

Days in Milk at Culling in Holstein Dairy Cows

A. Heravi Moussavi

Department of Animal Science, Ferdowsi University of Mashhad, Mashhad 91775-1163, Iran

Abstract: This study presents the overall culling reasons and also the days in milk at culling in Holstein dairy cows. Data regarding to all exits of cows from the herd were collected during 1996 until 2006 in 7 large commercial Holstein farms. Each exiting cow has been characterized by demographic data, production data and culling reason. The reasons for culling were grouped into 8 logical groups including sold for dairy purposes, low milk production, feet and legs problems, reproductive problems, death, mastitis, disease and udder problems. The dependent variable of interest was the number of days between calving and culling. The data on the Days In Milk (DIM) when a cow was culled for the defined category were analyzed using General Linear Models. The distribution analyze for when a cow was culled during the lactation period was done using the statistical software package JMP (SAS Institute Inc., NC, USA). The result showed that the most frequent primary culling reasons were diseases and reproductive problems. Parity at culling averaged 3.5. Calving-to-culling interval averaged 217.16 days and its distribution showed a progressive decrease in frequency. Days in milk at culling was impacted by the culling category ($p < 0.001$). Days in milk at culling for cows which culled due to udder problems and mastitis were the lowest and for reproductive problems was the greatest compare with the other categories. Days in milk at culling was impacted by the parity groups ($p < 0.001$) and was greatest for primiparous and lowest for the multiparous cows ($p < 0.001$). High producer cows had greatest days in milk at culling ($p < 0.001$). The result of this study demonstrated that almost half of the culls occurred due to diseases. The result also demonstrated that cows were culled at different stage of lactation according to the culling category.

Key words: Dairy cows, culling, milk, DIM, Iran

INTRODUCTION

Culling (exiting) is the departure of cows from the herd because of sale, slaughter, salvage, or death. The term "cull" refers to all cows that leave the dairy regardless of their destination or condition at departure (Fetrow *et al.*, 2006). Culling is a complex issue and many factors are involved in the decision to cull a cow. Farmer consider many cow factors, such as age, stage of lactation, milk production, health status, disposition and reproductive performance, when determining whether or not a cow should be culled (Beaudeau *et al.*, 2000). The culling decision may also be affected by economic factors, such as milk price, the price of culled cows and the price and availability of replacement heifers. In addition, the attitudes of farmers have an effect on which cows are removed from a herd (Bascom and Young, 1998). Cows are culled for a variety of reasons. Dairy cows may be culled for either involuntary reasons (i.e., mastitis, extreme lameness, poor reproduction, death, acute disease and so on) or voluntary reasons (i.e., dairy purposes or deemed normal except than they were poor producers). Both biology and

management affect the decision to cull a cow. When making a decision, the dairy farmer considers 5 major reasons: illness, low milk yield, conception status, stage of lactation and parity (Grohn *et al.*, 1998). But the predominant reasons for culling are reproduction (i.e., failure to conceive), health and low production (Bascom and Young, 1998).

Iranian dairy production has undergone significant and considerable structural changes during the last two decades with creation of larger herds. The increased prices for replacement heifers in the last several years have increased the interest in increasing productive life and there by lowering culling rates. Cow longevity is highly related to dairy farm profit and therefore, replacement of dairy cows is a major expense for producers. On the other hand, the risk of culling is not consistent across all stages of lactation. Cows experience the highest risk shortly after calving (Fetrow *et al.*, 2006). Only a few previous studies have characterized culled cows based on the associations between culling reasons and cow economic characteristic. One of this important characteristic is the lactation stage when the cow is culled.

The objective of this study was to study the overall culling reasons and also the days in milk at culling in Holstein dairy cows.

MATERIALS AND METHODS

Data regarding to all exits of cows from the herd (due to culling, sale, or death on the farm) were collected during 1996 until 2006 in 7 large commercial Holstein farms. During the period the median number of cows in the study herds was 500. Farms were located in eastern north of Iran and were enrolled in the official milk-recording scheme. The farm selection was done among those affiliated with at least one of dairy cooperatives and was also based on the farmer's willingness to cooperate in the study. Each farmer had dairy management software in farm to collect the data and manage all dairy operations. Farmers have recorded information about all culled cows. Each exiting cow has been characterized by demographic data (birth date, final calving date, exit date, parity at exit), production data (cumulative first 60 days milk productions) and culling reason. Collected data were checked for consistency of data. Extra attention was paid to numeric values and to the consistency of dates (birth, final calving, culling) and lactation number.

Herds were characterized by dummy variables. To describe the reasons for culling, the open-ended answers were grouped into 99 groups of primary culling reasons. On account of the small numbers of the observations for some of the primary groups, categories were combined into eight logical groups including sold for dairy purposes, low milk production, feet and legs problems, reproductive problems, death, mastitis, disease and udder problems (Table 1). Parity at culling was discretised by creating 5 classes: 1, 2, 3, 4 to 5, >5 (Table 2). The dependent variable of interest was the number of days between calving and culling. The data on the Days In Milk (DIM) when a cow was culled for the defined category were analyzed using General Linear Models. The distribution analyze for when a cow was culled during the lactation period was done using the statistical software package JMP (SAS Institute Inc., NC, USA).

RESULTS

During the study period, a total of 4405 cows (females having calved at least one) were culled or sold (28 mortalities were excluded). The most frequent primary culling reasons were diseases and reproductive problems (47.14 and 25.65% of total culls, Table 2). Parity at culling averaged 3.5. The median was 3 and 25% and 75% quartiles were 2 and 5, respectively. Its distribution showed a progressive decrease in frequency (Fig. 1). Calving-to-culling interval averaged 217.16 days. The median was 183 and 25 and 75% quartiles were 41.75 and 350 days, respectively. Its distribution showed a progressive decrease in frequency (Fig. 2). Cumulative first 60 days milk production in the last calving averaged 2015 kg. The median was 2036 and 25 and 75% quartiles were 1644 and 2405 kg, respectively. Its distribution showed a normal distribution (Fig. 3).

Days in milk at culling was impacted by the culling category ($p < 0.001$, Fig. 4). Days in milk at culling for cows which culled due to udder problems and mastitis were the lowest and for reproductive problems was the greatest compare with the other categories. Days in milk at culling

Table 1: Frequency of declared main culling reasons across parities

Culling reason	Parity (and number)						Total
	1 (963)	2 (853)	3 (859)	4 (662)	5 (476)	<6 (620)	
Sold for dairy purposes	91	65	52	38	18	46	310
Low milk production	37	45	68	54	41	73	318
Feet and legs problems	39	36	24	25	21	36	181
Reproductive problems	238	233	200	168	132	192	1163
Death	3	6	6	4	3	6	28
Mastitis	53	34	49	30	24	35	225
Disease	452	410	437	323	219	296	2137
Udder problems	50	24	23	20	18	36	171

Table 2: Description of variables and levels accounted for the statistical analysis

Variable	Levels definition	Frequency (%)
Culling reasons	Sold for dairy purposes	6.9
	Low milk production	7.015
	Feet and legs problems	3.993
	Reproductive problems	25.656
	Death	0.618
	Mastitis	4.964
	Disease	47.143
	Udder problems	3.772
Parity at culling	1	21.07
	2	17.70
	3	17.88
	4 to 5	25.30
	>5	18.05
Cumulative first 60 days production, kg	<1644	24.95
	1644 to 2036	24.99
	2036 to 2405	25.02
	>2405	25.05

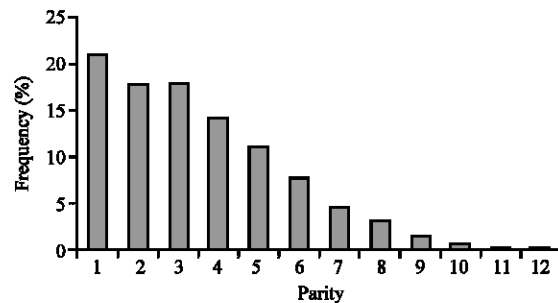


Fig. 1: Parity at culling in Iranian Holstein cows

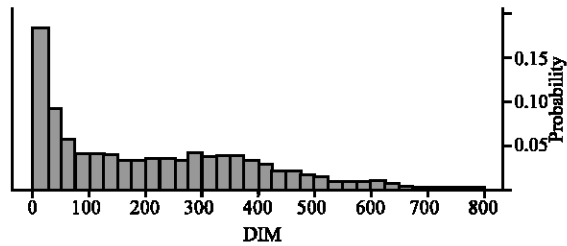


Fig. 2: Interval from the final calving to culling in Iranian Holstein cows

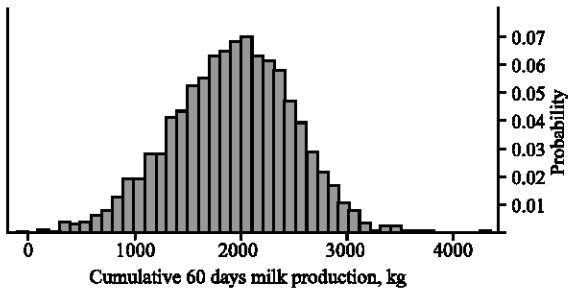


Fig. 3: Cumulative first 60 days milk production frequency in the final lactation in the culled cows

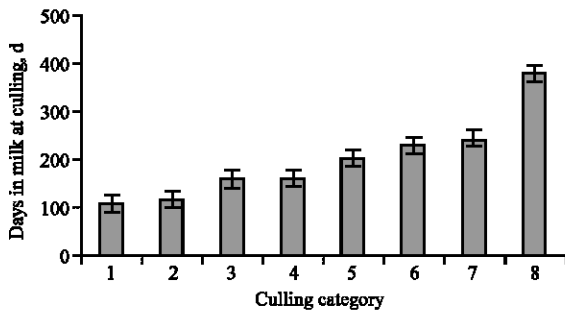


Fig. 4: DIM at culling for different culling category (1= udder problem, 2 = mastitis, 3= diseases, 4= feet and leg problems, 5= sold for dairy purposes, 6= death, 7= low milk production, 8= reproductive problems).

was impacted by the parity groups ($p < 0.001$, Fig. 5). Days in milk at culling was greatest for primiparous and lowest for the multiparous cows ($p < 0.001$, $SE = 12.20$).

Days in milk at culling was impacted by cumulative first 60 days milk production groups ($p < 0.001$, Fig. 6). Days in milk at culling was greatest for the high producer cows ($p < 0.001$, $SE = 12.50$). The cows produced less than 1644 kg in their cumulative 1st 60 days were culled sooner than the others. The other 2 groups, 1644-2036 kg and 2036-2405 kg, were in the middle.

Days in milk at culling was impacted by culling year ($p < 0.05$) but it was similar among the seasons.

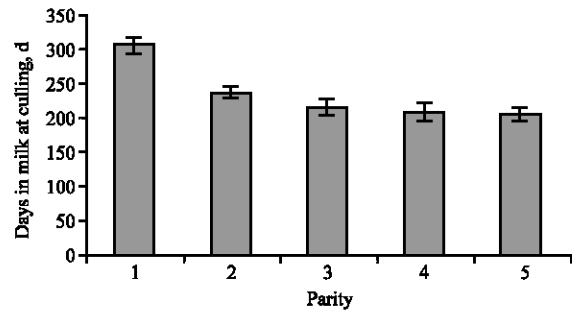


Fig. 5: DIM at culling for different parities

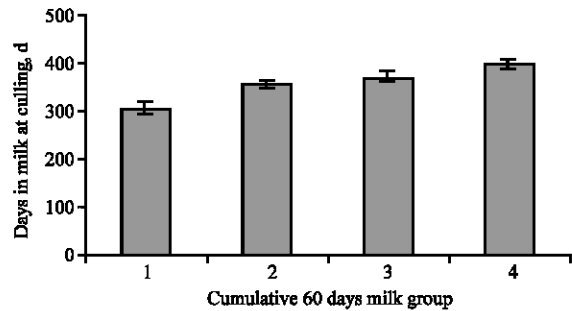


Fig. 6: DIM at culling for different cumulative first 60 days milk production group (1= less than 1644, 2= 1644-2036 kg, 3 = 2036-2405 kg, 4= more than 2405)

DISCUSSION

Diseases and reproductive disorders were the main reasons for culling in the present study. Disease, per se, accounted for almost half of the total culls in agreement with another study showed that half of the herd removals occur involuntarily and prematurely because of health disorders (Beaudeau *et al.*, 2000). This is much higher than reported previously (Seegers *et al.*, 1998; National Animal Health Monitoring System, 2002). Usually, culling reasons are grouped under two categories: involuntary and voluntary (Esslemont and Kossaibati, 1997). It was previously shown that dairy cows, experiencing a disease or a reproductive disorder, are exposed to higher culling rates (Dohoo and Martin, 1984; Erb *et al.*, 1985; Beaudeau *et al.*, 1993; Seegers *et al.*, 1998). This category of culls is usually designated as ‘involuntarily culled cows’, in contrast to all the other culls or sales, which are designated as ‘voluntarily culled cows’ (Seegers *et al.*, 1998). It was shown that diseases have an important effect on culling. Their effects differed depending on stage of lactation (Grohn *et al.*, 1998).

The second most prevalent primary reason for culling was reproduction. In contrast with our result another studies showed that reproductive disorders constituted the most-frequent culling reason (Bascom

and Young, 1998; Seegers *et al.*, 1998). Beaudéau *et al.* (1993) reviewed some studies on culling and showed that in the most reviewed studies, reproductive disorders were the main culling reasons. The frequency of culling due to reproductive disorders in the present study was similar to the other studies with French (Seegers *et al.*, 1998) and American cows (National Animal Health Monitoring System, 2002), but lower than the England cows (Esslemont and Kossaibati, 1997).

Low milk production was the third reason for culling in frequency (7.01%). The frequency was much lower than reported by Seegers *et al.* (1998) and National Animal Health Monitoring System (2002), but comparable to other study (Esslemont and Kossaibati, 1997) who reported a frequency of 4.8%.

Sold for dairy purposes was the fourth reason for culling and accounted 6.9% of total exits. The frequency is similar to other report (Seegers *et al.*, 1998). Mastitis and udder problems were the next reasons for culling and together accounted 8.7% of total exits. Seegers *et al.* (1998) showed that udder disorders accounted for one out of 8 culls which is higher than the frequency in our study. In another study udder or mastitis problems was the leading reason given for culling (National Animal Health Monitoring System, 2002). Bascom and Young (1998) reported the second most prevalent reason for culling as mastitis.

The proportion of cows culled for locomotor disorders and defects in the present study (3.99%) was greater than reported by Seegers *et al.* (1998) and Beaudéau *et al.* (2000), but lower than reported by Esslemont and Kossaibati (1997) and National Animal Health Monitoring System (2002). It seems that many foot problems stay on a subclinical level and perhaps do not play a major role in the culling decision. The low frequency for locomotor disorders in this study may also be related to the loose-stall housing.

Our result on parity at culling is consistent with other study showed that, out of every 4 cows entering a herd, three did not reach a 5th calving, two a 4th and one a 2nd; there was a high incidence of premature culling (Seegers *et al.*, 1998). To keep a cow until a higher parity allows the farmer to spread over a longer period the difference between the production cost of the replacement heifer and the carcass value of the culled cow. However, very high parities at culling reduce improvement in genetic merit (due to longer intervals between generations) and cows of higher parities also tend to be at higher risk for several health disorders (Bigras-Poulin *et al.*, 1990; Faye *et al.*, 1996). Optimal length of productive life span was estimated to be 33-48 months, but was very sensitive to prices and herd production level (Van Arendonk and Dijkhuizen, 1985; Rogers *et al.*, 1988; McCullough and DeLorenzo, 1996).

To assess the extent to which the culling circumstances of a given cow contribute to a possible economic loss, it is important to consider the stage within lactation at culling, which is associated with variation in future profitability (Van Arendonk, 1985). Our results showed that 25% of culling occurred before 42 days in milk. This result is in contrast to other report showing a bimodal distribution in calving-to-culling interval (Seegers *et al.*, 1998). Others also showed a desire to cull cows late in lactation (Milian-Suazo *et al.*, 1988; Pasman *et al.*, 1995). This contributes also to an economic loss, since the future profitability of a cow decreases from calving to 6 months in milk and then increases again after 8 months in milk (if she reaches a confirmed pregnancy status of several months) (Van Arendonk, 1985). The future profitability decreases also with increasing days in milk, for cows remaining open. It seems that the higher expenses in Iran for keeping cow in herd might be the reason for this discrepancy.

In the present study, DIM at culling was impacted by different culling category. Health disorders may have different effects on culling depending on when they occur and when their effect on culling is observed (Beaudéau *et al.*, 2000). The differential impact of udder problems, mastitis and health-related problems in reducing the DIM at culling and reproductive problems in increasing DIM at culling clearly explained the farmers' decision to cull. Studies on possible interactions between occurrence of health disorders and time of culling may indicate in which delay farmers react. Two categories of health disorders can be considered. The first one includes health disorders for which a culling decision is made very quickly and for which the cow leaves the herd soon after (Beaudéau *et al.*, 2000). In agreement with our result, other studies showed that teat injuries (Beaudéau *et al.*, 1994) and mastitis occurring before the peak of lactation (Grohn *et al.*, 1997) induced early culling. These health disorders are mainly related to the fact that they can prevent milking. The second group comprises other types of health disorders which, in most cases, do not affect milking ability and for which culling is generally delayed. These are mainly reproductive disorders and some metabolic disorders which farmers may choose to treat first in order to allow the recovery of the cow and therefore postpone her possible culling (Beaudéau *et al.*, 2000). This may also explain why we saw greater DIM at culling for the primiparous cows compare with the others.

Grohn *et al.* (1997) proposed the first 60 d cumulative milk yield as a relevant descriptor to control for milk yield. DIM at culling was impacted by cumulative first 60 days milk production and increased linearly with increase in the milk production. It seems that the economic advantage of keeping high producer cows affect the DIM at culling and farmers prefer to keep high production cows.

CONCLUSION

In this study, almost half of the culls occurred due to diseases. Health-related culling also consisted mainly of exits early within the final lactation. Therefore, better preventive measures and/or treatments should be implemented. The result of this study also demonstrated that cows were culled at different stage of lactation according to the culling category. Udder problem and reproductive problems had the lowest and greatest calving-to-culling interval, respectively. The median time when a cow was culled suggested that it was preferred to cull a cow far after milk peak.

ACKNOWLEDGMENTS

The authors gratefully acknowledge funding from Ferdowsi University of Mashhad.

REFERENCES

- Bascom, S.S. and A.J. Young, 1998. A summary of the reasons why farmers cull cows. *J. Dairy Sci.*, 81: 2299-2305.
- Beaudeau, F., K. Frankena, C. Fourichon, H. Seegers, B. Faye and J.P.T.M. Noordhuizen, 1994. Associations between health disorders of French dairy cows and early and late culling decision making within the lactation. *Prev. Vet. Med.*, 19: 213-231.
- Beaudeau, F., A. Henken, C. Fourichon, K. Frankena and H. Seegers, 1993. Associations between health disorders and culling of dairy cows: A review. *Livest. Prod. Sci.*, 35: 213-236.
- Beaudeau, F., H. Seegers, V. Ducrocq, C. Fourichon and N. Bareille, 2000. Effect of health disorders on culling in dairy cows: A review and a critical discussion. *Ann. Zootech.*, 49: 293-311.
- Bigras-Poulin, M., A.H. Meek, S.W. Martin and I. McMillan, 1990. Health problems in selected Ontario Holstein cows: frequency of occurrences, time to first diagnosis and associations. *Prev. Vet. Med.*, 10: 79-89.
- Dohoo, I.R. and S.W. Martin, 1984. Disease, production and culling in Holstein-Friesian cows. V-Survivorship. *Prev. Vet. Med.*, 2: 771-784.
- Erb, H.N., R.D. Smith, P.A. Oltenacu, C.L. Guard, R.B. Hillman, M.C. Powers, M.C. Smith and M.E. White, 1985. Path model of reproductive disorders and performance, milk fever, mastitis, milk yield and culling in Holstein cows. *J. Dairy Sci.*, 68: 3337-3349.
- Esslemont, R.J. and M.A. Kossaibati, 1997. Culling in 50 dairy herds in England. *Vet. Rec.*, 140: 36-39.
- Faye, B., R. Boulme, F. Lescourret and J.B. Coulon, 1996. A method describing disease patterns during the life span of dairy cows. *Vet. Res.*, 27: 453-464.
- Fetrow, J., K.V. Nordlund and H.D. Norman, 2006. Invited Review: Culling: Nomenclature, definitions and recommendations. *J. Dairy Sci.*, 89: 1896-1905.
- Grohn, Y.T., V. Ducrocq and J.A. Hertl, 1997. Modeling the effect of a disease on culling: An illustration of the use of time-dependent covariates for survival analysis. *J. Dairy Sci.*, 80: 1755-1766.
- Grohn, Y.T., S.W. Eicker, V. Ducrocq and J.A. Hertl, 1998. Effect of diseases on the culling of Holstein dairy cows in New York state. *J. Dairy Sci.*, 81: 966-978.
- McCullough, D.A. and M.A. DeLorenzo, 1996. Evaluation of a stochastic dynamic replacement and insemination model for dairy cattle. *J. Dairy Sci.*, 79: 50-61.
- Milian-Suazo, F., H.N. Erb and R.D. Smith, 1988. Descriptive epidemiology of culling in dairy cows from 34 herds in New York state. *Prev. Vet. Med.*, 6: 243-251.
- National Animal Health Monitoring System, 2002. Dairy 2002 Part I: Reference of Dairy Health and Management in the United States. USDA, Animal and Plant Health Inspection Service, Veterinary Services, Center for Epidemiology and Animal Health, Fort Collins, Co.
- Pasman, E.J., M.J. Otte and R.J. Esslemont, 1995. Influences of milk yield, fertility and health in the first lactation on the length of productive life of dairy cows in Great Britain. *Prev. Vet. Med.*, 24: 55-63.
- Rogers, G.W., J.A.M. Van Arendonk and B.T. McDaniel, 1988. Influence of production and prices on optimum culling rates and annualized net revenue. *J. Dairy Sci.*, 71: 3453-3462.
- Seegers, H., F. Beaudeau, C. Fourichon and N. Bareille, 1998. Reasons for culling in French Holstein cows. *Prev. Vet. Med.*, 36: 257-271.
- Van Arendonk, J.A.M., 1985. Studies on the replacement policies in dairy cattle. II, Optimum policy and influence of changes in production and prices. *Livest. Prod. Sci.*, 13: 101-122.
- Van Arendonk, J.A.M. and A.A. Dijkhuizen, 1985. Studies on the replacement policies in dairy cattle. III. Influence of variation in reproduction and in production. *Livest. Prod. Sci.*, 13: 339-349.