The fate of calves born on New Zealand dairy farms and dairy farmer attitudes towards producing dairy-beef calves

JP Edwards[a]*, S Cuthbert[b], JB Pinxterhuis[a] and A McDermott[c]

[a]*DairyNZ Ltd, Lincoln 7608;* [b]*Cuthbert & Associates, Rototuna, Hamilton 3210;* [c]*AgriFood Strategy Ltd, Collingwood 7073.*

**Corresponding author:* Email: Paul.Edwards@dairynz.co.nz

Abstract

Dairy calves that are not required as herd replacements provide an opportunity for beef production with a relatively low environmental footprint. A telephone survey of 262 New Zealand dairy farmers was conducted in October 2020 to gain insight into current mating and calving practices, and attitudes to dairy-beef breeding and rearing calves for beef. This number of respondents provided a margin of error of ±6%. On average, per herd, 28% of calves were kept as dairy replacements, 12% were reared on-farm for beef, 15% sold for beef rearing, 35% sold to process as 'bobby' calves, 5% euthanised and 4% born dead or died. The largest barriers to producing more beef calves were uncertainty around their value, followed by calving difficulties with beef bulls. The main barrier to rearing more calves for beef was higher earnings for milk than for beef. However, 60% of respondents agreed that the sector should aim to decrease the number of 'bobby' calves. This survey provides data for the development of cross-sector initiatives to increase dairy-beef integration and the utilisation of calves. These results provide a rich description of the current state of the sector and they suggest that at least 74% of New Zealand beef production originates in the dairy industry.

Keywords: dairy calf; dairy-beef; bobby calf; calf rearing; mating

Introduction

The New Zealand dairy sector is guided by a vision and strategy for its future, the Dairy Tomorrow Strategy (DairyNZ et al. 2017). One commitment in this strategy is a high level of animal care that provides all animals a life worth living. Consumer and public attention for the wellbeing of animals and the ethics of current animal production systems is growing, and it is expected that concerns about processing of young animals will increase (Bolton & Von Keyserlingk, 2021). Thus, the dairy sector and partners are developing pathways to reduce the number of dairy calves slaughtered at a young age, known as bobby calves.

Economic modelling of the beef value chain has indicated that increasing the number of dairy-beef-cross progeny would increase net value to the beef industry (McDermott et al. 2005). Value could potentially be shared by the various participants along the dairy-beef value chain, including dairy farmers, calf rearers, finishers and processors (McDermott et al. 2005). Modelling of environmental impact has demonstrated the potential of further dairy-beef integration to reduce greenhouse gas emissions by -22% (of the kg CO_2e per kg carcass weight) through substituting all suckler-beef production with dairy-beef production (van Selm et al. 2021).

Research also demonstrated the potential of animals of dairy origin for beef production (Muir et al. 2001; Pike et al. 2019), lending further weight to increasing dairy-beef production as a strategy to reduce the number of bobby calves. According to a 2004 survey, 13% of calf rearers and 41% of beef finishers used only dairy-beef animals in their systems; 41% of calf rearers and 82% of beef finishers indicated they wanted to move to or remain dairy-beef only (Oliver & McDermott 2005). However, it is not clear that dairy-beef numbers have increased since this time. Rearers and finishers indicated least satisfaction with their ability to source high-quality four-day old calves or weaner calves, respectively (both scoring 6.8 out of 10). Calf rearers selected calves based on breed, live weight, general health, colour, and sufficient colostrum. For beef finishers, breed was almost twice as frequently cited as purchase criterion for selecting weaner cattle than any other. However, breed by itself may not be a good indicator of the genetic potential of the animal for growth (Martín et al. 2020). Level of satisfaction of calf rearers with calves growing rapidly after weaning was 7.9 and with calf growth rates achieved 7.6 (out of 10). Beef finishers scored their satisfaction with growth rates as 7.5.

To achieve a significant change to the number of dairy-origin animals being finished for beef production, these 2004 survey results suggest more dairy-beef calves need to be available that will satisfy performance expectations. The start of this system is the dairy farmer producing calves that are desirable for beef production. Therefore, our study sought to gain insight into current mating and calving practices by New Zealand dairy farmers, and their attitudes to dairy-beef breeding and rearing calves for beef. Future surveys are planned amongst calf rearers and beef finishers to update the results of the 2004 survey, as well as research into consumer expectations and public perception. This information can be used for the development of effective cross-sector initiatives and helps to describe the current state of the sector, providing a platform for evaluating change.

Materials and methods

A telephone survey of dairy farmers was completed between 29 September and 27 October 2020. Questions related to the fate of calves born alive (reared for dairy replacement, sold for beef rearing, reared on farm for beef, euthanised on farm, or sold as a bobby calf) and

mating period plans for 2020. Euthanasia refers to any calf born alive but killed on farm, irrespective of reason for euthanising. Pilot testing of the questionnaire indicated that the contents of the survey were complex and required respondents to pause to consider their answers. As a result, the survey was adapted to give participants the option to give the researchers permission to access data on semen use for artificial insemination stored by LIC (Hamilton, New Zealand), thereby reducing the number of questions asked by telephone. In total 82 respondents took this option. If permission was not given the full suite of questions was asked by telephone.

A random sample of dairy farmers from each region of New Zealand who had not been surveyed in the previous 12 months, was sourced from DairyNZ's customer relationships management database. Only one contact per farm was supplied. The number of contacts for each region was proportional to the number of farms located in that region. Telephone interviews were conducted by independent interviewers contracted by Cuthbert and Associates (Hamilton, NZ). A total of 382 calls were made. The response rate was 69%, the remainder unable to be contacted (21%), refused to participate (7%), or were ineligible (4%; e.g. had left the dairy sector). The average call duration was 19 minutes. The number of respondents provided a margin of error of ±6% on all answers.

Survey questions

The survey covered demographics of the respondents, their mating practices, the fate of calves born, and barriers to use of proven beef genetics and rearing more calves for beef. Questions were developed based on the earlier survey from Oliver and McDermott (2005) and the authors' knowledge of current practices and opinions regarding dairy-beef. The introductory section collected information about the number of farms the respondent owned, sharemilked or managed (they were asked to answer questions about the farm they were most familiar with), the size of farm, their experience in the dairy industry, their use of support land, calving pattern (spring, autumn, split) and herd breed. The second section related to mating practices, including farmer use of artificial insemination (AI) and length of mating, and choice of natural mating bulls and breeds. Potential factors that could influence farmer decisions for producing more calves from proven beef genetics or rearing more calves for beef were evaluated. For these questions, a scale of 1-7 was used, with 1 being the factor having no influence whatsoever on the decision and 7 the factor being extremely influential. In the third section, farmers were asked questions about the fate of calves born on their farm; the number of calves that were reared as dairy replacements to keep or sell, sold for beef rearing, reared for beef (to keep or sell), died on farm, euthanised on farm, and sold as bobby calves for processing were recorded. Finally, participants were asked about their attitudes (on a scale of 1-7, strongly disagree to strongly agree) to a series of statements about the direction the industry should take regarding bobby calves.

Data analysis

The results were analysed and reported for all survey answers, with sub-group or cluster analysis reported where applicable. The number of responses (n) varied slightly among questions due to omitting obvious typographical errors, or variations to the questionnaire in response to pilot feedback (e.g., adding a question). Not all percentages sum to one hundred because of rounding or the question was multi-response.

A cluster analysis was performed to examine possible groupings of farmer behaviour based on what they do with calves born on-farm. The characteristics of clusters were compared. Significance testing was conducted between total results and the results for key demographic sub-groups. Results are based on two-sided tests assuming equal variances with a confidence level $P<0.05$.

Results

Demographic information

The mean herd size was 473 cows (393 in the North Island and 622 in the South Island) with an effective milking platform size of 167 ha (144 in the North Island and 207 in the South Island). In terms of herd breed, 28% were Friesian, 34% were Friesian-cross, 16% Friesian-Jersey-cross (i.e., major breed fraction was seven to nine parts Jersey or Friesian), 6% Jersey-cross, 12% Jersey and 4% other. Respondents had an average 25 years' experience in dairying. Seventy-four percent operated one farm and 67% owned or shared a support block, mean size of 92 ha (median 67 ha). Although support-block ownership was similar between the North and South Islands (69% and 68%, respectively), support-block size was larger in the South (median 101 ha compared with 50 ha in the North Island, in line with the effective platform size). Fifty-eight percent of respondents wintered some cows off the milking platform; mean 199 cows, median 100 cows. Cows were more likely to be wintered off the milking platform in the South Island than the North Island (74% and 49%, respectively) and 45% of farmers in the South Island wintered off the whole herd, compared with 10% of farmers in the North Island. Replacement young stock were grazed at a support block for 50% of respondents, 34% contracted them out, and 12% kept them on the milking platform. The remaining respondents had other arrangements, for example a combination of the above or not rearing young stock themselves.

Mating practices

Eighty-five percent of respondents operated a spring-calving system, 3% autumn calving and 12% operated a split spring-autumn calving system. The mean mating length was seven weeks for autumn-calving herds (autumn only and split), of which AI was used for four weeks (median six weeks mating and five weeks AI). For spring-calving herds (spring only and split), the mean and median mating length was 10 weeks, with six weeks of AI. Of the milking herds that were mated in spring, 17% were mated with AI only.

The length of AI was more likely to be longer in the South Island than the North (6.8 and 5.6 weeks, respectively).

Ninety-nine percent of respondents used AI with semen from dairy breeds, 72% used semen from beef breeds (including short-gestation length Hereford), and 36% used short-gestation-length (SGL) semen (e.g., at the tail end of mating). Forty-two percent of respondents used AI mating on rising two-year-old (R2) heifers. For this group, the average milking herd size was 593 and the mean number of R2s mated by AI was 118.

For cows that were pregnant to AI, an average of 83% of calves born were from dairy breeds, 13% from beef breeds and 4% from SGL. A subset of respondents (n=144) answered a version of the survey that related to mating outcome of all cows in the herd. On average 57% of the cows were pregnant to AI dairy sires, 3% to AI SGL sires, 21% to natural-mating bulls, 8% to AI beef sires, and 11% were not pregnant.

Four percent of respondents did not use any natural-mating bulls for either their milking herd or R2s. For those that used natural-mating bulls (for cows and/or R2s), 27% used dairy sires only, 30% used beef sires only and 44% used a mixture of both. The most common breed of sires was Jersey (35%), followed by Hereford (24%), Angus (13%), Friesian (8%) Jersey × Friesian cross (6%) and 'Other beef breeds' (14%). The majority (73%) of natural-mating bulls were unrecorded (i.e., the genetic merit of the animal was unknown).

Fate of calves

On average, 28% of all calves born on-farm were reared as dairy replacements (to keep or sell), 27% were for the beef industry (reared, kept or sold), 35% were sold to process as bobby calves, 4% were born dead or died, 5% were euthanised, and 1% were categorised as 'other' (e.g., bulls kept for breeding). The median number of animals finished for beef was 36, equivalent to 8% of the milking herd size.

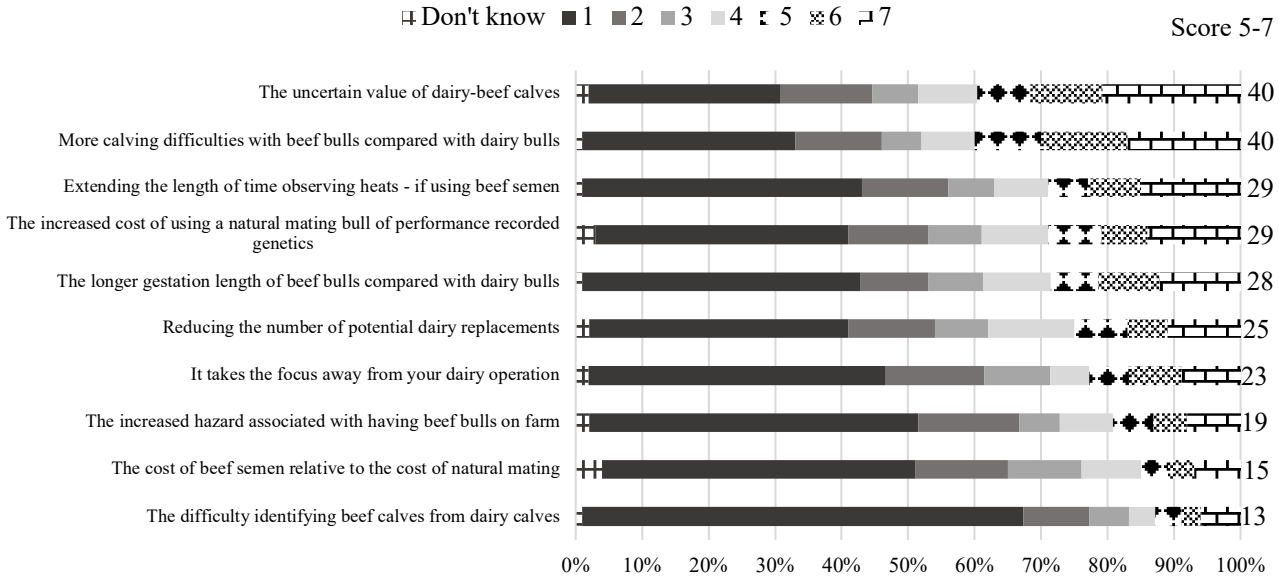
Fifty-nine percent of respondents finished animals for beef on their milking platform or support block. This includes 19% of the respondents who kept five animals or fewer to finish. This group could be assumed to produce meat for their own consumption, instead of producing beef for the general market.

Barriers to use of proven beef genetics and rearing more calves for beef

Factors influential in preventing the respondents producing more dairy-beef calves of proven beef genetics are presented in Fig. 1. The most influential barriers were 'the uncertain value of dairy-beef calves' and 'more calving difficulties with beef bulls compared with dairy bulls' (40% of respondents scoring these barriers a 5-7, with 7 being extremely influential). Of least importance were 'the difficulty identifying beef calves from dairy calves' (13% scoring this 5-7) and 'the cost of beef semen relative to the cost of natural mating' (15%). Other reasons mentioned that were not listed in the survey, mostly related to the limited market for calves with dairy genetics (46% of the responses to 'Other reasons').

Barriers to rearing most of the calves born on farm are listed in Fig. 2. The statement that respondents agreed

Figure 1 Responses to the question "On a scale of 1-7, where 1 means no influence whatsoever and 7 means extremely influential, how much does [statement] prevent you from producing more proven* beef calves on your farm?" n=221. Percentage of respondents that 'agreed' (scored 5-7) labelled at the end of the bar.



*A definition of the word proven was not given to respondents unless asked, in that case proven was considered having beef genetics that has been proven to perform well by an artificial breeding company or beef stud.

Figure 2 Responses on a scale of 1-7 (strongly disagree to strongly agree) to the question "how much do you agree that [statement] prevents you from rearing all or most of the calves born on your farm?" n=235. Percentage of respondents that 'agreed' (scored 5-7) labelled at the end of the bar.

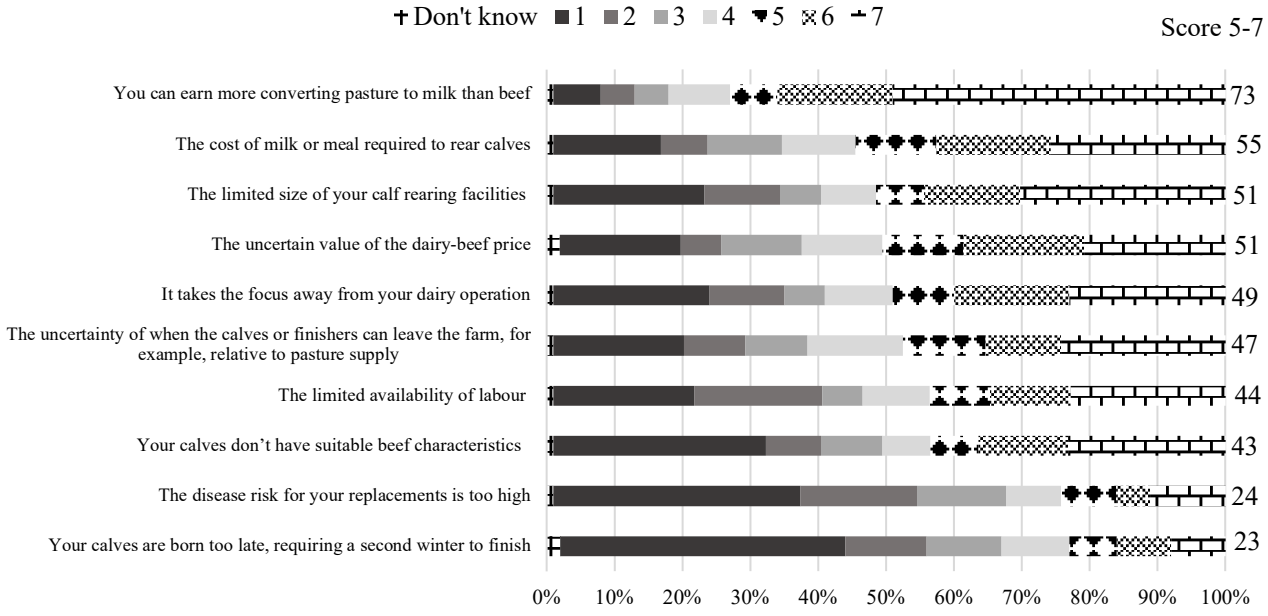
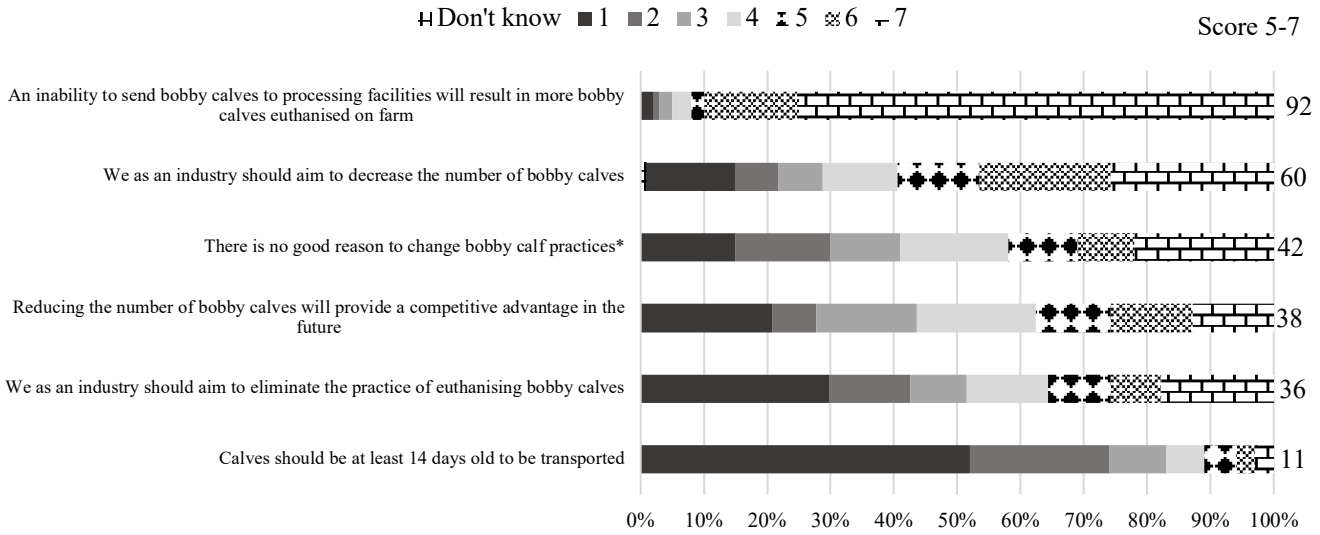


Figure 3 Responses to the question "using a 1 to 7 scale, where 1 means strongly disagree and 7 means strongly agree, how much do you disagree or agree with the following statements?" [about bobby calf practices] n=237. Percentage of respondents that 'agreed' (scored 5-7) labelled at the end of the bar.



*This statement was changed part-way through data collection. Earlier version: "dairy farmers are being forced to change bobby calf practices for no good reason", n=103. The answers to this earlier version of the question are included in the figure.

with most strongly was 'you can earn more converting pasture to milk than beef' (73% of respondents scoring this 5-7). Two statements were considered considerably less important than others: 'your calves are born too late, requiring a second winter to finish' (23% scoring this 5-7) and 'the disease risk for your replacements is too high' (24%). Other reasons mentioned that were not listed in the survey were diverse, but 28% of these related to lack of market.

Nearly all respondents agreed that 'an inability to send bobby calves to processing facilities will result in more calves euthanised on farm' (92% scoring 5-7) and disagreed that 'calves should be at least 14 days old to be transported' (83% scoring 1-3; Figure 3). The majority (60%) agreed (scoring 5-7) that 'we as an industry should aim to decrease the number of bobby calves'; 28% disagreed (scoring 1-3). There was less agreement (36% scoring 5-7 and 52% scoring 1-3) that 'we as an industry should aim to eliminate the practice of selling bobby calves for processing'. Verbal comments from respondents illustrated that, while in general they agreed with the aim to decrease the number of bobby calves, they do not yet see a way to make this work at scale.

"*I understand there may be a bobby calf issue but until somebody comes up with a solution (alternative) there is nothing I can do about it. I will not keep more calves on farm as they will drink the milk I want to sell.*"

"*I struggle with the industry saying they want to eliminate or decrease bobby calves. It's nice to say, however, the everyday reality and practicalities of it makes it just not practical in everyday life.*"

One respondent provided a clear driver for change, echoed by others and related to the main barrier of the uncertain value of the calves: the price you can get for the animals. Note the average lamb price has not reached $200/head in the last decade (Beef+Lamb NZ 2021) and, therefore, would be an attractive proposition:

"*Bobby calves are an essential part of dairying farming - but they are worth nothing, so nobody keeps them. If you could get a reasonable price (compare lambs at $200) then we would all find a way to make it work. Until the value of a young calf goes up nothing will change.*"

Distinct clusters regarding fate of calves

Four distinct clusters were identified based on respondents' estimates of the fate of calves born in their herds. Cluster 1 was 'euthanise on farm', Cluster 2 'sell bobby calves', Cluster 3 'sell for beef rearing' and Cluster 4 'rear for beef'. Significant differences in demographics and attitudes were apparent among the clusters (Table 1). The respondents that sold relatively more calves for beef or reared for beef had mostly Friesian or Friesian-cross herds. Those that reared for beef used less SGL semen than Clusters 1 and 2, and more AI beef semen than Cluster 2. Most barriers to rearing all or most calves born on farm were felt significantly less for Clusters 3 and 4 relative to Cluster 1 and 2. Respondents in Cluster 1 clearly considered labour to be a major barrier. The limited opportunity to earn income from beef calves was an important barrier for all groups, with average scores above 4 for the statement that they could earn more converting pasture to milk, rather than beef. The barriers of least importance were calves being born too late and disease risk for replacements.

Table 1 Mean percentage of calves by fate for four distinct clusters (n=261) and a description of the mean characteristics of each segment. Barriers were scored on a scale from 1 (no barrier at all) to 7 (severe barrier); values given are the mean of the scores.

	Cluster 1: Euthanise on farm	Cluster 2: Sell as bob-by calves	Cluster 3: Sell for beef rearing	Cluster 4: Rear for beef
Number and percentage of respondents	n=12*	n=126	n=75	n=48
	5%	48%	29%	18%
Fate of calf, %#				
Kept as dairy replacement	27%	27%	30%	30%
Sold for beef rearing	3%	7%	**34%**	4%
Reared for beef	9%	6%	9%	**45%**
Euthanised on farm	**58%**	2%	2%	2%
Sold to process as bobby calf	0%	**55%**	20%	15%
Description of segment^				
Demographics#				
Years working in the dairy industry	19 b	24 b	27 a	23 ab
Herd size (number of cows)	620	531	503	438
Friesian or Friesian cross	36% b	51% b	81% a	82% a
Friesian-Jersey	27%	24%	8%	9%
Jersey or Jersey cross	36% ab	25% a	11% b	9% ab
Herd pregnant to AI by type, %#				
AI Short Gestation Length	6.6% a	5.0% a	3.0% ab	1.7% b
AI Dairy	79.6% ab	85.0% a	82.2% ab	79.0% b
AI Beef	13.8% ab	12.2% a	15.0% ab	19.4% b
Barriers to rearing all or most calves born on farm (mean on scale of 1-7)				
The cost of milk or meal	5.6 a	5.0 a	4.1 b	3.6 b
Uncertainty of the dairy beef price	5.3 a	4.7 a	4.4 a	3.2 b
Limited availability of labour	6.0 a	4.3 b	3.2 c	3.4 c
Limited size of calf rearing facilities	5.2 ab	4.8 a	3.7 bc	3.6 c
Earning more converting pasture to milk	5.6 ab	5.9 a	5.4 ab	4.7 b
Unsuitable beef characteristics of calves	4.1 ab	4.6 a	3.0 b	2.7 b
Calves are born too late	3	3.1	2.8	2.7
The disease risk for replacements is too high	3.9 a	3.1 ab	2.5 b	3.2 ab
Uncertainty of when calves or finishers can leave the farm	4.7 ab	4.5 a	4.2 ab	3.5 b
Takes the focus away from their dairy operation	5.2 a	4.5 a	4.0 a	2.9 b

*Caution is advised due to low n number

#Percentages sum within cluster

^Means across a row followed by a common letter are not significantly different by the LSD test at the 0.05 level of significance

Respondents' comments illustrate that currently there is a lack of market opportunities, especially for calves with Jersey genetics:

"*Our herd is Jersey - people don't want a Jersey beef cross.*"

"*We are a Jersey herd, so people don't want beef calves out of our Jersey calves. There is no market for them.*"

"*We're actually going back to Jerseys this year as we couldn't sell enough beef cross calves. Had about 700 and only sold about 450, had to put the rest on the bobby and didn't want to do this. Just not a ready market for them, so disappointed.*"

Other respondents experienced that crossbreeds with Jersey genetics were suitable for beef:

"*We are a Kiwi Cross herd. The beef calf, we have to grow them through ourselves as they are all sorts. A week-old calf is worth nothing however to grow them through is of significant value.*"

Another barrier mentioned was the existence of *Mycoplasma bovis* infection (recorded in verbatim comments 13 times):

"*Bovis has stuffed everything for the bobby-calf market and we can't sell anything. No one in the South Island wants a dairy cross*."

"*Gone to Jersey due to Bovis and to be more self-contained.*"

However, *M. bovis* was also mentioned as the reason to produce more dairy-beef calves from natural mating:

"*Have Hereford bulls as can't trust Friesian bulls anymore due to Bovis. We buy bulls that come from up in the hills with no neighbours and are from a closed herd.*"

Discussion

The results of this survey provide an opportunity to improve current estimates of the extent of integration between the dairy and beef industries, and potentially account for a large number of animals that previously have had an unknown fate (van Selm et al. 2021). The present survey results relate to the 2020/21 dairy season; the latest dairy cow population data available from the New Zealand Dairy Statistics are for 2019/20, when the size of the dairy herd was 4,921,548 (LIC and DairyNZ 2020). There were 1.88 million calves processed in the year to December 2020 (StatsNZ 2020), representing produce from 38% of dairy cows. This is within the ±6% margin of error for the survey, lending validity to the results and suggesting that currently 1.33±0.30 million dairy calves are used for beef production, which is much higher than a previous estimate of 0.82 million (van Selm et al. 2021). Further, using a conservative estimate of the number of dairy calves reared for beef (1.03 million), combined with the 0.12 million dairy heifers (likely not-pregnant R2 animals) and 0.81 million cull dairy cows reported (StatsNZ 2020), these results indicate that around 74% of the 2.66 million adult cattle slaughtered in 2019/20 (StatsNZ 2020) originated in the dairy industry. This illustrates that the dairy sector already has a major role in beef production in New Zealand and that further increasing this proportion may be difficult. For example, beef farmers often mention the importance of beef cows for managing pasture quality in marginal areas such as hill country. It is unclear to us how many beef cows are currently used for this purpose and to what extent other cattle classes could fulfil this same function, such as carry-over dairy cows (non-pregnant and non-lactating) or growing beef animals.

The cluster analysis based on the fate of dairy calves indicates that the 47% of respondents classified in the 'rear for beef' or 'sell for beef' clusters are responsible for producing 73% of the dairy calves used for beef production and were only responsible for 23% of bobby calves. This indicates that to achieve further dairy-beef integration and a meaningful reduction in the number of bobby calves, efforts should focus on the 48% of respondents in the 'sell as bobby calves' cluster. However, whilst small, the 'euthanise on farm' cluster should not be overlooked, although their availability of labour barrier has to be addressed. Herds in these two clusters were less likely to be Friesian or Friesian cross. Despite evidence that animals with Jersey genetics can be reared successfully for beef (Muir et al. 2001), having Jersey or Kiwicross herds appears to still be a major barrier for rearers buying calves. These breeds are well-suited to New Zealand spring-calving and pasture-focused dairy systems (Edwards et al. 2019), aligning with this cluster's view about the ability to earn more converting pasture to milk. Therefore, it is unlikely that these farmers will make a large swing to Friesian or dual-purpose breeds to produce a different type of calf altogether. Future work, including demonstration of successful supply chains, will need to increase acceptance of Jersey genetics for beef production and facilitate mating strategies that produce more calves with beef sires.

Two factors that were key barriers to using improved genetics for beef production were certainty about the value of dairy-beef calves and concern about calving difficulties using beef bulls. These were the two most-important factors in a 2004 survey of dairy farmers (Oliver & McDermott 2005). Concern around calving difficulty may relate to the high proportion of unrecorded sires being used. Recent research highlights that appropriately selected beef sires have low rates of assisted calvings for adult dairy cows (Coleman 2020). Given that a dairy-beef calf can be processed as a bobby calf, the concern about their uncertain value implies that respondents believe that they are more costly to produce than dairy calves, or that their existing culling rate and reproductive performance dictate that their mating strategy is solely focused on generating replacement dairy animals. Potentially this has some validity, if their current system does not produce surplus replacements (e.g., 60% six-week in-calf rate × 50% female × 90% suitable for rearing = 24% available for replacements), then the most

straightforward method for increasing the amount of dairy-beef would be via a mating programme with sexed semen (~$63/straw), which is considerably more expensive than conventional semen (~$22/straw) and is not sufficiently offset by the lower cost of beef semen (~$18/straw). Under this system, to maintain profit, the price paid for the resulting dairy-beef animal would need to be higher than that received for a bobby calf (Oliver & McDermott 2005). Modelling could determine what this premium would need to be, or conversely, how much cheaper sexed semen would need to be, to influence semen choice based on costs and calf prices only. Oliver and McDermott (2005) indicated a premium of $30/calf would motivate dairy farmers to use beef semen, and/or that beef semen would need to be priced appropriately to encourage use. The risk of not achieving this premium would also need to be considered. Despite this risk, since this 2004 survey, the number of dairy farmers using beef semen has approximately doubled. In a supply-chain context, the resulting calf would also need to be worth more than the current bobby-calf price to a calf rearer or beef finisher. Supply-chain contracts where calves are bred to a clear specification could be one way of achieving this, although this may also require market development. Another potential avenue could be decreasing rearer and finisher uncertainty in the growth potential of the animal. This could be achieved through the use of herd recording data, where the parentage of the animal and growth potential are available to each part of the supply chain. If these options prove to be insufficient to attract more buyers of dairy-beef calves, dairy farmers may need to sell quality dairy-beef calves at bobby-calf prices or rear more calves themselves to reduce the number of bobby calves slaughtered.

Conclusion

Generally, dairy farmers surveyed agreed that their sector should aim to reduce the number of bobby calves slaughtered, but there was little support for eliminating the practice altogether. Cross-sectoral initiatives to increase dairy-beef integration and reduce the number of bobby calves should focus on the 48% of the dairy sector represented by the cluster 'sell as bobby calves'. Potential areas for initiatives to address include the real or perceived lack of value for Jersey and Jersey-cross animals and increasing the confidence of calf rearers and beef finishers in the growth potential of dairy-beef animals. Collecting data on genetics, liveweight gain and slaughter quality would assist with these aspects. Supply chain and market initiatives would also help to increase the demand for these animals.

Acknowledgements

This project was funded by the dairy farmers of New Zealand through DairyNZ Inc, contract AC2002. We would like to thank the farmers who participated in the survey for their time and LIC for extracting herd data.

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