The Pharma Innovation Journal 2023; 12(6): 6266-6269

www.ThePharmaJournal.com

The Pharma Innovation

**ISSN (E): 2277-7695**
**ISSN (P): 2349-8242**
**NAAS Rating: 5.23**
TPI 2023; 12(6): 6266-6269

www.thepharmajournal.com
Received: 06-03-2023
Accepted: 16-04-2023

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# Age specific disposal pattern of young crossbred cattle and influence of various non-genetic factors

**Shashikant, CV Singh, RS Barwal, CB Singh, SK Singh, Shiv Prasad and BN Shahi**

**Abstract**
Cattle are an important part of the livestock industry in India. India has the world's highest cattle population (192.49 million), with 142.11 million indigenous cattle and 50.42 million crossbred cattle. Culling of less productive animals is necessary for optimum genetic improvement. Data of 2128 female crossbred calves, born between 1988 and 2019 from 1000 crossbred cattle at IDF, Nagla, U.K, were analysed to study the influence of different non-genetic factors on disposal pattern (mortality and culling) of young crossbred cattle up to age at first calving (AFC). The analysis of influence of various non-genetic factors on disposal pattern was carried out by Chi-square method using the SPSS software.
**Result:** Revealed that 14.80% of the total female calves born died while 17.53 percent of total female calves were culled, before reaching the milking herd. Only effect of period was significant on total mortality. Age specific mortality among female calves from 0-1, 1-3, 3-6, 6-12 and 12 month to age at first calving was noted as 5.87, 3.06, 2.13, 1.68, and 3.13 percent, respectively. While, Age specific culling among female calves from 0-1, 1-3, 3-6, 6-12 and 12 month to age at first calving was recorded as 0.47, 0.70, 1.82, 4.72 and 13.17 percent, respectively. The period of birth had highly significant effect ($p \leq 0.01$) from birth to 1month as well as significant effect ($p \leq 0.05$) by period and season of birth was recorded on 1-3 months age mortality. Conclusion is that the early phase of life is more crucial for calves survival. So, rigorous feeding and healthcare management are required to reduce involuntary disposal.

**Keywords:** crossbred, culling, genetic, livestock, morality

## Introduction
Livestock is an essential component of our agricultural system. Cattle are an important part of the livestock industry in India. India has the world's highest cattle population (192.49 million), with142.11 million indigenous cattle and 50.42 million crossbred cattle. In 2020, the number of crossbred cattle reached from 39.73 million in 2012 to 50.42million (Livestock Census, 2019). India is contributing about 24 percent to the global milk pool and there has been a quantum increase of 6 to 7 times in the last four decades (FAO, 2022). Culling of less productive animals is necessary for optimum genetic improvement. However, substantial involuntary removal in a herd might hamper the genetic improvement by reducing the replacement and production life resulted in increased cost of production. New-born diseases and their mortality interferes with livestock propagation, as large number of calves die during their first year of life leads to heavy drain on the economics of livestock production (Piccione *et al.* 2008) [10]. The survivability of calf is an important trait both for breeding and economic point of view in dairy enterprise. It also reducing selection intensity and genetic progress. Therefore, mortality in dairy calves has great relevancy in terms of economic losses and also for animal health and welfare (Fuerst Waltl and Sorensen, 2010) [2]. Generally, on an average, cost of calf mortality in terms of replacement stock may be higher than the cost of mortality due to calf's stillbirth, since it reduces the genetic gain as well as the economic return (NAHMS 2007) [8]. Identifying the factors influencing calf mortality in different breeds would help to develop suitable management strategies to downsize its incidence. Therefore, the present study was undertaken to study the effect of non-genetic factors on calf mortality in crossbred cattle.

## Materials and Method
The data used in this study were collected from history sheets, stock registers, calf registers and auction and sales registers maintained at Instructional Dairy Farm of G.B.

Pant University of Agriculture and Technology, Pantnagar (U.A.). Data of 2128 female crossbred calves, born between 1988 and 2019 from 1000 crossbred cattle at IDF, Nagla, U.K, were analysed to study the influence of different non-genetic factors on disposal pattern (mortality and culling) of young crossbred cattle up to age at first calving (AFC). The data were divided into 6 periods. The first period comprised the data of 7 years, then each of second to fifth periods comprised the data of next 5 year in each group. Depending upon the climatic conditions of the farms, the year of birth was divided into three seasons i.e., Winter (October to January), Summer (February to May), and Rainy (June to September). The non-genetic factors considered in the present study to assess their influence on culling and mortality rate were season of birth and period of birth. The age of female calves and heifers were divided into five groups as 0–1 month, 1–3 month, 3-6 month, 6–12 month, and 12 month to AFC. The percent of animals disposed from the herd due to mortality and culling was calculated by proportion. The analysis of influence of various non-genetic factors on disposal pattern was carried out by Chi-square method (Snedecor and Cochren 1994) [16] using the SPSS software.

## Result and Discussion

### Mortality of female calves from birth to age at first calving

It was reported that 14.80% of the total female calves born died before reaching the milking herd (Table 1). The present findings were in close agreement with the reports of Singh (2001) [14] in Karan Fries cattle, and Mishra *et al.* (2015) [7] in Gir cattle herd. The higher mortality rates were reported by Saha (2001) [11] in Karan Fries cattle and Shahi and kumar (2014) [13] in Sahiwal cattle. The lower value recorded by Singh and Gurnani (2004) [15] in Karan Swiss cattle.

The effect of period on overall mortality rate was significant (Table 1). This could possibly be due to variation in population density, disease resistance, health care, management practices and climatic fluctuations over the periods. Similar findings was also reported by Kharkar *et al.* (2017) [5] in crossbred cattle herd, Mishra *et al.* (2015) in Gir cattle, and Goshu and Singh (2013) [4] in Holstein Friesian cattle.

Seasons of birth were showed non-significant effect on overall mortality rate (Table 1). Comparable judgment reported by Singh (2001) [14] in Karan Fries, and Goshu and Singh (2013) [14] in Holstein Friesian cattle. While significant effect disclosed by Kharkar *et al.* (2017) [5] in crossbred cattle and Selvan *et al.* (2019) [12] in crossbred cattle.

### Age specific mortality

Age specific mortality among female calves from birth to age at first calving is shown in table 1. The average female calf mortality from 0-1, 1-3, 3-6, 6-12 and 12 month to age at first calving was noted as 5.87, 3.06, 2.13, 1.68, and 3.13 percent, respectively. The results indicated that 39.66 percent of the total female calf mortality pinpointed during first month of life and it decline with advancement in age. The mortality could be maximum during early stage of life mainly due to more incidence of Pneumonia, Enteritis and Collibacillosis. Comparable finding reported by Singh (2001) [18], and Singh and Gurnani (2004) [15] in Karan Fries cattle as well as Shahi and kumar (2014) [13] in Sahiwal cattle. Some other author also reported more mortality in early life i.e., Saha (2001) [11] in Karan Faris cattle, and Upadhyay (2013) [17] in Sahiwal cattle.

The period of birth had highly significant effect ($p \leq 0.01$) from birth to 1month and significant effect ($p \leq 0.05$) on 1-3 months age mortality (Table 1). This might be due to immune dispersion, diseases, and neonatal infections. Complementary result recorded by Kharkar *et al.* (2017) [5], and Selvan *et al.* (2019) [12] crossbred cattle. The effect of period on mortality from 3-6 month, 6-12 months and 12 month to age at first calving was non-significant. Parallel findings was reported by Gaur *et al.* (2003) [3] in Gir cattle.

The mortality rate varied according to season from 0-1month stage only (Table 1). The effect of season was non-significant in other age groups. Similar result reported by Kharkar *et al.* (2017) [5], and Selvan *et al.* (2019) [12] in crossbred cattle. However, non-significant effect of season of birth from birth to AFC was recorded by Shahi and Kumar (2006) in Jersey x Sahiwal, and Goshu and Singh (2013) [4] in HF cattle.

### Culling of female calves from birth to age at first calving

The overall mean of culling rate among female calves was 17.53 percent (Table 2). Which was promoting by the earlier findings Saha (2001) [11] in Karan Swiss cattle. However, higher culling also reported by Singh and Gurnani (2004) [15] in Karan Swiss cattle, and Shahi and Kumar (2014) [13] in Sahiwal cattle. While, lower value of culling rate estimated by Upadhyay *et al.* (2017) [18] in Sahiwal cattle.

The effect of period on culling rate was non-significant (table 2). These results were supported by Upadhyay *et al.* (2017) [18] in Sahiwal cattle. While significant result reported by Upadhyay *et al.* (2013) [17] in Sahiwal cattle and Atrey *et al.* (2005) [1] in Frieswal calves.

The effect of season of birth on culling rate was non-significant (Table 2). Commensurate findings were reported by Shahi and Kumar (2006), and Goshu and Singh (2013) [4] in Jersey x Sahiwal and HF calves, respectively. while significant result reported by Kumar (1999) [6] in Hariana cattle.

### Age specific culling

Age specific culling among female calves from birth to age at first calving is shown in table 2. The average female calf culling from 0-1, 1-3, 3-6, 6-12 and 12 month to age at first calving was noted as 0.47, 0.70, 1.82, 4.72 and 13.17 percent, respectively. The results indicated that 75.00 percent of the total culling in female calf recorded at the age of 12months to AFC. This is due to the expel out of the female calves from breeding herd due to lower growth performance as well as abnormal reproductive organs. In early life the fluctuations in culling rate over the periods could be because of variations in management practices, diseases occurrence and environmental stress mostly. Comparable result recorded by Saha (2001) [11] in Karan Swiss and Karan Fries, and Singh and Gurnani (2004) [15] in Karan Swiss cattle. Lower value reported by Singh (2001) [18] on Karan Fries, and Shahi and kumar (2014) [13] in Sahiwal cattle. However, other researchers also reported lower total culling i.e., Nehra (2011) in Karan Fries cattle and Upadhyay *et al.* (2017) [18] in Sahiwal.

The period of birth had non-significant effect from birth to AFC (Table 2). Similar result reported by Kulkarni and Sethi (1990) in Karan Swiss cattle. However, other litterateur showed the significant of period of birth on culling i.e., Kumar (1999) [6] in Hariana cattle, and Goshu and Singh (2013) in HF calves. Upadhyay *et al.* (2013) [17], and Upadhyay *et al.* (2017) [18] reported significant influence ($p \leq 0.05$) on 12 month to AFC and birth to AFC, respectively, in Sahiwal calves.

The season of birth had non-significant effect from birth to AFC (Table 2). Corresponding finding presented by Singh (2001) [14] and Atrey *et al.* (2005) [1] in KF and Frieswal calves. Other hand Kumar (1999) [6] showed Significant effect of season in Hariana cattle.

**Table 1:** Age specific mortality rate in female calves of crossbred cattle and effects of non-genetic factors

| Effects | Overall | 0-1 months | | | 1-3 months | | | 3-6 months | | | 6-12 months | | | 12-AFC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Death (%) | Number | Death | % | Number | Death | % | Number | Death | % | Number | Death | % | Number | Death | % |
| **Overall** | **315 (14.80)** | **2128** | **125** | **5.87** | **1993** | **61** | **3.06** | **1918** | **41** | **2.13** | **1842** | **31** | **1.68** | **1724** | **57** | **3.31** |
| Periods | * | | | ** | | | * | | | NS | | | NS | | | NS |
| 1(1988-1994) | 52 (15.34) | 339 | 24 | 7.07 | 314 | 9 | 2.87 | 303 | 7 | 2.31 | 294 | 3 | 1.02 | 276 | 9 | 3.26 |
| 2(1995-1999) | 45 (13.04) | 345 | 15 | 4.35 | 326 | 6 | 1.84 | 317 | 7 | 2.21 | 301 | 7 | 2.33 | 277 | 10 | 3.61 |
| 3(2000-2004) | 34 (9.26) | 367 | 19 | 5.18 | 347 | 4 | 1.15 | 341 | 1 | 0.29 | 334 | 3 | 0.90 | 312 | 7 | 2.24 |
| 4(2005-2009) | 67 (19.25) | 348 | 21 | 6.03 | 325 | 14 | 4.31 | 309 | 9 | 2.91 | 293 | 9 | 3.07 | 273 | 14 | 5.13 |
| 5(2010-2014) | 72 (19.20) | 375 | 23 | 6.13 | 351 | 21 | 5.98 | 328 | 11 | 3.35 | 311 | 6 | 1.93 | 294 | 11 | 3.74 |
| 6(2015-2021) | 45 (12.71) | 354 | 23 | 6.50 | 330 | 7 | 2.12 | 320 | 6 | 1.87 | 309 | 3 | 0.97 | 292 | 6 | 2.05 |
| Season | NS | | | ** | | | NS | | | NS | | | NS | | | NS |
| Winter | 101 (14.94) | 676 | 29 | 4.29 | 645 | 17 | 2.64 | 624 | 21 | 3.37 | 589 | 10 | 1.70 | 553 | 24 | 4.34 |
| Summer | 106 (14.34) | 739 | 42 | 5.68 | 693 | 31 | 4.47 | 656 | 12 | 1.83 | 633 | 6 | 0.95 | 590 | 15 | 2.54 |
| Rainy | 108 (15.15) | 713 | 54 | 7.57 | 655 | 13 | 1.99 | 638 | 8 | 1.25 | 620 | 15 | 2.42 | 581 | 18 | 3.1 |

$p \leq 0.01$ **: $p \leq 0.05$ *

**Table 2:** Age specific culling rate in female calves of crossbred cattle and effects of non-genetic factors

| Effects | Overall | 0-1 months | | | 1-3 months | | | 3-6 months | | | 6-12 months | | | 12-AFC | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Culling (%) | Number | Culling | % | Number | Culling | % | Number | Culling | % | Number | Culling | % | Number | Culling | % |
| Overall | 373 (17.53) | 2128 | 10 | 0.47 | 1993 | 14 | 0.70 | 1918 | 35 | 1.82 | 1842 | 87 | 4.72 | 1724 | 227 | 13.17 |
| Periods | NS | | | NS | | | NS | | | NS | | | NS | | | NS |
| 1(1988-1994) | 59 (17.40) | 339 | 1 | 0.29 | 314 | 2 | 0.64 | 303 | 2 | 0.66 | 294 | 15 | 5.1 | 276 | 39 | 14.13 |
| 2(1995-1999) | 59 (17.10) | 345 | 4 | 1.16 | 326 | 3 | 0.92 | 317 | 9 | 2.84 | 301 | 17 | 5.65 | 277 | 26 | 9.39 |
| 3(2000-2004) | 74 (20.16) | 367 | 1 | 0.27 | 347 | 2 | 0.58 | 341 | 6 | 1.76 | 334 | 19 | 5.69 | 312 | 46 | 14.74 |
| 4(2005-2009) | 9 (2.59) | 348 | 2 | 0.57 | 325 | 2 | 0.62 | 309 | 7 | 2.27 | 293 | 11 | 3.75 | 273 | 35 | 12.82 |
| 5(2010-2014) | 52 (13.87) | 375 | 1 | 0.27 | 351 | 2 | 0.57 | 328 | 6 | 1.83 | 311 | 11 | 3.54 | 294 | 32 | 10.88 |
| 6(2015-2021) | 72 (20.34) | 354 | 1 | 0.28 | 330 | 3 | 0.91 | 320 | 5 | 1.56 | 309 | 14 | 4.53 | 292 | 49 | 16.78 |
| Season | NS | | | NS | | | NS | | | NS | | | NS | | | NS |
| Winter | 95 (14.05) | 676 | 2 | 0.29 | 645 | 4 | 0.62 | 624 | 14 | 2.24 | 589 | 26 | 4.41 | 553 | 49 | 8.86 |
| Summer | 156 (21.11) | 739 | 4 | 0.54 | 693 | 6 | 0.87 | 656 | 11 | 1.68 | 633 | 37 | 5.85 | 590 | 98 | 16.61 |
| Rainy | 122 (17.11) | 713 | 4 | 0.56 | 655 | 4 | 0.61 | 638 | 10 | 1.57 | 620 | 24 | 3.87 | 581 | 80 | 13.77 |

$p \leq 0.01$ **: $p \leq 0.05$ *

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