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Ewe culling in New Zealand: an interview study of 38 farmers

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ABSTRACT

Removal of ewes from a flock before the end of their productive life, sometimes described as ewe wastage, can potentially lead to reduced flock productivity. While the main reasons for culling ewes are largely known, their relative importance to New Zealand farmers and farmers' rational behind their culling decisions are not. Therefore, this study involved semi-structured interviews with 38 sheep farmers from throughout New Zealand to explore their ewe culling decisions. Farmers consistently culled mixed-age and two-tooth ewes who failed to become pregnant or who had a vaginal prolapse. For other culling reasons, farmers' use of them and their rationale for doing so was diverse and varied between farmers based on ewe age-group, severity, season, perceived economic consequences and farmers' personal preference. This diversity indicates that there is scope for some farmers to carefully evaluate some of their culling decisions.

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Introduction

Removal of ewes from a flock, commonly referred to as culling, is a method used by sheep farmers to ensure only those that meet specific criteria and are likely to be productive are retained for breeding (Flay et al. 2022). There are various reasons why ewes might be culled when they are considered to have reached the end of their productive life (sometimes referred to as culled-for-age or cast-for-age), or prior to this time, due to farmer preference or perceived imperfections. Culling ewes prior to the end of their productive lifespan contributes to flock wastage (Flay et al. 2022).

In New Zealand, and other similar pastoral-based sheep rearing countries, some of the main reasons for ewe culling include age, known poor reproductive performance (non-pregnant or failure to rear a lamb), and defects of the teeth, udder or feet (Annett et al. 2011a; Keady and McNamara 2014; McLaren et al. 2020; Flay et al. 2021; 2022). High levels of premature culling result in a younger flock age structure, reduced flock production and therefore reduced cash profit (Farrell et al. 2019). Reducing the incidence of premature

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culling can therefore lead to greater productivity and overall farm efficiency and potentially reduce the greenhouse gas emission intensity for sheep production systems.

Flay et al. (2021) followed approximately 13,000 ewes from three flocks over their lifetimes and established that half of these ewes were culled prematurely, before six years of age, while only 10% remained in their flocks until six years of age. Of the 50% of ewes that were culled prematurely, nearly half were culled for reproductive reasons of non-pregnancy or failing to rear a lamb. In contrast, in studies undertaken in the United Kingdom, Ireland and Norway, the reasons for premature ewe culling were diverse but it appeared that ewes were not culled for failing to rear a lamb and were often not culled for non-pregnancy (Annett et al. 2011a; Keady and McNamara 2014; McLaren et al. 2020).

While the main reasons for culling ewes are largely known, their relative importance to New Zealand farmers and farmers' rationale behind their individual culling decisions are not. Therefore, the aims of this study were to interview New Zealand sheep farmers to investigate their frequency of use of potential culling decision criteria and the rationale behind their culling decisions.

Materials and methods

Participants

Thirty-eight sheep farmers from across New Zealand were recruited via a network of personal contacts, farm advisors and veterinarians, who made the initial contact with the farmers and got their consent to pass on their contact details to the researchers. Farmers were then contacted by the researchers via email or a phone call and were emailed an information sheet.

Participants were located throughout New Zealand with 19 in the North Island and 19 in the South Island. Based on regional council boundaries (Anon 2023), farmers were in Bay of Plenty (n = 1), Canterbury (n = 12), Gisborne (n = 1), Hawke's Bay (n = 2), Manawatu-Whanganui (n = 5), Marlborough (n = 2), Otago (n = 1), Southland (n = 4), Waikato (n = 6) and Wellington (n = 4) regions.

Culling interviews

The interview methodology was to firstly review the literature to identify common culling reasons, and these were each printed onto a laminated card. The culling reasons included were age; dry/dry (not pregnant); wet/dry (pregnant but did not rear a lamb); teeth; udder; feet; bearing (vaginal prolapse); conformation; type/looks; body condition; scanned single (only one fetus at pregnancy diagnosis); scanned triplets (three fetuses at pregnancy diagnosis); other. For the latter card a marker pen was provided to allow additional culling reasons if required. A semi-structured interview guide was then developed to elicit dialogue from farmers regarding their rationale behind their use of culling decision criteria. The cards and interview guide were piloted with two farmers, who were not included in the larger study, and changes made as required (Kallio et al. 2016).

Interviews were conducted in-person at the farmer's residence with one or two interviewers present. Initially the project purpose was re-iterated, and farmers signed a consent form. The inclusion of human participants for this study was assessed as low

risk by the Massey University Human Ethics Committee, application number 4000021922.

Farmers were then given the 13 potential culling reason cards and asked to identify those that described a reason for which they would cull mixed-age (MA) ewes (ewes 28–30 months of age or older at breeding), and to put aside those that they would not use when making ewe culling decisions. This was followed by the semi-structured interview regarding their rationale. This process was repeated for two-tooth ewes (ewes bred at 16–18 months of age) and mated ewe hoggets (ewes bred at seven to nine months of age). Interviews were recorded and transcribed.

Analysis

For the culling reasons including non-pregnant, failure to rear a lamb, teeth, udder and feet defects, each was assigned a frequency of use of 'always', 'usually', 'sometimes', and 'never' based on researcher judgement of farmers' described use of that culling reason. The interview transcripts were analysed in an iterative process by identifying key themes for each culling reason to establish the farmers' rationale for their use of the different potential culling reasons, and to identify other rationale relating to their approaches to culling more generally.

Results

Farmer and farm demographics

All farmers interviewed were male and were either the farm owner (n = 21; 55%) or farm manager (n = 17; 45%). The farms ranged in size from 204 to 4000 effective hectares (ha) with a mean of 1227 ha effective. Thirty-six farmers farmed coarse wool sheep breeds (>30 microns), one farmed mid-micron breeds (22-29 microns) and one farmed fine-wool breeds (<21 microns). All farmers presented their mixed-age ewes and two-tooth ewes for breeding while 24 (63%) sometimes or always presented some or all their ewe hoggets for breeding. All but four of the farmers had a mob of mixed-age ewes which were bred to maternal-breed sires ('maternal mob' or 'A mob') as well as a mob of ewes bred to terminal-breed sires and whose progeny were all sold to slaughter ('terminal mob' or 'B mob'). All but one farm bred their own ewe lamb replacements, while one purchased replacement ewes and bred them all to terminal sires.

Culling decisions and their rationale

Age

Seventy one percent of farmers always or usually routinely culled their ewes at a fixed age (Table 1). The age at which this occurred ranged from four to nine years of age with a mean, median and mode of six years of age. The primary rationale described by those farmers who chose to cull at a fixed age was they thought that death rates would be unacceptably high if they kept older ewes. However, one farmer who culled at six years of age believed it to be the industry standard while another culled at five years of age as they were concerned about genetic gain. Two farmers

Table 1. Frequency (and percentage) of a sample of 38 New Zealand sheep farmers who always, usually, sometimes or never cull ewes at a fixed age or based on whether they are not pregnant, did not rear a lamb, or have defects of the teeth or udder. Thirty-eight farmers presented mixed-age (MA) and two-tooth (2 T) ewes for breeding while 24 presented ewe hoggets for breeding.

Culling reason	Age group of ewes	Always	Usually	Sometimes	Never	Unclear
Fixed age	MA*	26 (68%)	1 (3%)	0 (0%)	9 (24%)	2 (5%)
Not pregnant (dry/dry)	MA	37 (97%)	0 (0%)	1 (3%)	0 (0%)	0 (0%)
	2T	35 (92%)	2 (5%)	0 (0%)	1 (3%)	0 (0%)
	Hogget	3 (13%)	2 (8%)	1 (4%)	17 (71%)	1 (4%)
Pregnant but failed to rear a lamb (wet/dry)	MA	22 (58%)	2 (5%)	3 (8%)	10 (26%)	1 (3%)
	2T	11 (29%)	1 (3%)	6 (16%)	18 (47%)	2 (5%)
	Hogget	0 (0%)	1 (4%)	0 (0%)	22 (92%)	1 (4%)
Teeth	MA*	26 (68%)	2 (5%)	3 (8%)	3 (8%)	4 (11%)
Udder	MA	31 (82%)	2 (5%)	3 (8%)	1 (3%)	1 (3%)
	2T	27 (71%)	0 (0%)	3 (8%)	4 (11%)	4 (11%)
	Hogget	16 (67%)	0 (0%)	0 (0%)	3 (13%)	5 (21%)

*Culling reason only relevant for MA ewes.

that routinely culled at five years of age stated that they would sometimes keep a few very good five-year-olds for another year.

Amongst those farmers that never or rarely culled ewes at a fixed age, their primary rationale was that as long as ewes' teeth and udders were sound, and they were in good body condition score (BCS) there was no necessity to cull on the basis of age. Two indicated that they were interested in selecting for longevity and this was a motivator for keeping older ewes.

Not pregnant (dry/dry)

Almost all farmers culled mixed-age and two-tooth ewes that did not become pregnant (Table 1), with the rationale that there was no point in keeping them. Twenty one percent of those farmers that presented ewe hoggets for breeding would always or usually cull those that were non-pregnant and, while they didn't go into detail about their rationale, these farmers would present all their hoggets for breeding whereas most farmers who kept non-pregnant hoggets would not, i.e. those that kept non-pregnant ewe hoggets additionally had a mob of unmated ewe hoggets that had been kept as replacements but for various reasons were not presented for breeding.

Failure to rear a lamb (wet/dry)

There was a lot of variation between farmers and between sheep age-groups as to whether ewes that were pregnant but failed to rear a lamb would be culled. Sixty three percent of farmers would always or usually cull mixed-age ewes in this category whereas nearly half would never cull two-tooth ewes and almost all never culled hoggets for this reason (Table 1). Amongst farmers that would always cull mixed-age or two-tooth ewes that failed to rear a lamb, six (26%) and four (36%) respectively stated that if there was a significant weather event during lambing, they would be more lenient in their culling decisions. Farmers' rationale for always culling ewes that failed to rear a lamb were that they were non-productive and likely to re-offend, and that there were other ewes who had lambed at the same time and managed to rear their lambs. Four farmers had a lambing system which meant these ewes could be removed from the flock shortly after lambing

and they reasoned that culling them quickly meant they weren't consuming feed at a time when feed was limiting, and their sale value was usually high at that time of year.

Amongst farmers that would never cull mixed-age and/or two-tooth ewes that failed to rear a lamb, six (60%) and twelve (67%), respectively, stated that they would identify those ewes and cull them if they failed to rear a lamb again in the future. In most cases the ewes were put into a mob that was only mated to a terminal sire (i.e. a terminal mob/B-mob) in future years. Most of the farmers that kept ewes that failed to rear a lamb had the rationale that they may have been unlucky to give birth during poor weather or that they deserved a second chance. Those that discussed the likelihood of them failing to rear a lamb again in future believed it to be low, although none had data to support this.

For those that sometimes culled for failure to rear a lamb, this depended somewhat on the circumstances. For example, if they had a limited number of ewes they could cull in some years, they might choose to keep those that failed to rear a lamb whereas in other years they might cull them. Two farmers would only cull those that had been pregnant with a single fetus and failed to rear it while one would only cull those that had been pregnant with triplet fetuses and failed to rear them.

Teeth defects

Twenty-eight farmers (74%) always or usually checked the incisor teeth of their mixed-age ewes (Table 1) and culled those they considered to have poor teeth or that they judged would not last another 12 months in the flock. Tooth defects that were considered for culling included missing, very worn, excessively long or wobbly teeth. Many farmers described that they were looking for a 'nice even row' of incisor teeth. There was variation between farmers in how rigorous they described themselves at checking teeth, ranging from 'very tough' to 'fairly relaxed'. Of the 28 farmers that always or usually culled for teeth, six (21%) stated that they also took body condition score (BCS) into account when deciding whether to cull on teeth. Four (14%) indicated that ewes whose teeth were marginal would go into a mob that was only mated to terminal sires (i.e. a terminal mob/B-mob). Two (7%) stated that since they had started sometimes feeding concentrate feed (i.e. barley or maize) they were more rigorous at culling on teeth defects than they had been prior.

Amongst the six farmers (16%) who only sometimes, or never, checked and culled based on incisor teeth, they did not consider that incisor teeth wear, or defects were an issue in their flock. Most of these farmers culled ewes for age at a relatively young age (four or five years old) while two only checked the teeth of ewes in low BCS. The teeth of two-tooth ewes and hoggets were generally not examined but many of the farmers stated that they would cull younger ewes with overshot or undershot jaws.

Udder defects

Eighty-seven, 71 and 67 percent of farmers would always or usually cull mixed-age ewes, two-tooth ewes and hoggets, respectively, if they had udder defects (Table 1). Udder defects that were described included 'lumps', 'hard', 'mastitis', 'fibrous', 'blown-out', 'uneven', 'saggy' and 'too big'. There was variation in farmer decision-making for udders that contained lumps with four farmers stating that they would cull a ewe if the udder had large lump/s or lump/s near the teats but would not cull if the lumps were small and far away from the teats. Most farmers described checking the udders

of mixed-age ewes by palpation. However, five stated that they only examined them visually or asked the shearers to check them. Most did not palpate the udders of two-tooth ewes or hoggets that had lambed, instead culling those with visually abnormal udders or that had been detected by shearers. Those that palpated the udders of ewes did it at either docking/tailing, weaning and/or between weaning and breeding.

Feet

It was not possible to assign frequency to culling for foot defects as there was considerable variation in farmers' decision making, which generally depended on the perceived severity. However, only one farmer stated that they would never cull on foot defects. None of the famers described having a system or a specific strategy for checking feet, rather they identified foot defects if sheep were lame or were seen to have obvious hoof overgrowth. The most common foot defects described were footrot, hoof overgrowth ('skis') or 'lame'. Eleven farmers stated that they would cull ewes with hoof overgrowth, while two stated that they would trim their feet and put them into the terminal mob/B-mob. Eight stated that they would cull lame sheep regardless of cause whereas others would decide based on the cause and the severity of lameness.

Conformation/type/looks

Farmers varied in how they interpreted conformation and type/looks and therefore these potential culling reasons have been considered together. Due to a multitude of conformation/type/looks defects described by farmers, it was not possible to ascribe frequencies of culling for this culling category. Ten farmers (26%) appeared to place a heavy emphasis on this potential culling category and made it clear, with comments like 'I just hate ugly sheep', that having sheep of a certain type or look was important to them. However, there was wide variation in what they considered to be good or bad conformation/type/looks. In contrast, five farmers (13%) indicated that they did not cull mixed-age or two-tooth ewes for this and did not care what they looked like if they were productive. The remaining farmers sometimes culled for conformation/type/looks. Depending on the perceived defect, in many cases ewes were not culled to slaughter but were instead put into a terminal mob/B-mob. The most identified conformation issue, specifically mentioned by five farmers (13%), was foot defects or weak pasterns. The most common issue associated with type/looks was pink noses and white feet, which were specifically mentioned by nine farmers (24%).

Body condition score (BCS)

All but one farmer stated that they would cull ewes in very poor BCS. Twenty-one farmers (55%) specified that they would assess the BCS of ewes, usually at weaning, and separate out those in low BCS to preferentially feed and then cull any that did not gain BCS with this treatment. Five (13%) said they would automatically cull ewes below a set BCS (usually below BCS 2.5 or 3.0 out of 5).

Vaginal prolapse ('bearing')

All but one farmer would cull ewes with a vaginal prolapse, either at the time of occurrence or they would treat them and identify them and then cull later. However, one farmer said that they would treat ewes with vaginal prolapse but not cull them.

Other culling reasons

Other stated reasons for culling that farmers described were black spots (n = 2), wool (n = 2), temperament (n = 2), ewes scanned pregnant with quads or quins (n = 1) and late lambing ewes identified at pregnancy scanning (n = 1).

Other factors related to culling

Many farmers stated that sometimes culling decisions were not based on a single factor but rather a combination of two or more factors, such as marginal feet, BCS and teeth. Several also described the high cost of replacing ewes and the importance of making careful culling decisions.

Discussion

Previously published studies on ewe culling have either simply reported whether farmers have used various culling reasons without further detail (Corner-Thomas et al. 2016) or reported the percentage of cohorts of sheep culled for various reasons across their lifetime (Annett et al. 2011a; Keady and McNamara 2014; McLaren et al. 2020; Flay et al. 2021). However, to the best of our knowledge, this is the first study in New Zealand to have assessed farmers' relative frequency of use for culling reasons and their rationale behind their culling decisions. This study identified only two ewe culling reasons which virtually all farmers consistently utilised. These were firstly, culling non-pregnant mixed-age and two-tooth ewes and secondly, culling ewes with vaginal prolapse. Kleeman et al. (2015) reported that up to half of ewes found to be non-pregnant were non-pregnant in subsequent years while Jackson et al. (2014) identified that 35% of ewes that had a vaginal prolapse and were not culled had a reoccurrence of the condition at the subsequent lambing. These studies vindicate the decision-making of the farmers in the present study to cull non-pregnant ewes or those with vaginal prolapse due to the high likelihood of similar poor performance in future years.

For the other potential culling reasons there was considerable diversity in use and decision making between farmers and between ewe age-groups on the same farm. Additionally, there were subtleties in decision-making for individual farmers based on the season, number of affected ewes, severity of defects, economic considerations, and personal preference.

It has been demonstrated that premature culling (i.e. culling before the end of a ewe's potential productive lifespan) contributes to ewe wastage and leads to a requirement for increased ewe replacement rates, both of which have an economic impact on farms (Farrell et al. 2019; Flay et al. 2021). Conversely, however, failing to cull ewes which then fail to rear a lamb or who die on-farm will also contribute to wastage. Therefore, well-thought through, evidence-based, culling decisions are essential for limiting wastage.

Nearly three-quarters of the farmers in this study routinely culled their ewes at a fixed-age, mostly at six years of age but with a range from four to nine years of age, and their main rationale was concern about increased death rates in older ewes. However, there appears to be no New Zealand data on death rates in ewes of different ages. In six Irish hill country flocks, the odds ratio of rising-six-year-old ewes surviving to the next mating was 0.11 when compared with rising-three-year-old ewes (Annett et al. 2011a). In Australia, within a cohort of 355 Merino ewes, Robertson and Friend (2023) did not find a significant increase in mortality rate as ewes aged from five to nine years of age although the number of sheep in the study was

relatively small which may have influenced statistical power. In terms of productivity, there appears to be no New Zealand data on the production of ewes six years and over compared with younger ewes. In Irish hill country flocks, Annett et al. (2011b) reported that six-year-old ewes had poorer lambing and weaning rates compared with younger ewes, but their overall output of weaned lambs was better than two-year-old ewes. Overall, these data indicate that there may be scope for some farmers to reconsider routinely culling for age, particularly if culling ewes at less than six years of age, but with the caveat that there is a paucity of New Zealand data on the implications of keeping older ewes. If keeping ewes to an older age, careful consideration of other aspects of ewe health (e.g. teeth and BCS) and ensuring good nutrition would likely be important considerations (McGregor 2011).

Culling decisions for ewes that failed to rear a lamb were diverse between farmers and between ewe age-groups. Griffiths et al. (2018) reported that 5.4% of two-tooth ewes that were diagnosed pregnant subsequently failed to rear a lamb while Flay et al. (2021) reported that, over their lifetimes, 15.9% of ewes were culled prematurely for that reason. Hence, this is a potential large source of premature culling and wastage. Griffiths et al. (2018) reported that ewe hoggets who failed to rear a lamb were no more likely to do so in the following season than those that did rear a lamb as a ewe hogget. In contrast, however, Amer et al. (2009) reported that 'wet-dry' adult ewes produced fewer lambs and the lambs produced had lower survival rates and weaning weights, although it was not clarified whether those ewes had been inspected and culled for udder defects prior to subsequent retention and re-breeding. Thus, the evidence for keeping ewes that fail to rear a lamb is mixed. If their udders are sound (Griffiths et al. 2019), keeping younger ewes that fail to rear a lamb, particularly if the weather during lambing was inclement, would be a means to reduce premature culling. Most of the farmers in the present study who kept ewes that failed to rear a lamb would identify them in some way and cull them if it occurred in subsequent years.

Most farmers in this study assessed ewes' incisor teeth for making culling decisions and those who didn't generally culled ewes at a relatively young age. This makes sense as incisor tooth defects increase with increasing age (McGregor 2011). The variation in how rigorous farmers described themselves when making culling decisions based on incisor tooth defects demonstrates that decisions for individual ewes are not always clear-cut. Incisor tooth defects reduce the liveweight of affected sheep, particularly when pasture supply is limiting (reviewed by McGregor 2011) and therefore taking BCS and predicted future pasture supply into account may also help when deciding whether to cull based on teeth.

Given the known impacts of ewe udder defects on lamb survival, growth and overall lamb production (Griffiths et al. 2019a, 2019b; Flay et al. 2020), it was encouraging that most farmers culled ewes with udder defects. However, some did not palpate the udders and only checked them visually or asked the shearers to notify them if they observed abnormalities during shearing. Most udder defects consist of hardness or lumps within one or both sides (Griffiths et al. 2019a; Ridler et al. 2022) which are often not visible, emphasising the importance of palpating udders rather than simply looking at them.

Farmer approaches to sheep with foot defects was variable and there was a somewhat *ad hoc* approach to foot examination. Many farmers would choose to simply cull affected ewes rather than attempt treatment. Footrot causing moderate or severe lameness is relatively uncommon in coarse-wool breeds of sheep in New Zealand (West et al. 2017) and

resistance to footrot has a genetic basis with a heritability of 15–25% (Raadsma and Dhungyel 2013). Therefore, if only a small number of ewes in a flock are affected this suggests they are likely to be more genetically susceptible and hence culling them is likely a reasonable approach. However, many of the farmers would also cull ewes with hoof overgrowth and it is possible that one-off hoof-trimming of these ewes might mean the issue does not recur. This could be a consideration for farmers to reduce wastage.

Farmer attitudes towards culling for conformation, type or looks were variable and primarily based on personal preference. If the perceived defects are non-structural and do not impact on production, retaining such ewes would reduce flock wastage. Use of a terminal mob/B-mob is likely a good method to retain ewes whose appearance is considered undesirable but who are still productive. This would ensure that any potential genetic influence of the appearance is not passed on to future generations of ewes. Use of terminal sires also results in increased cash operating surpluses (Farrell et al. 2020).

Most farmers separated low BCS ewes at weaning, preferentially fed them to gain BCS and culled those that failed to do so. This management strategy is believed to both optimise production (reviewed by Kenyon et al. 2014) and reduce the risk of mortality (Flay et al. 2021).

While the farmers in this study were located throughout New Zealand and their farms ranged in size, it is unknown how reflective their culling decisions and rationale are of the New Zealand sheep farmer population more generally. Further data would be required for a more thorough understanding of culling practices.

Conclusions

Apart from culling mixed-age and two-tooth ewes for non-pregnancy and culling ewes with vaginal prolapse, New Zealand farmers' culling decisions and rationale were diverse and varied between farmers, different ewe age-groups on the same farm and for individual farmers based on season, severity, economic considerations, and personal preference. There is scope for some farmers to reconsider some of their culling decisions, in particular age (especially if culling at less than six years of age), pregnant ewes that failed to rear a lamb, and perceived defects of the feet, conformation, type or looks if they are unlikely to be limiting production. Careful consideration of culling decisions will aid in reducing ewe wastage and potentially improve overall farm efficiency.

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