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Genetic and non-genetic factors affecting disposal up to first calving in Karan Swiss cattle

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ABSTRACT

A study was conducted on the factors and mode of culling and mortality up to first calving in 992 Karan Swiss females born during 1982 to 1992 at National Dairy Research Institute, Karnal. The culling and mortlity rates accounted for 13.4 and 26.1% of herd strength. Inbreeding, age group and year of birth have significantly affected the disposal rate. Maximum mortality (70% of total loss) was observed up to the age of 3 months. The respiratory and digestive disorders were the primary causes. The extreme climatic conditions resulted in higher incidences of mortality. Significantly adverse effect of inbreeding above 6% coefficient was observed on survivability at early ages. The mortality up to first calving varied from 7.8 to 28.0% and the culling rates over the years ranged from 17.2 to 35.0%. Poor growth, late maturity, reproductive disorders, foot problems and diseases were important causes of culling and accounted for 8.5, 3.7 3.2, 2.9 and 2.8% of herd strength, respectively. Culling at early ages was mainly due to poor growth and health disorders and at later ages was mainly due to late maturity and infertility problems. The present study suggested the improvement in nutritional status, effective prevention and medication measures and keeping inbreeding under safer limit.

Key words: Animal breeding, Culling, Inbreeding, Karan Swiss, Mortality

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. High producing animals are likely to be more affected by diseases, teat and udder problems and reproductive disorders (Allaire *et al.* 1977, Simianer *et al.* 1991) probably due to higher stress. The Karan Swiss was evolved as high performance dairy cattle strain at National Dairy Research Institute (NDRI), Karnal, by crossbreeding of mainly Sahiwal cows with Brown Swiss bulls and subsequently by inter-se mating. It followed the closed breeding system and has completed 7–8 generations. There was likelihood of increase in inbreeding levels affecting growth, health and survivability. Therefore the present study was undertaken to investigate the genetic (inbreeding) and environmental (age-group, month and year of birth) factors affecting mortality and culling, so that necessary managemental interventions and breeding plan could be developed for organized herds. Major causes of culling and mortality were also examined.

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MATERIALS AND METHODS

The data were collected on 992 females born during 1980 to 1992 and sired by 46 bulls. The data were classified according to age group, inbreeding-group, year and month of birth and reasons of culling and mortality. The females were culled every year in March and September on the basis of poor growth, late maturity, locomotive and health disorders. The animals were divided into 4 groups based on the level of inbreeding as non-inbred (F_x:0), low inbred (F_x:≤6%), moderately inbred (F_x:>6≤12%) and highly inbred (F_x:>12%). The inbreeding coefficient of the animals was estimated as per Wright (1922). The χ^2-test was applied to test the significance of differences in proportions survived in different inbreeding groups up to first calving. The number of animals disposed off in various age groups for different inbreeding levels, was calculated by 4×1 contingency table.

RESULTS AND DISCUSSION

Effect of inbreeding

The average percentage of inbred females was 36.2 with an inbreeding coefficient of 5.5%. The overall average of

Table 1. Disposal rate (% herd strength) in various inbreeding levels and years of birth under different age groups

Inbreeding groups	0–1 months			1–3 months			3–6 months			6–12 months			12–18 months			18 months-AFC			Birth-AFC	
	NA	% culled	% mortality	NA	% culled	% mortality	NA	% culled	% mortality	NA	% culled	% mortality	NA	% culled	% mortality	NA	% culled	% mortality	% culled	% mortality
Non-inbred	645	0.30	4.00	617	0.60	4.21	587	2.21	0.09	570	4.39	0.70	542	4.61	0.55	514	18.10	2.16	25.42	11.94
Low-inbred	206	1.45	6.80	189	0.50	4.23	180	2.20	2.22	172	6.39	0.60	160	4.37	0.62	152	17.76	1.97	25.73	11.50
Mod. inbred	84	0.00	11.90	74	1.35	4.05	70	2.86	2.86	66	6.06	3.00	60	5.00	1.66	56	30.35	1.78	32.10	22.61
Highly inbred	57	0.00	8.78	52	1.92	3.84	49	2.00	2.04	47	6.38	2.12	43	7.00	2.30	39	23.00	5.12	29.82	21.00
Overall	992	0.50	5.54	932	0.75	4.18	886	2.24	1.35	855	5.02	0.81	805	4.72	0.63	769	19.29	2.23	26.30	14.00
Year of birth																				
1980	102	0	2.94	99	0	1.00	98	0	0	98	2.00	3.00	93	3.22	0	90	22.23	1.10	24.50	7.84
1981	79	0	3.80	76	0	1.31	75	0	0	75	1.33	1.33	73	2.73	0	71	25.35	2.81	26.58	8.86
1982	100	0	10.00	91	0	1.09	90	2.11	1.11	88	3.40	0	85	7.05	2.35	77	16.88	0	23.00	13.00
1983	90	0	7.70	83	0	7.23	77	–	2.60	75	6.67	0	70	7.14	0	65	30.76	0	33.34	16.67
1984	102	0.90	3.92	97	0	1.00	96	4.16	–	92	2.17	1.08	89	3.37	1.10	85	20.00	2.35	26.47	8.82
1985	102	0	3.92	98	0	5.10	93	1.07	3.22	89	7.86	0	82	6.09	0	77	10.38	0	20.58	11.76
1986	97	1.03	2.06	94	0	8.51	86	5.81	1.16	80	6.25	1.25	74	9.45	0	67	23.88	0	35.05	12.37
1987	80	1.25	2.50	77	2.59	7.79	69	2.90	4.34	64	3.12	1.56	61	4.91	0	58	24.13	0	30.00	15.00
1988	73	1.36	5.47	68	4.41	1.47	64	1.56	0	63	9.52	0	57	0	0	57	17.54	7.01	28.76	12.33
1989	64	0	9.37	58	3.44	0	56	0	0	56	7.14	0	52	3.84	2.00	49	6.12	6.12	17.18	15.62
1990	50	2.00	6.00	46	0	13.04	40	5.00	5.00	36	5.50	0	34	2.94	2.94	32	15.62	0	22.00	22.00
1991	53	0	13.20	46	0	6.52	43	6.97	0	40	10.0	0	36	2.77	0	35	8.57	14.28	20.75	28.00

NA Number appeared.

inbreeding coefficient of herd was 2%. The mortality and culling rate in different age groups according to inbreeding groups and year of birth were presented in Table 1. The χ^2 analysis indicated significant effect ($P<0.05$) of inbreeding on disposal rate. The inbreeding beyond 6% had resulted in higher mortality and culling in at almost all ages, however, the effect was significant ($P<0.05$) only on mortality rate in 0–1 month age group. At early ages, low survivability was observed in highly inbred, whereas low inbreeding did not adversely affect survivability. Higher disposal above 6% inbreeding could be because such animal might be prone to diseases and have lesser tolerance to cope up stress. The results were in agreement with the reports of Srinivas and Gurnani (1981), Reddy and Sampath (1989), Singh and Gurnani (2003) in zebu cattle, Miglior *et al.* (1992) and Thompson *et al.* (2000) in exotic cattle. In a closed herd like Karan Swiss, gradual build up of inbreeding was eventual. However, higher levels of inbreeding could be voided by careful pedigree control of breeding stocks, use of bulls for short duration, rotational use of sire line and by allowing open breeding system.

Effect of age

The maximum mortality was observed in the age group of 0–1 month (5.54%) followed by 1–3 months (4.18%) and 18 month to AFC (2.23%). Slightly higher mortality in 18 month-AFC group might have occurred due to its longer duration (16 months). The mortality and culling accounted for 13.40% and 26.10% disposal of herd strength from birth to age at first calving. The incidence of mortality decreased and incidence of culling increased as the age advanced (Table 1). The females in their early life died mostly due to pneumonia and gastro-intesinal disorders and culled due to poor growth and health problems. The results were in agreement with the findings of Allaire *et al.* (1977), and Rao and Nagarcenkar (1980). Maximum culling (19.29%) was found in the 18 month to the age at first calving mainly due to infertility and late maturity. Higher culling rates after 18 months of age was due to culling policy of Institute as all females are being retained up to first lactation unless their disposal became essential on involuntary ground (reproductive, health disorders and late maturity). The culling rates at various ages observed in the present study were in agreement with the findings of Thakur *et al.* (1994), Jadhav *et al.* (1995) and Singh and Gurnani (2003). The results of mortality pattern were similar with the report of Taneja *et al.* (1989).

Effect of year

The animals disposed off through mortality varied from 7.84 to 28.00% and through culling from 17.18 to 35.05% over the years (Table 1). Inconsistent trend over the years was observed for mortality and culling rate in animals of different age groups. This could possibly be due to variation in population density, disease resistance, health care, management practices and climatic fluctuations. Results were in consonance with Singh and Gurnani (2003) in Karan Fries.

Effect of month of birth

Results of the χ^2 analysis showed nonsignificant effect of month of birth on mortality rate and were in agreement to the reports of Choudhry *et al.* (1984). The maximum mortality (20.78% of total loss) was recorded in the animals born in September followed by those born during June (20.33%) and December (15.51%) (Table 2). The losses were higher in extreme weather conditions i.e. rainy (September), summer (June) and winter (December). The extreme humidity and temperature might put the calves under stress and made them susceptible to pathogens and resulted in high incidences of disease. Roy *et al.* (1971), Rao and Nagarcenkar (1980), Singh and Mishra (1989) also observed high disease rate under extreme climates.

Table 2. Mortality rate according to (A) month and (B) causes in Karan Swiss females

Month	% of total mortality	Causes	% of total mortality
January	13.51	Pneumonia	14.28
February	12.59	Pneumo-enteritis	5.10
March	11.30	Gastroenteritis	7.14
April	10.99	Theileriosis	7.14
May	15.15	Toxaemia	11.22
June	20.33	Septicaemia	7.14
July	11.59	Tuberculosis	6.12
August	9.28	Cardiac problems	3.00
September	20.78	Peritonitis	5.10
October	11.30	Liver problems	6.12
November	13.11	Spradle leg conditions	6.12
December	15.51	Debility	4.08
Overall	13.40	Natural death/old age	7.14
		Miscellaneous	10.20

Reasons of culling

The culling rates over the years varied 9.75% in 1992 to 31.88% in 1984 with an overall average of 20.26% (Table 3). The culling rate was lowest in 1992 because year auction was held only once instead of twice. The fluctuation of culling rate might be due to variation in females' availability, disease occurrence, environmental stress and managemental practices over the years. The results observed were in conformity with the report of Kulkarni and Sethi (1990). Poor growth was the principal reason of culling which accounted for 8.52% of the herd strength. This was followed by the late maturity (3.67%) reproductive disorders (3.20%), hoof problems (2.93%) and poor health (2.75%). The results obtained were in conformity with the findings of Singh and Gurnani (2003). Disease problems are to be taken seriously, as many times the poor reproduction and growth caused by sub-clinical infections could be misclassified when disease is the cause

Table 3. Causes of culling (% herd strength) in Karan Swiss females over years

Year	No. of females	Poor growth	Reproductive disorders	Poor health	Hoof problems	Late maturity	Total
1982	222	–	–	–	–	–	20.72
1983	197	–	–	–	–	–	20.30
1984	138	14.49	1.45	1.45	5.802	8.70	31.88
1985	160	8.75	3.12	1.25	3.75	1.25	18.12
1986	156	9.61	1.92	5.13	3.20	3.20	23.71
1987	136	13.24	1.47	2.20	0.00	2.20	16.91
1988	126	3.96	2.38	5.56	1.58	0.00	13.49
1989	107	6.54	6.54	4.67	5.60	4.67	23.36
1990	100	6.00	5.00	4.00	2.00	3.00	20.00
1991	88	5.56	6.67	2.23	2.23	6.67	18.88
1992	80	3.66	4.88	1.21	0.00	4.88	9.75
Overall	1091	8.52	3.20	2.75	2.93	3.67	20.26

of culling. Moreover, some diseases like tuberculosis, brucellosis, diphtheria, mad cow etc. are transmissible to human and thus they are of public health concern. The results indicated that poor growth and late maturity were the principal reasons of culling. Therefore, attention needs to be paid to improved growth of animals right from the birth by taking suitable measures like better feeding as poor nutrition predisposes the animals for infections, preventive health measures and prompt medication. These measures will raise the selection intensity leading to higher genetic gain.

Reasons of mortality

The causes of mortality are presented in Table 2. Pneumonia, enteritis and complex of digestive and respiratory diseases accounted for nearly 65% of total losses. Maximum mortality was observed mainly due to pneumonia, enteritis and collibacillosis. This is probably because neonates are more susceptible to viral and bacterial infections. The mortality patterns observed in the present study were in agreement with the reports of Jadhav *et al.* (1995).

The study inferred that adequate attentions need to be paid to improve the general environmental conditions i.e. nutrition, health care, housing, medication from birth and inbreeding should be kept under safer limits.

REFERENCES

Allaire F R, Sterwerf H E and Ludwick T M. 1977. Variation in removal reasons and culling rates with age for dairy females. *Journal of Dairy Science* **60**: 254–67.

Choudhry G, Banerjee G C and Guho H. 1984. Genetic and environmental causes of variation in the mortality rates among the crossbred calves of Jersey × Hariana and Holstein × Hariana calves. *Indian Journal of Animal Health* **23**: 125–29.

Jadhav K L, Tripathi V N and Kale M M. 1995. Disposal pattern in Holstein × Sahiwal crossbred calves. *Indian Journal of Animal Production and Management* **11**: 85–89.

Kulkarni N R and Sethi R K. 1990. Culling and replacement pattern in Karan Swiss and Karan Fries cattle. *Indian Journal of Animal Sciences* **60**: 107–09.

Milglior F, Szkotnicki B and Burnside E B. 1992. Analysis of levels of inbreeding and inbreeding depression. *Journal of Dairy Science* **75**: 1112–18.

Rao M K and Nagarcenkar R. 1980. Calf mortality in crossbred dairy cattle. *Tropical Animal Health and Production* **12**: 137–44.

Reddy A O and Sampath S R. 1989. Inbreeding and its effects on economic traits in Red Sindhi herd. *Indian Journal of Animal Sciences* **59**: 871–72.

Roy J H B, Stobo I J F, Gaston H J, Ganderton P, Shotton S M and Ostler D C. 1971. The effect of environmental temperature on the performance and health of the preruminant and ruminant calf. *British Journal of Nutrition* **26**: 363–81.

Simianer H, Solbu H and Schaeffer L R. 1991. Estimated genetic correlations between disease and yield traits in dairy cattle. *Journal of Dairy Science* **74**: 4358–65.

Singh M K and Gurnani M. 2003. Factors affecting disposal trend in crossbred cattle at closed organised farm. *Indian Journal of Animal Sciences* **73**: 166–70.

Singh R B and Mishra R R. 1989. Causes of mortality among half bred cattle. *Indian Journal of Animal Sciences* **59**: 486–88.

Srinivas B and Gurnani M. 1981. Incidence of inbreeding and its effect on some traits of Sahiwal cattle. *Indian Journal of Dairy Science* **34**: 8–15.

Taneja V K, Dwivedi V K, Nivasarkar A E, Saxena M M and Nautiyal L P. 1989. Disposal pattern in three halfbred groups. *Indian Journal of Animal Sciences* **59**: 158–61.

Thakur Y P, Katoch S, Singh S, Manuja N K and Gupta K. 1994. Disposal pattern in Jersey and Red Sindhi × Jersey halfbred in organised herd. *Indian Veterinary Journal* **71**: 1035–37.

Thompson J R, Everett R W and Hammerschmidt N L. 2000. Effects of inbreeding on production and survival in Holsteins. *Journal of Dairy Science* **83**: 1856–64.

Wright S. 1922. Coefficient of inbreeding and relationship. *American Naturalist* **56**: 330–38.