

AGE AT CULLING AND REASONS OF CULLING IN AUSTRALIAN DAIRY COWS

Z.W. Workie, J.P. Gibson and J.H.J. van der Werf

School of Environmental and Rural Science, University of New England, Armidale, NSW,
Australia

SUMMARY

Culling reasons in Australian dairy cattle were examined using culling records from 1995 through 2016. A total of 2,452,124 individual cow culling observations were obtained of which 2,140,337 were Holstein and 311,787 were from Jersey cows. The most important culling reasons identified were infertility (17.2%), mastitis (13.3%), low production (9.7%), sold for dairy purpose (6.4%) and old age (6.5%) while 38.7% were “other reasons not reported”. The average age at culling was nearly the same for Holsteins (6.75 years) and Jerseys (6.73 years). The trend in age at culling over the last twenty years showed a slight increase for Holstein cows (by 0.01 years) and a decrease for Jersey cows (by 0.03 years). Over the last two decades, culling age has changed little in both breeds, whereas culling reasons have changed with low production becoming a less important reason for culling (decreasing by 29% and 37% in Holsteins and Jerseys, respectively) and infertility increasing in both breeds by 13% and 19% in Holsteins and Jerseys, respectively).

INTRODUCTION

A key objective of dairy farmers is to reduce replacement costs, by keeping productive and fertile cows in their herds. However, a number of reasons may trigger farmers to cull cows from their herd; such reasons for culling can be classified as voluntary, or involuntary culling (Weigel *et al.* 2003; Fetrow *et al.* 2006). Involuntary culling happens when the farmer is coerced to cull a productive, profitable cow due to illness, injury, infertility, or death. Voluntary culling, on the other hand, occurs when a farmer chooses to remove a cow due to poor milk production, old age and replacement. Longevity of a cow is also an important trait affecting dairy farm profitability. Increased longevity of dairy cattle helps dairy farmers to get more economic return and reduce replacement cost (Allaire and Gibson 1992; Pritchard *et al.* 2013). Protein yield and fertility are important traits in the breeding objective, in addition to being possible reasons for culling. A previous study (Haile-Mariam and Pryce 2015) estimated genetic parameters for survival traits over time, however, information on reasons for culling and their trend over time is limited in the Australian dairy herd. The aim of this study was therefore to investigate the main causes of culling in Australian dairy herds and thereby to evaluate trends in age of culling and culling reasons.

MATERIAL AND METHODS

Data source. For this study, data on culling reasons were provided by DataGene (previously ADHIS). The data used for this study were extracted from milk recorded herds in Australia. The data were collected based on farmers’ recording about each culling reason. A total of 2,502,258 records were received with each record including data on cow identification number, national herd identification number, breed, date of birth of a cow, disposal date of a cow and a code for individual culling reasons. Only a single reason of culling was recorded for each cow removed from the herd. Records of all culled cows were examined across year of culling. Analysis based on year of birth was not considered due to the effect of censored data in recent birth years and relatively older cows in the data for herds in those earlier birth years.

For an evaluation of trend in age at culling over time, we undertook an analysis based on ordering

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cows by culling year and counting the total number of cows culled for all years from 1970 through to 2016. However, for the years from 1970 to 1994, there were very few recorded reasons for culling. As a result, records that had a year of culling before 1995 were disregarded. In the final data set, a total of 2,452,124 records (2,140,337 Holstein and 311,787 Jersey cows) were retained from cows in 11,145 herds culled between 1995 and 2016. Birth season of a cow was classified into two categories; season 1 contained the records of cows that were born from January to June while season 2 covered the period from July to December, as in (Visscher and Goddard 1995b). For evaluation of trend of culling reasons, data were also split into two year groups (1995-2005 and 2006-2015) based on the differences observed in proportion of culling reasons on these periods.

Statistical analysis. Descriptive statistics were carried out to identify and describe the main disposal reasons stated by farmers. Trends in age at culling were analysed based on year of culling to evaluate how herd life has changed over time according to the animal's culling year and how it differed between breeds. Age at culling was analysed using a univariate analysis with the following linear model,

$$y_{ijkm} = \mu + B_i + Y_j + HS_k + e_{ijkm}$$

where, y_{ijkm} = is an observed age (in years) on animal $ijkm$ in breed i , year j and in herd-season k , μ = the overall mean, B_i = effect of breed, Y_j = effect of culling year and HS_k = the fixed effect of herd-season, e_{ijkm} = error term.

RESULTS

Reasons for culling. About 38.7% of the cows left the herd for 'other reasons' (Table 1). Aside from 'other reasons', the main reasons for culling across breeds were infertility, mastitis, low production, sale for dairy purpose and old age. The proportion of cows culled due to infertility was slightly higher for Holstein than Jersey cows. The proportion of cows culled for infertility in both breeds increased in the culling year group (2006-2015) compared with the culling year group (1995-2005). Next to infertility, the second and third most common reasons of culling in Holstein cows were mastitis and low production. By contrast, the second and third causes for culling were reversed in Jersey cows. Culling due to low production decreased from 10.4 to 7.4% in Holstein and 18.2 to 11.4% in Jersey cows, between the decades 1995-2005 and 2006-2015. In contrast, the proportion of cows culled due to sale reasons increased from 1995-2005 to 2006-2015. Culling of cows for involuntary culling (IC) reasons included infertility, mastitis and accident, which together accounted for 33.0% of culling reasons for the 2 breeds. Voluntary culling (VC) accounted for 22.5% of reasons, with about 9.7%, 6.4% and 6.4% of cows removed because of low production, sale for dairy purpose and old age, respectively.

Table 1. Proportion (%) of culling reason types by breed and year of culling

Culling reasons	Year of culling (1995-2005)		Year of culling (2006-2015)		Overall
	Holstein	Jersey	Holstein	Jersey	
Other reasons	39.8	37.5	38.5	33.8	38.7
Infertility	16.4	14.5	18.5	17.3	17.3
Mastitis	14.0	11.9	12.8	13.6	13.3
Low production	10.4	18.2	7.4	11.4	9.7
Old age	7.0	7.4	5.7	6.4	6.6
Type defect	3.3	2.9	3.2	4.2	3.3
Sold for dairy purpose	3.3	3.5	9.7	9.6	6.4
Accident	2.7	1.6	1.8	1.4	2.2
Poor temperament	1.9	2.1	1.2	1.8	1.6
Calving difficulties	1.2	1.2	1.2	0.6	1.1

Trend in culling age. The least squares mean of age at culling across year of culling for Holstein and Jersey cow breeds is shown in Figure 1. The difference in estimated age at culling was small between breeds but significant ($P < 0.05$). Holstein dairy cows had slightly higher estimated mean age at culling compared with their Jersey counterparts (6.75 years for Holstein and 6.73 years for Jersey cows). The minimum and maximum mean estimated ages at culling for Holstein cows were observed in the year 2003 (6.55 years) and in 1997 (7.0 years), whereas for Jersey cows the corresponding average values were 6.45 years in 2005 and 7.10 years in the year 1997, respectively. Holstein cows had a slightly increasing trend in age at culling (0.01 years) over the last 20 years whereas the estimated age at culling had declined little in the same period for Jersey cows. Overall, Holstein cows were culled at a slightly older age, especially in the last decade, and that the age of voluntary culling (VC) was overall slightly lower than involuntary culling (IC) with more difference for the Jersey cows. There was also an association between culling reasons, whereby younger cows were culled for low production and infertility, while older cows were culled for mastitis.

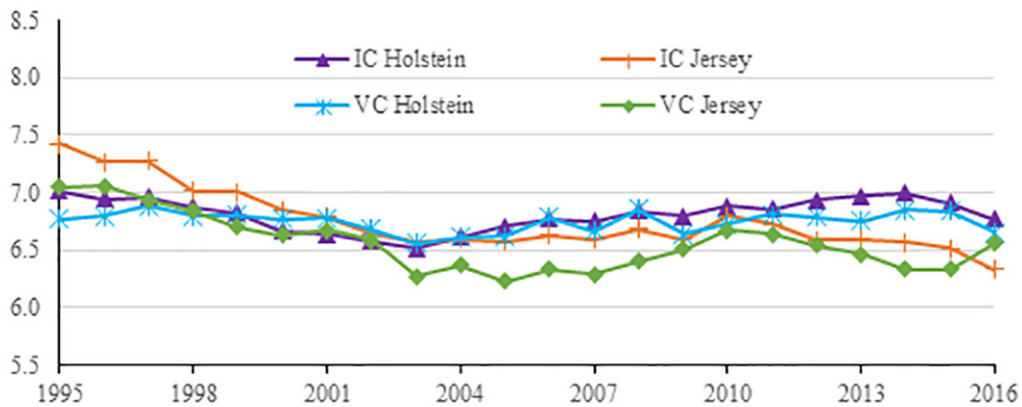


Figure 1. Least squares means of age at culling in each year for Holstein and Jersey dairy cows by year of culling

DISCUSSION

Descriptive statistics were used to calculate the proportion of culling reasons recorded for the two dairy breeds. Identifying reasons for culling cows could also be useful in determining the main problems in dairy herds and in identifying breeding objectives and evaluating results of selection. Excluding other reasons not reported, the most prevalent reason for culling dairy cows was infertility followed by mastitis and low production. In agreement to the current study, previous research findings identified infertility as the main reason of culling dairy cows in Sweden (Ahlman *et al.* 2011) and USA (Bascom and Young 1998; Smith *et al.* 2000). In this study, the phenotypic trend of culling cows due to infertility has increased for both dairy cow breeds from 1995-2005 to 2006-2015, whereas low production has shown a sharp decline. Culling due to low production could be part of the economic and management decisions to maintain a required number of dairy cows in a particular farm where good producing cows might have low chance to be culled (Roxström and Strandberg 2002; Pinedo *et al.* 2014). The proportion of Jersey cows culled for mastitis increased over the year groups. Previous studies regarding the proportion of cows leaving for mastitis of 12.1% (Hadley *et al.* 2006) and 12.0% (Smith *et al.* 2000) in the US dairy cows are closer to the levels in this study.

In the current study, culling related to other reasons not reported had the highest proportion for both dairy breeds. In terms of making management decisions, this category yields no information. A more descriptive category needs to be developed that can account for the list of reasons that these cows were removed from the herd.

The pattern of age at culling over time for both dairy breeds was evaluated with the year of birth and year of culling. When age at culling was evaluated against year of birth, the estimated trend of age at culling sharply declined (results not presented) but this estimate was deemed to be biased because of censoring. A censored record can be seen as the minimum survival the cow reaches and this could be a problem in prediction of breeding values for survival because estimated breeding values are required for live animals. By fitting year of culling in the model, all age groups of culled cows were included in the analysis. In the same way, the trend of estimated age at culling for the two dairy breeds for the last 20 years was less varied (Figure1). The overall estimated least squares mean for age at culling was about 6.65 years. By assuming the average age of 2 years at first calving for most of the heifers, the productive life of cows in the present study estimated to be 4.6 lactations, which is comparable with earlier reports of average productive life of 4.6 and 4.3 lactations for Holstein and Jersey cows, respectively in Australian dairy cattle (Visscher and Goddard 1995a). The average herd life observed in the current study is higher than the average herd life observed in Dutch dairy cattle (Van Pelt *et al.* 2015), which was found to be 3.2 lactations.

CONCLUSION

Phenotypic analysis of culling data showed that the estimated average age at culling has changed little between 1995 and 2016. The proportion of major culling reasons such as infertility, low production and mastitis in both dairy breeds have changed over the past two decades; which might indicate a change in survival traits over time and a likely change in correlation of survival with other objective traits such as yield and fertility.

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