulkerson, et al., 1978; Krohn, 2001).

3.6.2.4 Reproduction

The potential for suckling to cause a prolonged period of post-partum anoestrous is often referenced as a reason for separating calves and cows (Flower & Weary, 2003) and studies have in fact shown this to be true (Krohn, et al., 1990; Thomas, et al., 1981). Despite this, it appears that whilst the period of post-partum anoestrous may be longer, the actual calving to conception interval does not appear to be affected (Flower & Weary, 2003; Krohn, 2001; Krohn, et al., 1990), with one study finding that the calving to conception interval was significantly shorter in cows rearing calves (Metz, 1987). In short, whilst it may take them longer to start cycling, it appears that cows suckling calves could, in fact, be more fertile.

3.6.3 Effects of Separation on the calf

3.6.3.1 Passive Transfer

Colostrum is the first 'milk' that comes from the udder after calving and contains a range of important molecules including antibodies. Calves depend on the ingestion of an adequate volume of sufficient quality colostrum within the first 24 hours of life in order to confer protection against a range of diseases. Failure of passive transfer (FPT) occurs when calves fail to absorb an adequate concentration of antibodies from colostrum into their bloodstream and leaves them vulnerable to disease (Weaver, et al., 2000).

Statistics about the high percentage of dairy calves that fail to record an adequate transfer of passive immunity when left alone to suckle their mothers are often quoted. Published figures include 38% (Franklin, et al., 2003), 42% (Brignole & Stott, 1980) and as high as 68% (Besser, Gay & Pritchett, 1991).

Additionally, Beam, et al. (2009) conducted a survey, finding that calves on US farms that allowed suckling were 2.4 times more likely to suffer FPT than calves on farms that did not allow suckling and instead hand-fed colostrum to calves within four hours of birth. Despite this, a cross-sectional study of conventionally reared Victorian dairy calves, the majority of which were separated within 24 hours of birth and hand-fed colostrum, still recorded an FPT rate of 38% (Vogels, Chuck & Morton, 2013). This suggests that despite the promotion of early separation for improving FPT rates, current management standards may still be failing to achieve the desired outcome in some situations.

There is little argument against the case that leaving calves to suckle alone is less likely to result in adequate passive transfer of immunity. However, there are few reasons why active colostrum management cannot be practiced in systems where calves are reared on cows. A recent study by Johnsen, et al. (2019) found that calves that suckled their dams and were visually monitored during the first few hours of life had a similar risk of FPT as calves in conventional herds that were separated from the dam and fed a fixed amount of colostrum by bottle. Thus, if passive transfer is actively managed on farms where calves are reared on cows, the incidence of FPT may in fact be equal to or less than when calves are separated.

3.6.3.2 Disease Incidence

Interestingly, while Franklin, et al. (2003) recorded 38% of calves that suckled their dams with FPT, there were no differences between suckled and bottle fed calves for total daily live weight gain, grain consumption, incidence of diarrhoea, or electrolyte treatments per calf. In

addition, average days to weaning was actually greater for bottle fed calves compared with suckled calves.

Calves suckling their dams were also found to have a lower incidence of diarrhoea by both Weary & Chua (2000) as well as Rajala & Castrén (1995). Further, a review by Krohn (2001) found that in general, suckled calves tend to have a low incidence of disease. This is supported by Grøndahl, et al. (2007) who did not observe any calf illness during a case study of calves suckling their dams for the first 6 to 8 weeks of life. Furthermore, a systematic review by Beaver, et al. (2019) concluded that the available scientific evidence does not support the recommendation of immediate separation of calves on the basis of promoting calf health.

However, one of the most significant concerns around suckling calves and disease incidence is the potential for transmission of Johne's disease. It has been shown that in herds infected with Johne's disease, strict separation of calves from cows immediately from birth can lead to a sharp decrease in the disease prevalence (Marcé, et al., 2011). For this reason, immediate separation of calves from their dams is considered best practice management in the Australian dairy sector. However, in their review, Beaver, et al. (2019) found 'an absence of literature to suggest that immediate dam-calf separation confers benefits toward mitigating Johne's disease', placing more importance on the maintenance of good hygiene as opposed to immediate separation. Consideration therefore needs to be given to promoting further research in this space in order to better understand the complexities around cow-calf separation and Johne's disease prevalence.

3.6.3.3 Growth

A discussion on the positive effects of feeding ad-libitum milk to calves via a nipple was made earlier in chapter 3.5 and it appears that these benefits also translate to systems where calves suckle from cows. Significant weight gain advantages have been shown in calves suckling cows even for a short period of time with both Metz (1987) and Krohn (2001) noting that these calves exhibited double the growth rates of conventionally reared calves, gaining up to 1kg per day. Longer term suckling systems also result in accelerated calf weight gains (Bar-Peled, et al., 1997; de Passillé, et al., 2001) with growth rates up to 1.3kg per day reported by Grøndahl, et al. (2007) when calves were kept with their mothers for the first six to eight weeks of life.

Interestingly, Krohn, et al. (1999) showed that both calves allowed to suckle their dams as well as calves reared with their mothers but who were prevented from suckling both grew at twice the rate of calves reared in absence of their mothers. This suggests a positive effect of the mere presence of the dam on the growth rate of the calf, separate from the increased nutrition offered by suckling directly from the udder.

Figure 9: Ten-week old dam-reared purebred Jersey calf exhibiting impressive body condition at Old Hall Farm, United Kingdom, June 21st, 2019 (Photo credit: Rebecca Mayhew)

3.6.3.4 Future productivity

It has been shown that heifer calves reared on increased volumes of milk can reach puberty earlier and experience an increased milk yield in their first lactation (Shamay, et al., 2005). Bar-Peled, et al. (1997) also found that age at conception was significantly lower and conception rate was significantly higher for calves that suckled their dams three times a day in the first six weeks of life.

Positive effects for male dairy calves being reared for beef were also found by Grøndahl, et al. (2007) who recorded an average daily gain of 1.4kg for growing bulls that were reared on their

dams for the first six to eight weeks of life. This was in comparison to the average daily gain of 0.9kg recorded in the wider population.

3.6.3.5 Behavioural

Perhaps one of the most profound behavioural effects of keeping cows and calves together is the reduction seen in non-nutritive sucking. 'Inappropriate' or 'non-nutritive' oral behaviours such as sucking other calves ('cross sucking'), inanimate objects or tongue rolling are thought to be related to an unsatisfied need to suckle (de Passillé, et al., 2001; Krohn, 2001). The behaviour has been seen to cause injuries to other calves, increase the spread of disease and has been one of the primary reasons for housing calves individually (Veissier, Caré & Pomiès, 2013).

Inappropriate oral behaviours are less common in calves kept with their dams (Fröberg & Lidfors, 2009; Veissier, et al., 2013), even when they are not receiving milk from the cow (Krohn, et al., 1999). This reduction in cross sucking in dam-reared calves has been seen to persist post-weaning and is thought to be more significant than in calves reared on an automatic milk feeder (Veissier, et al., 2013).

3.6.4 Weaning

Several authors have noted increased stress on both cows and calves at weaning after being kept together for extended periods of time (Flower & Weary, 2001; Lidfors, 1996; Veissier, et al., 2013). This stress is likely compounded by the fact that dam-reared calves often consume less concentrates pre-weaning than calves on restricted milk diets, leading to a growth check at the time of weaning (Bar-Peled, et al., 1997).

Options for mitigating these disadvantages are largely centred on encouraging nutritional independence from the dam prior to full weaning. The use of fence line separation of cows and calves that allows physical contact but not suckling prior to complete weaning has been shown to reduce stress responses from calves (Johnsen, et al., 2015). Implementing a supplemental milk source such as an automatic milk feeder or artificial teats delivering warm water or milk has also been shown to reduce the impact of separation on calves (de Passillé, et al., 2001; Johnsen, et al., 2018). The use of removable plastic nose flaps that allow calves to drink and eat solid food but prevent suckling from the udder have also been shown to reduce the stress experienced by both cows and calves (Loberg, et al., 2007; Loberg, et al., 2008). Presumably, the use of nose flaps to induce nutritional independence from the dam would

also encourage better concentrate consumption prior to weaning and potentially ameliorate growth rate reductions at this time.

3.6.5 Case Study: The Ethical Dairy, Scotland

David and Wilma Finlay milk 110 cows on their organic, grass-fed dairy in the south-west of Scotland. In October of 2016, they changed to their 'ethical dairy' model, where calves are reared with their dams.

A three-way cross of Swedish Reds, Montbéliardes and Holsteins, these cows rear their calves until weaning at five months of age, at which point they average 200kg live weight (Figure 10). The cows are fed on a grain-free ration for a 6000L annual milk production per cow, with 4000L going into the vat and an estimate of 2000L being consumed by each calf. The ration comprises forage and 900kg of lucerne pellets per cow per lactation and calving is split – once in March and once in November. Calves stay with their mothers 24 hours a day until 6 weeks of age, at which point they are separated for 12 hours overnight. Leading up to weaning, separation is increased to 16 hours a day.

Figure 10: Holstein/Montbéliarde/Swedish Red cross cows rearing calves at The Ethical Dairy, Scotland, June 26th, 2018.

Cows are milked once daily while rearing calves and twice daily post weaning. David advises that there is little extra milk yielded if cows with calves at foot are milked twice daily compared to once daily. Cows yield between 3L and 10L per day while suckling calves and being milked once daily. Post weaning, cows average 23L per day from twice daily milking. Twice daily milking continues for approximately ten weeks post calving before going back to once daily milking and an 18L per day average. Milk constituents from suckled cows are approximately 2.8% butterfat and 4.5% protein. The reduced butterfat is thought to be related to suckling, being around 4.5% when not suckling calves.

David remarks that "udder health has been surprisingly good given the amount of milk dribbling from swollen udders post calving." In the Spring of 2018, they treated five out of 110 cows for mastitis and only three of those were with an antibiotic. Teat injury during suckling is a slight issue and appears to worsen the longer calves are kept on 24-hour suckling.

Post-partum anoestrous was an issue in their first year of the system, with a delay of approximately 30 days. They have since purchased a vasectomised bull to run with the fresh herd which appears to have mitigated the issue. Difficulties with milk let-down by heifers was a challenge but this has been greatly reduced by spending more time acclimatising heifers to the parlour pre-calving.

Following an outbreak of *Cryptococcus* diarrhoea in the barn during their first year of keeping calves with cows, the Finlays have implemented a rigorous colostrum management routine with good success. Cows calve in steam-cleaned calving pens and are kept separate from the rest of the herd for the first three days post-partum. Calves are closely observed to ensure they take 300 'sucks' of colostrum direct from the udder and are supplemented with an additional 2.5L of measured quality colostrum to achieve a total intake of 4-4.5L in the first 24 hours of life.

Pre-weaning, calves gain an average of 1.3kg per day which reduces to 0.8kg per day once weaned onto a grass-based diet. An Angus bull is used over the heifers as well as 60% of the mature herd, resulting in half the calves born on the farm being Angus cross (Figure 11). NRDCs are either sold as rosé veal at 8-9 months of age and 350kg live weight or into the organic market at 16 months of age and 550kg live weight.

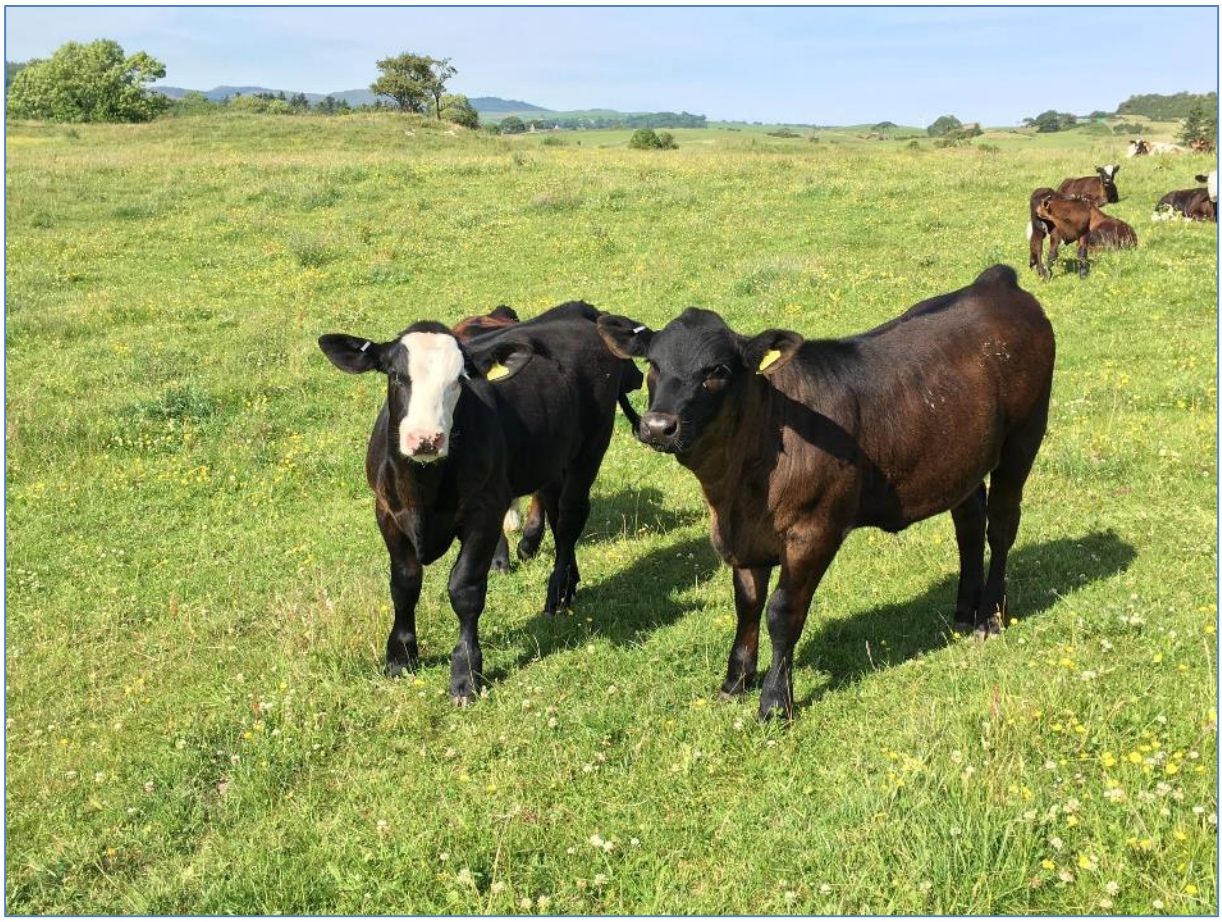

Figure 11: Four-month old Angus cross calves being reared by their Swedish Red/ Montbéliarde /Holstein cross dams at The Ethical Dairy, Scotland, June 26th, 2018.

The business has a strong online presence and is very active on social media, with an emphasis on transparency. By restructuring their production system in order to re-align with public values, the Finlays have succeeded in their vision of a 'radical new approach to dairy farming' (David Finlay, pers. comm., June 2018).

3.6.6 Where to from here?

Whilst well-designed systems where dairy calves are reared on cows offer many potential benefits to production, health, welfare and potentially economics, they are by no means a one size fits all solution for the dairy industry as it currently stands.

There is a significant need for further research into cow-calf systems in regard to production, profitability, health risks and benefits. It should also be recognised that the concept presents a unique challenge in largely grass based dairy systems such as Australia and New Zealand.

Regardless, the benefits of social housing and increased milk allocations for calves offer benefits more accessible to today's average dairy farm.

3.7 Selling the story

In attempting to realise the value potential of non-replacement dairy calves, there are significant opportunities to be explored when it comes to telling the story behind the product. Far from being a genuine 'waste product', dairy beef offers several unique selling points that speak to a genuine inherent value. It simply requires a shift in perspective.

3.7.1 Taste and nutrition

The enhanced eating experience of Jersey beef in comparison to traditional beef breeds was discussed earlier in the chapter and Holstein beef has also been shown to exhibit higher degrees of marbling (Lehmkuhler & Ramos, 2008). The current trend towards the health benefits of grass fed beef offers an opportunity to combine this with an emphasis on eating quality to add value to dairy beef products. This 'story' behind the product has been exemplified by Thise and Ko in Denmark (see 3.4.4 'Case study: Thise and Ko, Denmark').

3.7.2 Welfare

Opportunity also exists to brand dairy beef products on their high welfare status. Whilst welfare is only one of the influences on consumer behaviour (Coleman, 2018), it could be argued that the negative associations drawn between male dairy animals and their welfare in the past make an emphasis on the higher welfare status of the product all the more important. Programs such the 'RSPCA Approved Farming Scheme' for veal, grass fed certification schemes and the use of online platforms to achieve production system transparency all offer vast potential to brand veal or dairy beef products as high welfare.

3.7.3 Carbon footprint

Since the release of the FAO report 'Livestock's Long Shadow' (Steinfeld et al., 2006), significant debate has focused on the impact of red meat farming on climate change. However, it has been suggested that beef from the dairy herd 'shows the largest potential to mitigate the environmental impacts of beef' (de Vries, van Middelaar & de Boer, 2015).

Several reports have shown beef from the dairy herd to have significantly less environmental impact than beef from specialized beef herds, notably on global warming impact, acidification and eutrophication (Mogensen, et al., 2015; Nguyen, Hermansen & Mogensen, 2010; Tichenor, et al., 2017). One particular study found that the emission intensity of beef from specialised beef herds is almost fourfold that produced by dairy beef (68 vs. 18 kg CO2-e per kg of carcass weight) (Gerber, et al., 2013). The primary reason for this reduced footprint is the fact that when analysing the environmental impact of a particular production system, it is

necessary to distribute the total impact of the system between the various products (Mogensen, et al., 2015). In the case of dairy beef, emissions are allocated to both milk and meat, whereas they are allocated to beef alone in the case of specialised beef herds. When only the beef animals themselves are considered, specialized beef and surplus dairy calves have similar intensity per kilogram of carcass weight. It is the emission allocations from the reproductive animals, (the 'breeding herd') that account for the significant reduction in the case of dairy beef (Gerber, et al., 2013).

Discussions surrounding the ethical aspects of dairy beef are not only significant for adding value to the product in order to address the issue of low value non-replacement dairy calves, they are also central aspects of the conversation that needs to be had in regard to the preservation of the dairy sector's social licence.

Chapter 4: Changing the conversation

Moving forward as a sector on the matter of bobby calves requires a fundamental change in conversation. Real improvements are unlikely to come from focusing on communicating facts and figures that speak to an acceptable minimum standard of care. Instead, we must work towards better alignment of industry practices with community values. This must be achieved by actively engaging in conversation with the public, changing the perspective of producers and creating a shared vision of professionalism in order to maintain public trust.

4.1 Engaging with the community

The creation of platforms to engage in meaningful two-way conversation between dairy sector stakeholders and the community offers one of the most promising ways to build and maintain public trust (Ventura, et al., 2013). It is important here to acknowledge the distinction between the consumer and the public. It has been established that while consumers express concern about animal welfare, it does not necessarily result in a change in purchasing habits in the majority of cases (Coleman, 2018). In contrast, the wider public comprises consumers of dairy and meat products, as well as those who do not consume these products but whose voices are as much a part of the conversation on whether social licence to operate is granted.

According to Weary & Von Keyserlingk (2017), 'engagement efforts must extend beyond consumers of dairy products, to include citizens that are interested in the issues and who influence corporate and government responses'. New scientific research in regard to animal husbandry performed in tandem with social science research also has the opportunity to allow for the development of husbandry practices that are formed on these shared values, benefiting both the producer and the citizen.

4.2 Changing producer perspectives

Despite the growing interest in the concept of social licence within the agricultural sector, it appears that many people within the industry are still reluctant to consider the citizen's perspective as valid. According to Lush (2017), 'as a general observation, many Australian farmers seem to not fully comprehend or do not take seriously the consequences of consumers that do not understand the importance of an agricultural industry that has freedom to operate'. Raising awareness within the sector of the non-monetary value attached to the maintenance of social licence to operate is therefore of vital importance.

4.3 Can the livestock sector position itself as a profession rather than an industry?

In order to foster a culture of proactive protection of social licence and maintenance of public trust, could there be value in moving away from the term livestock 'industry' and its connotations?

Fraser (2014) draws parallels between the Industrial Revolution and the intensification of animal production. He explains that the emergence of these 'industries' led to public concerns, the response to which was the development of minimum welfare standards for both human factory workers and production animals. In contrast, Fraser explains that the concept of a 'profession', as opposed to an 'industry' provides a model of work that fosters higher performance. This model typically involves the provision of a service that people need, competence in a specialized area of skill, knowledge demonstrated to peers and creation of public trust by respecting the interests and ethical expectations of society, normally through self-regulation. Charlie Arnott (pers. comm., October 2018) of the Center for Food Integrity furthers this concept by explaining that 'collectively, you need to raise the bar, hold each other accountable and have programs in place to do that'.

By promoting a culture of professionalism, the issue of low-value non-replacement dairy calves is more likely to be seen as a shared responsibility by the entire dairy sector. When the maintenance of social licence and public trust is valued by all stakeholders, collective action is facilitated. This, in turn, will allow the sector to overcome immediate economic and logistical barriers to develop a common vision for how non-replacement dairy calves are managed in the future.

Conclusion

The inherent low value of non-replacement dairy calves both in Australia and overseas has led to public rejection of the way bobby calves are managed. This, in combination with the issue of cow-calf separation has brought the dairy industry's social licence under threat and resulted in missed financial opportunities for producers. In order to preserve public trust, the dairy sector must focus on the development of shared values with the community which relies on raising the value of non-replacement dairy calves.

Options for increasing the value of dairy beef animals include specialised rearing programs, the use of targeted beef crossbreeding combined with the use of sexed semen as well as marketing programs that position the products in a new light. Dairy systems where calves are reared on cows also have the potential to directly address public concerns while at the same time offering potential animal welfare and production benefits.

When it comes to bobby calves, preservation of the dairy sector's social licence relies on engaging in meaningful communication with citizens and ensuring that industry practices are in line with public expectations. Raising the value of non-replacement dairy calves is not only fundamental to the viability of dairy beef systems but will allow the dairy sector as a whole to move forward with a vision of professionalism and shared community values.

Recommendations

- Stakeholder-wide engagement on the issue of non-replacement dairy calves across the Australian livestock sector, focusing on solutions that appeal to the values of the community, with an emphasis on profitability across the value chain.
- Further investments from the beef and dairy sectors into research that evaluates the most profitable dairy beef production systems in the Australian context.
- Increased extension delivery from the beef and dairy sectors on profitable dairy beef production systems as well as the economic value attached to maintenance of social license.
- Further promotion from the dairy industry of the use of sexed semen combined with targeted beef over dairy cross breeding, utilising case studies that demonstrate economic and social advantages.
- Collaboration from the beef and dairy industries as well as retailers on the development of marketing campaigns to sell the story behind dairy beef, including Jersey beef, creating market pull-through for the products.
- Stronger focus from the livestock sector on combining research and policy development with social science research.
- Further research led by the dairy sector into cow-calf separation and the viability of suckling systems in largely pasture-based Australian dairy systems.

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Plain English Compendium Summary

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Objectives	To assess the threat posed by low value non-replacement dairy calves and cow-calf separation to the Australian dairy industry and identify options for increasing calf value while maintaining public trust.
Background	The practices of cow-calf separation and early-life processing or euthanasia of non-replacement dairy calves are falling out of step with public values. The inherent low value of dairy calves as beef animals has been the main obstacle to increased uptake of dairy beef systems.
Research	Farmers, processors, government bodies, research institutions, extension bodies, NGOs, farmers unions and levy boards were visited in The UK, Ireland, Italy, Denmark, France, The US, Canada and New Zealand. Visits and interviews centred on social licence and public trust, dairy beef production and cow-calf separation.
Outcomes	Interviews revealed the importance of creating shared values between the dairy sector and the community when it comes to low value non replacement dairy calves. This relies on realising the value potential of dairy beef through innovative rearing systems and marketing. The separation of calves from their mothers is also of increasing concern to the public. Dairy systems where calves are reared on cows come with some significant challenges but also offer many benefits.
Implications	Significant opportunities exist to increase the value of non-replacement dairy calves, simultaneously improving profits for stakeholders and contributing to the maintenance of public trust. Dairy systems where calves and cows are reared together offer an alternative method of production where greater revenue can be generated from improved calf growth rates with potential also existing for an 'ethical' marketing angle.
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