YYÜ TAR BİL DERG
(YYU J AGR SCI)
2013, 23(2): 134–140

Geliş Tarihi(Received):06.03.2013
KabulTarihi (Accepted):19.04.2013

Araştırma Makalesi/*Research Article (Original Paper)*

# Culling Reasons and Affecting Factors in a Holstein Dairy Herd Raised in Southeast Region of Turkey

**Hasan ÜLKER[1*] Galip BAKIR[2]**

[1]Yüzüncü Yıl University Faculty of Agriculture Department of Animal Sciences Van, Turkey
[2]Kahramanmaraş Sütçü İmam University Faculty of Agriculture Department of Animal Sciences Kahramanmaraş, Turkey
*e-mail: hasulker3@yahoo.com; Tel: +90 (432) 2251017 / 1606; Fax: +90 (432) 2251041

**Abstract:** This study was done to obtain some descriptive aspects and determine the reasons for culling in a dairy herd in a State Farm located in South East of Turkey. Culling and yield records of 2617 animals during years 2000-2010 were evaluated. The effects of year, parity and milk yield classes on ratios of culling reasons were analyzed. Data were analyzed using SPSS program and chi-square test was applied. The proportions of culled animals were due mainly to involuntary culling (85.8%) with small proportion of voluntary culling (14.2%). The most frequent primary involuntary culling reasons for lactating cows were diseases (22.5%), udder problems (22.2%), reproductive disorders (19.7%) and conformation (17.4%). Culling reasons' ratios were affected from years, parity and milk yield classes ($P<0.05$). It was concluded that data obtained in the present study were compatible with many data determined in various farm or environmental conditions and farm management in those ten years of period is reasonably successful. Some cautions on health issues would help farm administration to make more profitable dairy farming.

**Key Words:** Holstein, Reasons for culling, Parity, Yield

## Güneydoğu Anadolu Bölgesinde Yetiştirilen Bir Siyah Alaca Sürüsünde Sürüden Çıkarma Nedenleri ve Etkileyen Fakltörler

**Özet:** Bu araştırma, Türkiye'nin Güney Doğusunda bir Devlet Tarım İşletmesinde yetiştirilen bir süt sığırı sürüsünde bazı tanımlayıcı değerler elde etmek ve sürüden çıkarma nedenlerini belirlemek amacıyla yapılmıştır. Araştırmada 2000-2010 yıllarını kapsayan 2617 baş sığıra ait sürüden çıkarma ve verim kayıtları değerlendirilmiştir. Yıl, buzağılama sayısı ve süt verim sınıfının sürüden çıkarma nedenleri oranına etkisi analiz edilmiştir. Veriler SPSS istatistik paket programında değerlendirilmiş ve ki-kare testi uygulanmıştır. Ayıklanan hayvanların önemli kısmı (%85.8) zorunlu nedenlerle sürüden çıkarılırken az bir kısmı (%14.2) isteyerek sürüden çıkarılmıştır. Sağılan ineklerde en sık görülen belli başlı zorunlu sürüden ayıklama nedenleri hastalıklar (%22.5), meme problemleri (%22.2), üreme bozuklukları (%19.7) ve konformasyondur (%17.4). Ayıklama nedenleri oranları yıl, buzağılama sayısı ve süt verim sınıflarından etkilenmiştir ($P<0.05$). Çalışmada elde edilen bulguların bir çok çiftlik ve çevre koşullarında elde edilen verilerle uyumlu olduğu ve geçen on yıllık süre boyunca çiftlik yönetiminin orta düzeyde başarılı olduğu söylenebilir. Çiftlik yönrtimince sağlık konularında alıncak bazı tedbirler daha karlı bir süt sığırcılığı yapmaya yardım edecektir.

**Anahtar Kelimeler:** Siyah Alaca, Sürüden çıkarma nedenleri, Buzağılama sayısı, Verim

## Introduction

Dairy farm husbandry seeks economic profit via mainly increase in milk and calf production. For many dairy enterprises it has been reported that cows are not valued for their genetic potentials and culled at early ages (Kumlu et al. 1991; Uzmay et al. 1998; Kumlu and Akman 1999). Culling can be defined as departure of cows from the herd due to sale, slaughter or death. In this respect, culling could be voluntary (depending of the free choice of farmer such as removing animal from herd because of low milk production or old age) or involuntary (when there is no choice but to remove the animal for some reasons such as infertility or diseases) (Fetrow et al. 2006). Optimum dairy herd profitability could be achieved by

effective culling management strategies. Information, therefore, regarding to reasons for culling and ratio of culling in a dairy herd has crucial importance for subsequent management strategies.

Demographic information regarding to culling in dairy cows are relevant to the Turkish agricultural industry, however, few data are available on the demographics of cows within a national dairy husbandry. A relatively small number of studies have examined culling rate and characterization of culled dairy cows under Turkish dairy farming conditions and provided some demographic information for some regions of the country (Yaylak 2003; Işık 2006; Kara et al. 2010). Reported studies were done in Southwest and West regions of the country and there is few data on the herds in South East part of the country (Koncagül et al. 2007). Thus, this study was designed to report some descriptive aspects and the reasons for culling in a dairy herd in a State Farm located in Southeast of Turkey.

## Materials and Methods

Data used in the present study were obtained from Holstein Friesian herd raised in Ceylanpınar State Farm located in Southeast region of Turkey between 2000 and 2010. The final data contained 2617 animals' several records.

Primary reasons for culling were broadly categorized into 9 groups as low milk yield, surplus sale, reproductive problems, diseases, udder problems, conformation, genital tract disorders, old age and Freemartin. Definition of each culling reason used in this study is shown in Table 1. While whole herd was analyzed for all defined reasons, milking cows were analyzed for low milk yield, reproductive disorders, diseases, udder problems, genital tract disorder, conformation and old age reasons. Additional evaluations were done at year, parity or milking classes bases.

Table 1. Definition of culling reasons categories

| | Category | Definition |
|---|---|---|
| 1 | Low milk yield | Low milk production in the absence of a known disease problem |
| 2 | Surplus sale | Surplus to herd requirements |
| 3 | Reproductive problems | Failure to conceive, continuous heat, persistent metritis |
| 4 | Diseases | Acute and chronic, pneumonia, arthritis, congenital paralyze, hernia, BVD, repeater abortus |
| 5 | Udder problems | Acute mastitis, ruptured suspensory ligaments, slow milker, teat injuries, etc |
| 6 | Conformation | Development disorders, foot/leg defect, shortness, cachexia, lack of breed properties |
| 7 | Genital tract disorders | Prolapsus uteri, adhesion in genital organs, vaginal tear, vaginal rupture, undeveloped genital organs |
| 8 | Old age | More than 5 years old |
| 9 | Freemartin | Diagnosed freemartin signs |

Chi-Square test was used to assess the relationship between primary reasons for culling and milking classes and parity. All statistical analysis performed using SPSS (1999) statistical software version 10 (SPSS Inc., Chicago, USA) and P-value less than 0.05 was considered as significant.

## Results and Discussions

Overall, 2617 animals of the herd were culled during the studied period. Table 2 was prepared to provide a general view for the whole herd. The proportions of culled animals were due mainly to involuntary culling (85.8%) with small proportion of voluntary culling (low milk yield, 3.8%, surplus sale, 5.5% and old age, 4.9%). The primary involuntary culling reasons for entire herd were diseases (23,6%), conformation (17.7%), reproductive problems (17.3%) udder problems (16.9%), genital tract disorders (5.8%) and freemartin (4.5%).

The culling reasons for calves ranged as follow: Diseases 46.7%; conformation 33.8%; freemartin 11.1% and surplus sale 8,4%. A considerable amount of weaners (yearlings) were culled for surplus sale

(66.3%). Heifers were culled for freemartin reason at the highest ratio (31.1%). This was followed by reproductive problems (27.9%), disease (18.5%), conformation (13.1) and genital tract disorders (9.4%). As lactating cows, 1983 cows were culled during the studied period. The proportions of culled dairy cows were due mainly to involuntary culling (88.5%) with small proportion of voluntary culling (11.5%). The most frequent primary involuntary culling reasons were diseases (22.5%), udder problems (22.2%), reproductive disorders (19.7%) and conformation (17.4%). These were followed by genital tract disorders (6.7%). No heifers or cows were culled for surplus sale reason.

Table 2. Numbers and frequencies (%) of main culling reasons based on status of the animals in the herd

| | | Culling reasons | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Status | | Low milk yield | Surplus sale | Reproductive problems | Diseases | Udder problems | Conformation | Genital tract disorders | Old age | Free martin | Total |
| Calf | n | 0 | 19 | 0 | 105 | 0 | 76 | 0 | 0 | 25 | 225 |
| | % | 0.0 | 8.4 | 0.0 | 46.7 | 0.0 | 33.8 | 0.0 | 0.0 | 11.1 | |
| Weaner | n | 0 | 124 | 0 | 25 | 0 | 14 | 0 | 0 | 24 | 187 |
| | % | 0.0 | 66.3 | 0.0 | 13.4 | 0.0 | 7.5 | 0.0 | 0.0 | 12.8 | |
| Heifer | n | 0 | 0 | 62 | 41 | 0 | 29 | 21 | 0 | 69 | 222 |
| | % | 0.0 | 0.0 | 27.9 | 18.5 | 0.0 | 13.1 | 9.4 | 0.0 | 31.1 | |
| Cow | n | 99 | 0 | 390 | 447 | 441 | 345 | 132 | 129 | 0 | 1983 |
| | % | 5.0 | 0.0 | 19.7 | 22.5 | 22.2 | 17.4 | 6.7 | 6.5 | 0.0 | |
| Total | n | 99 | 143 | 452 | 618 | 441 | 464 | 153 | 129 | 118 | 2617 |
| | % | 3.8 | 5.5 | 17.3 | 23.6 | 16.9 | 17.7 | 5.8 | 4.9 | 4.5 | |

This study provides some descriptive aspects and the reasons for culling in a dairy herd in a state farm located in South East of Turkey. The description showed that the proportions of culled animals, regardless of their status in the herd, were due mainly to involuntary culling ranging from diseases, conformation, and reproductive to udder problems. Similar pattern was determined for cows as well.

As a general view for the whole herd; diseases comprised a considerably high value for culling of the calves. This might be an implication that health care practices were not properly taken care in the farm. Calves and weaners were the primary income source for the farm via surplus sales. No heifers and cows were culled for surplus sale reason. This implied that the farm had a tendency for expanding herd size. A high ratio of heifers culled for freemartin seemed to be odd.

Disease had the highest ratio among other culling reasons in cows in the present study. Previous studies in lactating cows reported the diseases as a culling reason at average 33.0% (Dentine et al. 1987; Shook 1989). Even, Beaudeau et al. (2000) and Moussavi (2008) implied that almost half of the cow removals from herd occurred because of health disorders. Contrary to these literatures, considerably lower amount of culling rates (1.1-7.4%) for this reason were reported as well (Mohammadi and Sedighi 2009; Mohammad 2011). Similarly, about 8.0% culling rate for diseases could be inferred from a study done in Turkey (Yaylak 2003). Culling rate (22.5%) in milking cows for diseases reason determined in the present study was lower than the values reported for many herds.

Udder problems play crucial roles among culling reasons in lactating cows. Culling rates for udder problems were reported as 9.0-25.0% by various researchers (Martin 1982; Bascom and Young 1998; Seegers et al. 1998; Moussavi 2008; Mohammadi and Sedighi 2009; Mohammad 2011). Including the present study, udder problems culling rates determined in Turkey (Yaylak 2003; Işık 2006, Koncagül et al. 2007; Kara et al. 2010) seemed to be relevant to the findings in other countries. Although diseases and udder problems ratios as culling reasons have been either similar or lower than the values determined in other studies, these culling ratios together comprised a very high value (44.7%) for milking cows. Considering the fact that mastitis was the main factor numerically among udder problems, health services in this farm should be taken care seriously.

One of the most important factors considered in culling decisions is fertility status. Culling rates for reproductive problems were reported as 15.0-34.0% by various researchers (Martin 1982; Bascom and Young 1998; Seegers et al. 1998; Moussavi 2008; Mohammadi and Sedighi 2009; Mohammad 2011). Culling rates for reproductive problems in Holsteins raised in different regions of Turkey ranged within 16.6-20.0% (Yaylak 2003; Işık 2006, Koncagül et al. 2007; Kara et al. 2010). Reproductive problems was one of the most important reasons of culling in our study. Even though the value determined in the present study for reproductive problems (19.7%) falls within the range reported in studies done in Turkey or abroad this value is high.

Culling reasons were evaluated over years (Table 3). In this analysis, except 2005, diseases reason had the highest values ranged between 26.0 and 37.6% within years 2000-2006. Udder problems ratios had highest values (18.5-25.3%) within these years as well. These ratios decreased during the last four years. Reproductive problems ratio fluctuated over the years, with the highest ratio (46.1%) in 2009. For three years, no animals were culled for low milk yield. Additionally, the ratio of this culling reason remained small over years. This might be an indication that average milk yield of the cows in the farm was at appropriate level.

Table 3. Numbers and frequencies (%) of main culling reasons over years in the herd

| Year | | Culling reasons | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Low milk yield | Surplus sale | Reproductive problems | Diseases | Udder problems | Conformation | Genital tract disorders | Old age | Free martin | Total |
| 2000 | n | 12 | 2 | 19 | 62 | 48 | 19 | 10 | 8 | 10 | 190 |
| | % | 6.3 | 1.1 | 10.0 | 32.6 | 25.3 | 10.0 | 5.3 | 4.2 | 5.3 | |
| 2001 | n | 10 | 0 | 34 | 81 | 45 | 28 | 15 | 6 | 7 | 226 |
| | % | 4.4 | .0 | 15.0 | 35.8 | 19.9 | 12.4 | 6.6 | 2.7 | 3.1 | |
| 2002 | n | 14 | 1 | 37 | 48 | 34 | 39 | 6 | 5 | 0 | 184 |
| | % | 7.6 | 0.5 | 20.1 | 26.1 | 18.5 | 21.2 | 3.3 | 2.7 | 0.0 | |
| 2003 | n | 16 | 0 | 20 | 64 | 52 | 48 | 8 | 6 | 22 | 236 |
| | % | 6.8 | 0.0 | 8.5 | 27.1 | 22.0 | 20.3 | 3.4 | 2.5 | 9.3 | |
| 2004 | n | 4 | 0 | 27 | 75 | 57 | 41 | 9 | 9 | 29 | 251 |
| | % | 1.6 | 0.0 | 10.8 | 29.9 | 22.7 | 16.3 | 3.6 | 3.6 | 11.6 | |
| 2005 | n | 0 | 38 | 41 | 74 | 71 | 101 | 18 | 7 | 2 | 352 |
| | % | 0.0 | 10.8 | 11.6 | 21.0 | 20.2 | 28.7 | 5.1 | 2.0 | 0.6 | |
| 2006 | n | 0 | 0 | 22 | 77 | 39 | 48 | 13 | 4 | 2 | 205 |
| | % | 0.0 | 0.0 | 10.7 | 37.6 | 19.0 | 23.4 | 6.3 | 2.0 | 1.0 | |
| 2007 | n | 34 | 25 | 53 | 57 | 30 | 63 | 26 | 15 | 24 | 327 |
| | % | 10.4 | 7.6 | 16.2 | 17.4 | 9.2 | 19.3 | 8.0 | 4.6 | 7.3 | |
| 2008 | n | 7 | 0 | 66 | 48 | 30 | 41 | 20 | 37 | 15 | 264 |
| | % | 2.7 | 0.0 | 25.0 | 18.2 | 11.4 | 15.5 | 7.6 | 14.0 | 5.7 | |
| 2009 | n | 0 | 0 | 71 | 28 | 19 | 18 | 9 | 6 | 3 | 154 |
| | % | 0.0 | 0.0 | 46.1 | 18.2 | 12.3 | 11.7 | 5.8 | 3.9 | 1.9 | |
| 2010 | n | 2 | 77 | 62 | 4 | 16 | 18 | 19 | 26 | 4 | 228 |
| | % | 0.9 | 33.8 | 27.2 | 1.8 | 7.0 | 7.9 | 8.3 | 11.4 | 1.8 | |
| Total | n | 99 | 143 | 452 | 618 | 441 | 464 | 153 | 129 | 118 | 2617 |
| | % | 3.8 | 5.5 | 17.3 | 23.6 | 16.9 | 17.7 | 5.8 | 4.9 | 4.5 | |

Numbers and frequencies of main culling reasons at different parities in cows were given in Table 4. Diseases were the highest recorded reason for culling during the first two parities (31.4 and 28.1%). As the parity increased the ratio of culling for diseases decreased. This might be a consequence of the increase of proportion of disease-resistant animals in the herd in response to culling sick animals. Udder problems became prominent at 3$^{rd}$ and 4$^{th}$ parities. Old age was a noticeable culling reason at 6$^{th}$ and 7$^{th}$ parities as 31.3 and 49.6% rates. The ratio of culling for reproductive problems was 5.4% in first parity

and, this ratio increased to 24.6, 28.8 and 22.2% at 2nd, 3rd, and 4th parities, respectively. Culling ratio for reproductive problem in the herd increased during the first four parities and, tended to decrease at later calvings. The lack of care for calved animals might be a reason for this problem in the earlier parities. As the parity increased the culling ratio for reproductive problems decreased relatively because most of the animals sensitive to reproductive problems might have been already culled during the earlier parities. The ratio of culling for low milk yield was 4.1% in first parity and, this ratio increased to 6.2, 9.1 and 9.9% at 5th, 6th, and 7th parities, respectively. It appears that yield of the first lactation is not considered seriously by the administration and is waited for the subsequent lactations to see exact yields. One other reason of higher culling ratio for low milk yield during the later lactations might be a consequence of udder problems.

Udder problems remained as the highest culling ratio thru parities, except at the 7th parity. Similar pattern was observed in diseases trait. Once again, disease related factors had considerable amount among other culling reasons.

Table 4. Numbers and frequencies (%) of main culling reasons at different parities in cows.

| | | Culling reasons | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Parity | | Low milk yield | Reproductive problems | Diseases | Udder problems | Conformation | Genital tract disorders | Old age | Total |
| 1 | n | 12 | 16 | 93 | 64 | 78 | 33 | 0 | 296 |
| | % | 4.1 | 5.4 | 31.4 | 21.6 | 26.4 | 11.1 | 0.0 | |
| 2 | n | 17 | 120 | 137 | 98 | 73 | 43 | 0 | 488 |
| | % | 3.5 | 24.6 | 28.1 | 20.1 | 15.0 | 8.8 | 0.0 | |
| 3 | n | 23 | 139 | 99 | 117 | 74 | 30 | 0 | 482 |
| | % | 4.8 | 28.8 | 20.5 | 24.3 | 15.4 | 6.2 | 0.0 | |
| 4 | n | 12 | 61 | 52 | 80 | 60 | 10 | 0 | 275 |
| | % | 4.4 | 22.2 | 18.9 | 29.1 | 21.8 | 3.6 | 0.0 | |
| 5 | n | 13 | 29 | 43 | 45 | 38 | 10 | 33 | 211 |
| | % | 6.2 | 13.7 | 20.4 | 21.3 | 18.0 | 4.7 | 15.6 | |
| 6 | n | 9 | 10 | 17 | 19 | 11 | 2 | 31 | 99 |
| | % | 9.1 | 10.1 | 17.2 | 19.2 | 11.1 | 2.0 | 31.3 | |
| 7 | n | 13 | 15 | 6 | 17 | 11 | 4 | 65 | 131 |
| | % | 9.9 | 11.5 | 4.6 | 13.0 | 8.4 | 3.1 | 49.6 | |
| Total | n | 99 | 390 | 447 | 440 | 345 | 132 | 129 | 1982 |
| | % | 5.0 | 19.7 | 22.6 | 22.2 | 17.4 | 6.7 | 6.5 | |

The ratio of culling for reproductive problems increased during 2nd-4th parities and tended to decrease as the parity increased. Presence of reproductive problems especially in high yielding animal is a widely known phenomenon. Findings in the present study coincided with many studies reported reproductive problems during first 2-4 parities (Stevenson and Lean 1998; LeBlanc 2010). Diseases and udder problems observed at high ratio might contribute to this high culling ratio for reproductive problems. Additionally, the cows culled after 6th and 7th parities for old age reason probably were the cows inseminated and calved later because of reproductive problems.

Considerable amount of cows were culled for old age reason at 6th and 7th parities. Assuming that cows had their calves at 24 months of age they were at 6 years age at the 5th parity and completed their 4th lactation. Apparently cows did not stay in production in this herd for a long time and the herd was composed of relatively young cows. Herd life of the cows in this farm seemed to be relevant to suggested values (McCullough and De Lorenzo 1996; Galiç et al. 2010).

The ratio of culled animals for reproductive tract disorders tended to decrease as the parity increased. This might be result of strong culling practice applied for this trait. Culled cows were evaluated for culling reasons based on their milk yield classes (Table 5). In general, udder problems (24.7%), reproductive

problems (22.6%) and diseases (21.8%) were in the first rank in culling reasons in lactating cows. The highest culling reason in three groups producing 2501-5500 kg milk (23.7, 29.2 and 32.6%) was udder problems. As the milk yield increased there was an increase in the ratio of culling for reproductive problems. It reached up to 57.7% in 7500>kg group. Diseases and conformation remained almost constant culling ratios within yield classes, except the group 7500>kg.

Table 5. Numbers and frequencies (%) of main culling reasons based on milk yield classes

| Milk yield classes (kg) | | Culling reasons | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Reproductive problems | Diseases | Udder problems | Conformation | Genital tract disorders | Old age | Total |
| 2500< | n | 15 | 23 | 23 | 28 | 4 | 16 | 109 |
| | % | 13.8 | 21.1 | 21.1 | 25.7 | 3.7 | 14.7 | |
| 2501-3500 | n | 25 | 31 | 32 | 27 | 7 | 13 | 135 |
| | % | 18.5 | 23.0 | 23.7 | 20.0 | 5.2 | 9.6 | |
| 3501-4500 | n | 52 | 54 | 75 | 44 | 12 | 20 | 257 |
| | % | 20.2 | 21.0 | 29.2 | 17.1 | 4.7 | 7.8 | |
| 4501-5500 | n | 66 | 104 | 143 | 67 | 19 | 39 | 438 |
| | % | 15.1 | 23.7 | 32.6 | 15.3 | 4.3 | 8.9 | |
| 5501-6500 | n | 82 | 92 | 81 | 71 | 22 | 24 | 372 |
| | % | 22.0 | 24.7 | 21.8 | 19.1 | 5.9 | 6.5 | |
| 6501-7500 | n | 71 | 43 | 48 | 45 | 14 | 15 | 236 |
| | % | 30.1 | 18.2 | 20.3 | 19.1 | 5.9 | 6.4 | |
| 7500> | n | 64 | 14 | 8 | 8 | 9 | 8 | 111 |
| | % | 57.7 | 12.6 | 7.2 | 7.2 | 8.1 | 7.2 | |
| Total | n | 375 | 361 | 410 | 290 | 87 | 135 | 1658 |
| | % | 22.6 | 21.8 | 24.7 | 17.5 | 5.2 | 8.2 | |

Considering the milk yield classes, most of the culling reasons appeared to be equally distributed among yield classes, except, reproduction problems reason. Higher culling ratios for reproduction problems were determined in higher milk producing groups. These findings were in agreement with many reports that high milk yields were linked with reproductive problems (Macmillan et al. 1996; Royal et al. 2000; Lucy 2001).

In summary, involuntary culling reasons constituted a considerable proportion in the present study. Diseases had always higher culling ratio in the herd for both lactating cows and animals at other stages. Also, in this study high rates of premature culling because of disease reason were noted: Many calves, weaners or heifers were culled before reaching productive stage. Higher ratio of diseases reason might be an influencing factor for higher culling ratios for reproductive problems and udder disorders. Management techniques in the farm should be improved for minimizing the effects of diseases. These precautions could help more economical production. Many culling reasons' ratios remained more or less similar thru ten years of period indicating that farm management did not utilize radical cautions. Nevertheless, data obtained in the present study were compatible with many data determined in various farm or environmental conditions. Thus, it can be concluded that farm management in those ten years of period is reasonably successful.

## References

Bascom SS and Young AJ (1998). A summary of the reasons why farmers cull cows. J. Dairy Sci. 81: 2299-2305.

Beaudeau F, Seegers H, Ducrocq V and Fourichon C (2000). Effect Of Health Disorders on Culling in Dairy Cows: A Review and Critical Discussion. www.interbul. slu. se/ bulletin21/ beaud abs.pdf

Dentine MR, McDaniel, BT and Norman, HD (1987). Comparison of Culling Rates, Reasons for Disposal and Yields for Registered and Grade Holstein Cattle, J. of Dairy Sci. 70: 2616–2622.

Fetrow J, Nordlund KV and Norman HD (2006). Invited review: Culling: Nomenclature, definitions, and recommendations. J Dairy Sci; 89: 1896-1905.

Galiç A, Işık UE and Kumlu S (2010). Replacement rate and reasons for culling in dairy cattle breeding. (In Turkish). Akdeniz Üniversitesi Ziraat Fakültesi Dergisi, 23(1), 11-14.

Hadley GL, Wolf CA and Harsh SB (2006). Dairy cattle culling patterns, explanations, and implications. J Dairy Sci; 89: 2286-2296.

Işık UE (2006). Longevity and reasons for culling in Holstein dairy cows in Antalya. (In Turkish). Akdeniz Üniversitesi Ziraat Fakültesi Zootekni Anabilim Dalı Yüksek Lisans Tezi.

Kara NK, Koyuncu M and Tuncel E (2010). Longevity and reasons for culling in Holstein dairy cows. (In Turkish). Hayvansal Üretim 51(1): 16-20.

Koncagül S, Çadırcı Ş, Yazgan K and Başkurt Ö (2007). Culling reasons in dairy farms in Şanlıurfa and Diyarbakır. (In Turkish). Gap V. Tarım kongresi, 17-19 Ekim, Şanlıurfa.

Kumlu S and Akman N (1999). Milk yield and reproductive traits of Holstein Friesian breeding herds in Turkey. (In Turkish). Lalahan Hay. Araşt. Enst. Derg. 39(1): 1-15.

Kumlu S, Pekel E and Özkütük, K (1991). Investigations on Holstein Fresian, Israeli Fresian, Kilis and its crosses II. Reproductive traits in cows. (In Turkish). Ç.Ü.Z.F. Dergisi, 6, (1):155-168.

Lucy MC (2001). Reproductive loss in high-producing dairy cattle: where will it end? J Dairy Sci; 84:1277–93.

LeBlanc S (2010). Assessing the association of the level of milk production with reproductive performance in dairy cattle. J Reprod Dev. 56 Suppl:S1-7

McCullough DA and De Lorenzo MA (1996). Effect of price and management level on optimal replacement and insemination decisions. Journal of Dairy Science 79: 242-253.

Macmillan KL, Lean IJ and Westwood CT (1996). The effects of lactation on the fertility of dairy cows. Aust. Vet. J. 73:141–147.

Martin SW, Aziz SA, Sandals WCD and Curtis RA (1982). The association between clinical disease, production and culling of Holstein-Friesian cows. Can. J. Anim. Sci. 62: 633-640.

Mohammad A (2011). Characterisation and pattern of culling in Holstein-Friesian dairy herds in Khorasan Razavi Province, Northeast of Iran. Veterinary Research Forum. 2011; 2 (4) 254-258.

Mohammadi GR and Sedighi A (2009). Reasons for culling of Holstein dairy cows in Neishaboor area in northeastern Iran Iranian Journal of Veterinary Research, Shiraz University, Vol. 10, No. 3, Ser. No. 28,

Moussavi AH (2008). Days in milk at culling in holstein dairy cows. J. Animal and Veterinary Advances, 7 (1): 89-93.

Royal MD, Darwash AO, Flint APF, Webb R, Woolliams JA and Lamming GE (2000). Declining fertility in dairy cattle: changes in traditional and endocrine parameters of fertility. Anim. Sci. 70:487–502.

Seegers H, Beaudeau F, Fourichon C and Baraille, N (1998). Reason for culling French Holstein cows. Preventive Veterinary Medicine 36: 257-271.

Shook GE (1989). Selection for Disease Resistance, J. of Dairy Sci. 72: 1349–1362.

SPSS (1999). SPSS for Windows. Release 10.0.5 Standard Version. SPSS Inc. Headquarters. 233 S. Wacker Drive. 11th Floor Chicago. IL 60606.

Stevenson MA and Lean IJ (1998). Descriptive Epidemiological Study on Culling and Deaths in Eight Dairy Herds. Aust. Vet. Journal, 76 (7): 482–488.

Yaylak E (2003). Reasons for culling, herd life and productive life in Holstein cows. (In Turkish). Akdeniz Üniv. Zir. Fak. Derg. 16(2): 179-185.

Uzmay C, Kaya A, Kaya I, Akbaş Y, Saçlı and Y (1998). Comperative analysis of some yield caharacteristics of Holstein Fresian cows imported from Italy and born in Turkey in İzmir, Manisa and Aydın cities under Turkish-Anafi Project. (In Turkish). Ege Bölgesi 1.Tarım Kongresi, 7-11 Eylül 1998, Aydın. Cilt II: 511-519.